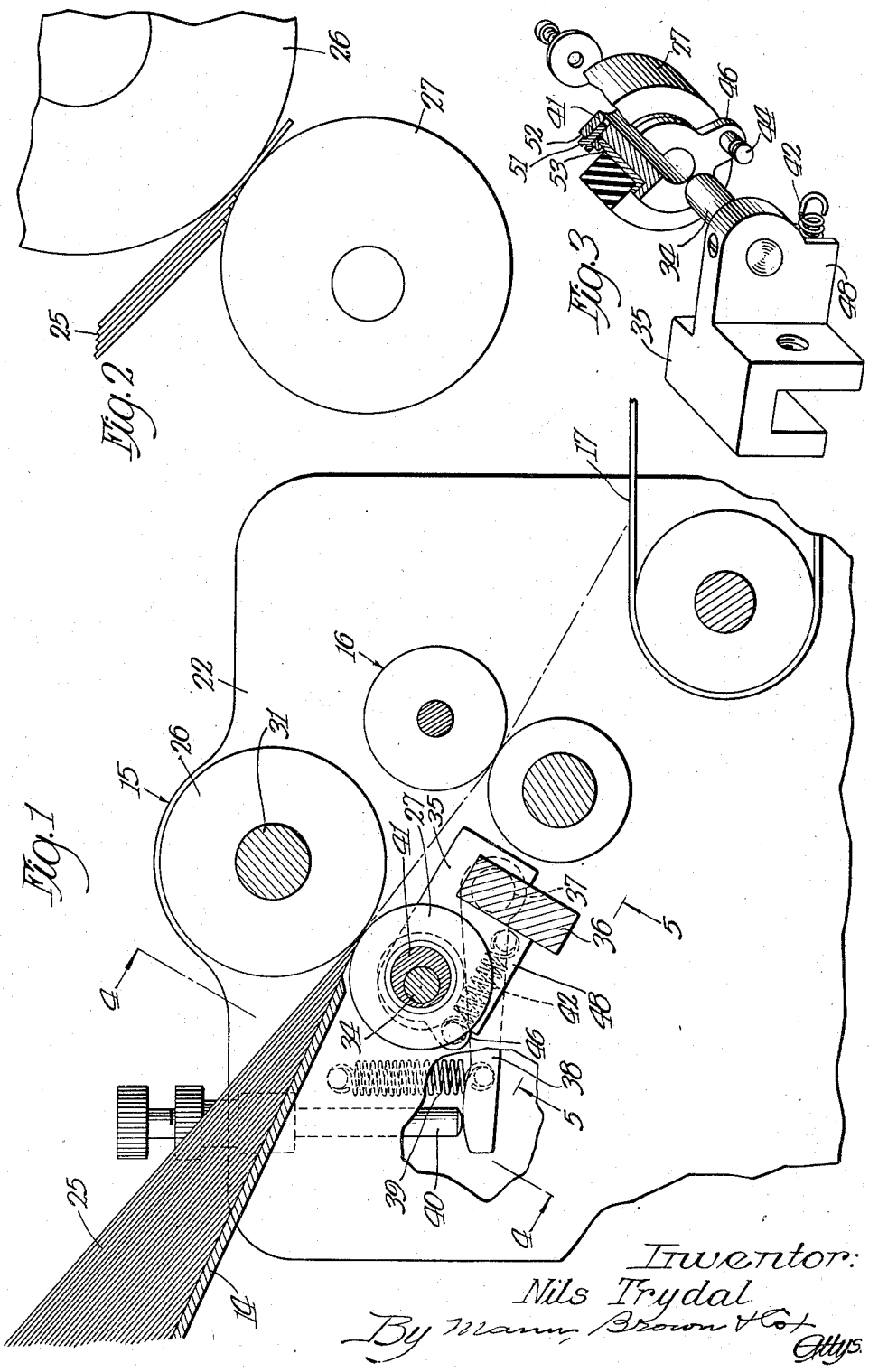
Dec. 10, 1940. N. TRYDAL 2,224,138

FRICTION FEEDER

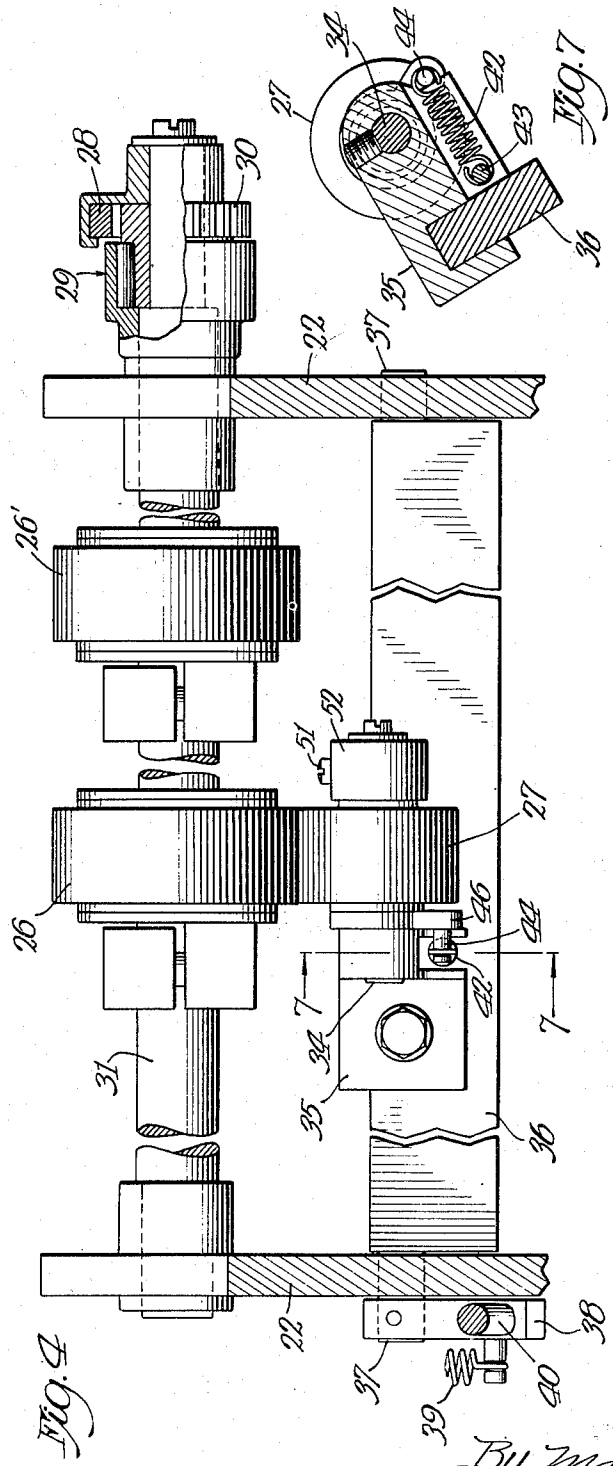
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Dec. 10, 1940. N. TRYDAL 2,224,138

FRICTION FEEDER

Filed March 16, 1939 3 Sheets-Sheet 2



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Dec. 10, 1940. N. TRYDAL 2,224,138

FRICTION FEEDER

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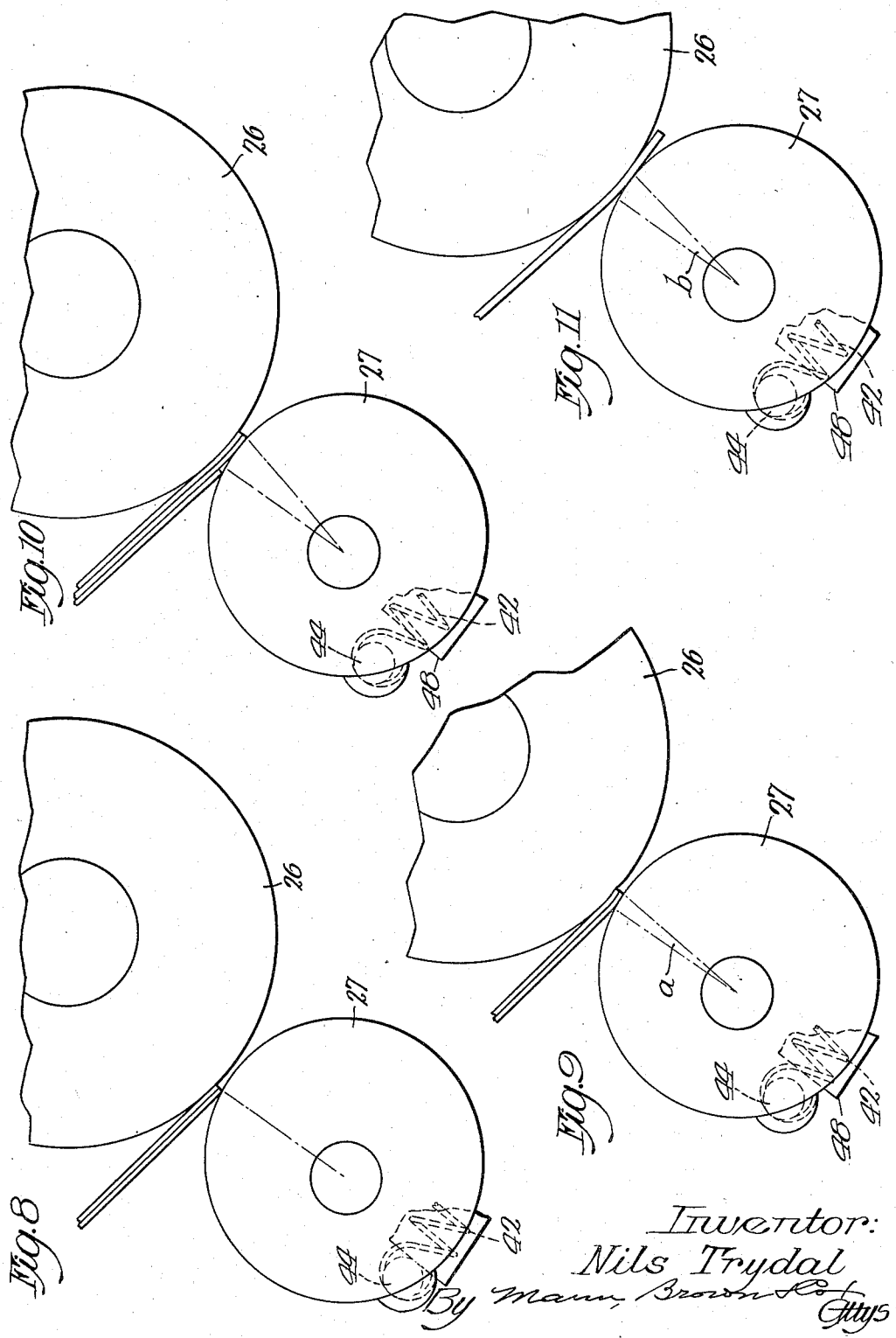


Fig. 8

Fig. 9

Fig. 10

Fig. 11

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UNITED STATES PATENT OFFICE

2,224,138

FRICTION FEEDER

Nils Trydal, Chicago, Ill., assignor to Davidson Manufacturing Corporation, a corporation of Illinois

Application March 16, 1939, Serial No. 262,208

24 Claims. (Cl. 271—37)

In printing sheets of paper, and also for a variety of other purposes, it is necessary to feed the sheets to the press one at a time. The problem of automatically separating successive sheets from a stack is a troublesome one since there are numerous factors that sometimes tend to cause two or more sheets to stick together and since a given separating apparatus must be capable of handling a wide variety of thicknesses of sheet and types of paper. In a copending application Serial No. 205,560, filed May 2, 1938, Frank J. Breman and Edward F. Dell, there is disclosed a separator which is a great improvement over prior art separators from the standpoints of effectiveness and simplicity. The present invention provides various improvements in this separator. The disclosure of application Serial No. 205,560 is incorporated herein by reference.

In using both the feeder of said application, and the improved form thereof comprising my invention, the sheets are stacked on a table in such a manner that they slide edge-first against a pair of separator rolls. The upper of these is called the advancing roll and drags the first sheet of a pile over the other roller, called the retard roll, so that if a second sheet is stuck to the first sheet the action between the rolls will separate them. The retard roll does not rotate freely but pivots about an eccentric axis so that it cannot jam the sheets but will be moved out of the way by them although maintaining a drag until it has succeeded in separating the extra sheets from the first sheet.

According to the present invention this action is improved in two fundamental respects. First, the possible movement of the retard roll in the line of movement of the sheets is increased so as to exert a firm drag for a longer time if necessary and thus render the separation of the sheets more certain. Second, the resistance to this forward movement of the retard roll is made more constant. This is accomplished in part by reducing the inertia of the parts which move with the forward movement of the retard roll and in part by providing an adjustment for sheet thickness which has no effect on the retard resistance. Both of these last mentioned changes are accomplished very simply by the same structural changes, which furthermore have the advantage of permitting a wider range of adjustment for thickness and protecting the apparatus against injury in case some oversize foreign object should be presented to the separator rolls. In addition, the movement of the retard roll to accommodate the thickness of extra sheets does not necessarily reduce the drag by causing it to rotate.

Additional objects and advantages of the invention will be apparent from the following description and from the drawings, in which:

Fig. 1 is a fragmentary vertical longitudinal sectional view through the form of the apparatus chosen for illustration.

Fig. 2 is a corresponding diagrammatic view illustrating the normal feeding action.

Fig. 3 is a detailed perspective view partly broken away, showing especially the construction and mounting of the retard roll.

Fig. 4 is a vertical transverse sectional view taken approximately on the line 4—4 of Fig. 1.

Fig. 5 is a fragmentary view taken approximately on the line 5—5 of Fig. 1, showing particularly the mounting of the spring for the retard roll.

Fig. 6 is a sectional view taken approximately on the line 6—6 of Fig. 5.

Fig. 7 is a sectional view taken approximately on the line 7—7 of Fig. 4.

Figs. 8 to 10 illustrate a feeding action which could possibly occur if two sheets were stock together very firmly.

Fig. 11 illustrates the feeding action with a sheet thicker than the normal spacing between the rolls.

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 timed intervals, and for the purpose of this disclosure it may be assumed that the feeder is being used with a printing press and is operated intermittently in timed relation therewith. 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 for such apparatus the feeder can be run continuously.

The illustrated form of feeder comprises a feed board 14 for feeding the sheets to the separator rolls indicated generally at 15, which feed one sheet at a time to the pull-out rolls 16 and to the conveyor belts 17. Both the feed board 14 and the separator rolls 15 are suitably mounted on the feeder frame 22 and so disposed that a

pile 25 of sheets resting thereon as shown will be fanned out so that the sheets will slide by gravity, edge first, against the separator rolls 15. The separator rolls 15 comprise a feed roll or advancing roll 26 and a retard roll 27. The advancing roll 26 has a high coefficient of friction with the sheets so as to advance the top sheet against any dragging effect of which the retard roll is capable. Preferably, the advancing roll 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.

When intermittent driving is desired, the advancing roll 26 will be driven by a reciprocating rack 28 connected with the advancing roll 26 through an overrunning clutch 29. This overrunning clutch permits the sheets to be drawn from the separator rolls 15 by the continuously driven pull-out rolls 16 even though the intermittent drive through the overrunning clutch 29 may have ceased. The overrunning clutch is of course designed to permit the roll 26 to be driven in the advancing direction, which is counterclockwise as seen in Fig. 1. When the rack 28 moves in the reverse direction for its idle stroke, the pinion 30 meshing therewith is permitted by the overrunning clutch 29 to rotate freely. The advancing roll 26 is mounted on a shaft 31 which drives the roll 26 and also carries the overrunning clutch 29 and pinion 30.

The retard roll 27 is carried by a stub shaft 34 which in turn is carried by a bracket 35 mounted on a crossbar 36 which, in the illustrated form, is pivoted at 37 to the frame 22. To adjust the normal spacing of the retard roll 27 from the advancing roll 26 the bar 36 may be pivoted by means of an arm 38 which is drawn upwardly by spring 39 until it strikes a screw stop 40. Not only does this arrangement provide a convenient means for adjusting the spacing between the rolls but it also protects the apparatus against the danger of injury if large foreign objects should in some manner be fed between the rolls 26 and 27 since a very extensive movement of the roll 27 is possible. However, the spring 39 may be so stiff that it will not yield during ordinary operation of the feeder.

The retard roll 27 is not mounted directly on the stub shaft 34 but instead is mounted rigidly on an eccentric bushing 41 which is journaled on the shaft 34 but is yieldingly restrained from rotation by a spring 42. The spring 42 is suspended between a pin 43 on the bracket 35 and a pin 44 carried by an arm 46 formed on the bushing 41. The bracket 35 is provided with an extension 48 which serves as a housing for the spring 42 and also as a stop for the pin 44, the pin coming to rest against the extension or plate 48 under the influence of spring 42.

Because the retard roll 27 is rigidly mounted on the eccentric bushing 41, the retard roll rotates about the shaft 34 and therefore may be said to be journaled on said shaft. Because the shaft 34 is eccentrically positioned with respect to the retard roll 27, this roll does not rotate with a purely rotative movement, but instead moves farther away from the advancing roll 26 as it rotates.

There are a variety of positions at which the shaft 34 may be positioned with respect to the center line of the roll 27. In copending application Serial No. 205,560 the eccentric axis for the retard roll 27 was positioned approximately directly rearwardly from the center line of the retard roll 27, i. e., in the direction from which the sheets are fed to the separator rolls 15. Such an arrangement has been found to be very satisfactory. On the other hand, it has also been found to be very satisfactory to position the eccentric axis 90° further around the center line so that it would lie approximately at the furthest point possible from the feed roll 26. The former position gives the maximum initial movement of the retard roll away from the advancing roll, while the latter position gives the minimum initial movement and the maximum total movement of the retard roll away from the advancing roll upon rotation of the retard roll. In the illustrated form of the invention a position (135° to the rear of the contact point) midway between these two positions has been chosen, although of course it may be found that under some circumstances one of the other positions is better.

The sheets from the pile 25 slide edge first against the rolls 26 and 27. When the roll 26 rotates, it draws the top sheet, which is resting against it, through between it and the retard roll 27 and feeds it to the pull-out rolls 16 which draw it out from the rolls 26 and 27, the overrunning clutch 29 letting the advancing roll 26 be rotated by the sheet. As the top sheet is urged forwardly by the advancing roll 26, any additional sheet or sheets which may be stuck thereto will engage the retard roll 27. Ordinarily the retard roll will not be moved by these extra sheets but will merely prevent their movement so that the top sheet will slide through alone as seen in Fig. 2. Occasionally, however, the retard roll will be moved a slight bit and it appears that this slight movement is very advantageous in that it prevents a too rapid build-up of pressure on two sheets which are stuck together. In other words, if the roll 27 were entirely fixed, two sheets which are stuck together might be wedged tightly between the rolls 26 and 27 so quickly that there would not be time for them to separate before the pressure built up so high that the friction between them was too great to permit them to separate. Whether this theory is correct or not, it has been found that these rolls with the eccentric mounting of the retard roll 27 do an exceptionally dependable job of separating the sheets.

The probable operation of the separator rolls can best be understood from Figs. 8 to 10, although the thickness of the sheets is exaggerated in these figures for the sake of clarity and this exaggerated thickness somewhat alters the apparent effect of rotation of retard roll 27. In Fig. 8 it is assumed that two sheets which are stuck together quite firmly have been drawn by roll 26 firmly enough against roll 27 so that they are about to rotate roll 27 against the retraining force of spring 42. Depending on the thickness of the sheets, the size of the roll 27, and the position of the eccentric axis of rotation, the two sheets may initially be squeezed more firmly together as roll 27 rotates through the angle α as seen in Fig. 9 because the rotation of roll 27 may not separate it from roll 26 as fast as would be necessary to accommodate freely the two sheets stuck together. Sooner or later, however, the roll 27 will have been rotated far enough by the sheets so that, as its separation from roll 26 continues to increase, the pressure on the two sheets will be decreased. It should be remembered that the coefficient of friction between roll

26 and the sheets is considerably higher than that between roll 27 and the sheets, the latter roll being made of harder rubber, and that the roll 26 is driven forwardly while the roll 27 is resiliently urged rearwardly by the spring 42. If one thick sheet is fed between rolls 26 and 27 it will rotate roll 27 until, as seen in Fig. 11, the pressure is so reduced that the sheet will slide with respect to roll 27 rather than rotate roll 27 to stretch the spring 42 further. When two sheets are stuck together, however, the reducing pressure will tend to reduce the total friction between these sheets to such an extent that the upper sheet will slide on the second sheet before the second sheet will slide on the roll 27, and hence the sheets will be separated. In fact, once the cleavage between the sheets has thus been broken, the spring 42 may rotate the roll 27 rearwardly to its starting position drawing the second sheet with it.

Ordinarily the sheets will not wait until this reduction of pressure to separate from one another, but instead will be separated as the sheets enter the bite. The movement of two sheets under influence of roll 26 will press the second sheet against the roll 27 until the total friction between the rolls 26 and 27 is either enough to separate the sheets or to rotate the roll 27. Usually the first mentioned of these two possibilities occurs first, although sometimes the sheets are drawn in with enough momentum so that they cause the roll 27 to budge slightly and momentarily as the separation takes place. The automatic separation of the rolls 26 and 27 as the roll 27 rotates positively eliminates any danger that because of such momentum or otherwise the pressure between the sheets will be built up to a locking point and held there until both sheets have been passed entirely through the rolls. The movability of roll 27 under the restraint of spring 42 also overcomes any possibility that due to any abnormal cause the sheets will both be stopped by roll 27 and not be fed at all.

When sheets of a single thickness are being fed, the crew stop 40 will ordinarily be adjusted to such a position that the spacing between the rolls 26 and 27 is approximately the thickness of the sheet so that when a single sheet is fed there will be very little rubbing action between it and the roll 27 and hence very little wear on the roll 27. However, if thick sheets should be run together with the thin sheets or if thick sheets should be run without a re-adjustment, the feeding action would still be perfect even though there would be a little more rubbing on the roll 27 and hence a little more wear. The reason that the action would still be perfect is that the thick sheet would merely cause the retard roll 27 to rotate slightly until its spacing from the roll 26 should thus be automatically adjusted to approximately the thickness of the sheet. Thus, as seen in Fig. 11, the roll 27 has been rotated through the angle *b* by the top sheet so that it is spaced the proper distance from roll 26 for the passage of the thick top sheet. The action with respect to sheets below the top sheet is substantially identical with the action that would take place if the roll 27 were in its normal position.

One of the advantages of the present invention is that the wear on the roll 27 may easily be spread evenly around the surface of the roll so that the roll will not have any flat spots. The periphery of the bushing 41 is concentric with the periphery of the roll 27, and hence the roll 27 may be rotated about the bushing 41 to present a new portion of the roll 27 for wear without changing the action or spacing adjustment. The manner of accomplishing this can best be seen from Fig. 6. A screw 51 is loosened which loosens a clamping lug or ring 52. This permits the roll 27 and its sleeve 53 to be rotated on the bushing 41 to present a fresh surface to the sheets, after which the screw 51 may be tightened to lock the sleeve 53, and with it the roll 27, on the bushing 41. The sleeve 53 merely forms the permanent hub of the roll 27 which is of course rigidly positioned thereon.

Except for this feature of occasionally shifting the retard roll 27 to present a fresh surface for wear, it is obvious that the retard roll could take various forms and may be mounted in numerous ways other than that shown without departing from the spirit of this invention. For example, the retard roll 27 could be elliptical in form or ovate or any other shape as long as the roll retains its characteristic function of retarding the extra sheet with which it is in contact.

The pile of sheets 25 should be so positioned that the separator rolls 15 will engage the sheets at the middle of the front edge thereof. In addition, a pair of auxiliary advancing rolls 26' may be provided, spaced on opposite sides of the advancing roll 26, one of them being shown in Fig. 4. These auxiliary rolls 26' will not ordinarily be necessary, but, when feeding very thin wide paper, these rolls keep the paper under better control. No additional retard rolls 27 will be necessary, although they could be provided if desired since each one would function independently of the others, each one being provided with its own eccentric bearing pin and independent return spring 42.

Although only one retard unit will be used on each feeder, the completeness of the retard unit within itself is one of the features of the present invention. The screw stop 40 and crossbar 36 are ordinarily adjusted only for the purpose of adjusting the initial spacing of the retard roll 27 from the advancing roll 26. Whatever this adjustment may be, the tension of the spring 42 at its normal position remains unchanged. The angle of eccentricity of the mounting of the retard roll 27 likewise remains substantially the same for all adjustments of the stop screw 40 and crossbar 36. This results in a very high degree of uniformity in the action of the retard roll 27. Furthermore, when this roll is rotated by movement of the sheets, it is not necessary for it to overcome any great inertia. Except for the spring 42, the only parts which oppose the movement of the roll 27 by their inertia are the roll 27 including its hub 53 and the bushing 41. In like manner, once the sheet starts the roll 27 rotating, this roll has very little momentum to keep it rotating. Hence, the dragging effect corresponds with great uniformity to the tension of the spring 42, both the initial reinforcement by inertia and the subsequent diminution by momentum being negligible.

Although the crossbar 36 which carries the retard roll 27 has been shown as journaled directly in the main frame 22 of the separator and the stop screw 40 carried thereby, they could be journaled and carried in an auxiliary frame pivoted coaxially with the advancing roll 26 and provided with lock means for securing it in any position as taught in the patent of W. W. Davidson, No. 2,089,946. This form of mounting would not interfere with the function of separating the

sheets but it would enable the separator rolls to be adjusted so that the sheets would approach the bite at a satisfactory angle even if they did not lie on the feed board 14 at the angle shown.

Although the apparatus has been described with respect to sheets, it should be recognized that this term is used in a broad sense including all sheet-like articles such as envelopes, for example.

I claim:

1. 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 so as to form a bite with the advancing roll and yieldable in said direction in response to the pressure of a sheet greater than the force normally necessary to separate two sheets which tend to stick together, one of the separator members being yieldable relatively away from the other, in response to a pressure exerted on the retard member by a sheet being moved into the bite by the advancing roll, and means for adjusting the normal minimum spacing between the retard member and the advancing roll without varying the pressure at which the separation will take place.

2. 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 on a shaft with respect to which it may rotate, and means for yieldingly resisting such rotation.

3. 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, means for rotating the advancing roll when a sheet is desired, the retard member being rotatably mounted about journal means eccentric with respect to the sheet-engaging surface thereof, means for resisting its rotation, and adjustment means independent of the last named means for adjusting the distance of the journal means from the advancing roll to adjust the spacing of the retard member from the advancing roll for various sheet thicknesses.

4. 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, means for rotating the advancing roll when a sheet is desired, the retard member being rotatably mounted about journal means eccentric with respect to the sheet-engaging surface thereof, means for resisting its rotation, and adjustment means independent of the last named means for adjusting the distance of the journal means from the advancing roll to adjust the spacing of the retard member from the advancing roll for various sheet thicknesses, the adjustment means being yieldable to permit a wide separation of the retard member from the advancing roll in case an unexpectedly large object should be presented to said bite.

5. 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 so as to form a bite with the advancing roll, one of said separator members being yieldable relatively away from the other, in response to a pressure exerted on the retard member by a sheet being moved into the bite by the advancing roll, and means for adjusting the normal minimum spacing between the retard member and the advancing roll without varying the pressure at which the separation will take place.

6. A friction feeder including an advancing roll and a retard roll assembly including a bracket, a shaft fixed on the bracket, a shoulder on the bracket extending approximately radially with respect to the shaft, a bushing rotatably mounted on the shaft and having a pin extending therefrom in a position to engage the shoulder, a spring extending between the bracket and the bushing for urging the pin against the shoulder, and a retard roll rigidly secured to the bushing, and said assembly being adjustably and resiliently mounted to control the normal spacing between the rolls.

7. A friction feeder including an advancing roll, a retard roll normally restrained from rotation whereby the sheets are slid along the retard roll by the advancing roll, the retard roll being rotatably mounted on a yieldable restraining member and normally secured against rotation with respect thereto by a clamp which may be released to permit rotational shifting of the retard roll to present a new surface to the sliding sheets.

8. A retard roll assembly for friction feeders, including a bracket, a shaft fixed to the bracket, a bushing carried by the shaft, means for yieldably restraining rotation of the bushing, a roll carried by the bushing, and means for releasably locking the roll at a given angular position with respect to the bushing.

9. A retard roll assembly for friction feeders, including a bracket, a shaft fixed to the bracket, a bushing carried by the shaft, means for yieldably restraining rotation of the bushing, and a roll carried by the bushing and normally secured rigidly thereto.

10. A retard roll assembly for friction feeders, including a bracket, a shaft fixed to the bracket, an eccentric bushing carried by the shaft, means for yieldably restraining rotation of the bushing, a roll carried by the bushing, and means for releasably locking the roll at a given angular position with respect to the bushing.

11. A retard roll assembly for friction feeders, including a bracket, a shaft fixed to the bracket, an eccentric bushing carried by the shaft, means for yieldably restraining rotation of the bushing, and a roll carried by the bushing and normally secured rigidly thereto.

12. A retard roll assembly for friction feeders, including a bracket, a shaft fixed on said bracket, a shoulder on the bracket extending approximately radially with respect to the shaft, a bushing rotatably mounted on the shaft and having a pin extending therefrom in a position to engage the shoulder, a spring extending between the bracket and the bushing for urging the pin against the shoulder, and a retard roll rigidly secured to the bushing.

13. A friction feeder including an advancing roll, a retard roll adjacent the advancing roll mounted to rotate about an axis eccentric of the center of the retard roll and positioned further than said center from 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 roll, means for rotating the advancing roll when a sheet is desired, and means for yieldingly resisting the rotation of the retard roll.

14. A friction feeder including a driven roll having a high coefficient of friction with the sheets to be fed, a retard roll having a lower coefficient of friction with said sheets and positioned adjacent the driven roll and mounted to rotate about an axis eccentric with the center of the retard roll and so positioned that rotation of the retard roll by the driven roll will separate the rolls, means for feeding sheets to the bite between the driven roll and the retard roll, means for yieldingly resisting the rotation of the retard roll, and means for adjusting the initial spacing of the rolls without affecting the resistance to the rotation of the retard roll.

15. 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 so as to form a bite with the advancing roll and yieldable in said direction in response to the pressure of a sheet greater than the force normally necessary to separate two sheets which tend to stick together, one of the separator members being yieldable relatively away from the other, in response to a pressure exerted on the separator members by a sheet being moved into the bite by the advancing roll, and means for adjusting the normal minimum spacing between the retard member and the advancing roll without varying the pressure at which the separation will take place.

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 so as to form a bite with the advancing roll and yieldable in said direction in response to the pressure of a sheet greater than the force normally necessary to separate two sheets which tend to stick together, one of the separator members being yieldable relatively away from the other, in response to movement of the surface of the retard member in said direction by a sheet being moved into the bite by the advancing roll, and means for adjusting the normal minimum spacing between the retard member and the advancing roll without varying the pressure at which the separation will take place.

17. 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 so as to form a bite with the advancing roll, one of said separator members being yieldable relatively away from the other, in response to a pressure exerted on the separator members by a sheet being moved into the bite by the advancing roll, and means for adjusting the normal minimum spacing between the retard member and the advancing roll without varying the pressure at which the separation will take place.

18. A friction feeder including two separator members, one an advancing roll and the other a retarding member, a pressure unit including one of said separator members mounted on the unit for relative movement with respect to a supporting part of the unit in directions receding from and approaching the other separator member and yieldably urged with a given firmness in the approaching direction, and means limiting the relative movement in the approaching direction; said unit also being movable in directions receding from and approaching the other separator member, and being urged yieldably in the approaching direction but with more firmness than said given firmness, and means for limiting the movement of the unit in the approaching direction to control the initial spacing of the separator members.

19. 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 sheets by the advancing roll so as to form a bite with the advancing roll, said retard member being mounted to permit movement of the surface by the sheet generally in the direction of movement of the sheet, a spring urging the retard member in the opposite direction to a normal position but stretching and increasing the amount of drag as the retard member is moved by the sheet, said retard member also being so mounted that its movement by the sheet causes a variation of pressure on the sheet or sheets between the retard member and the advancing roll, and means for regulating the normal space between the advancing roll and the retard member without altering the amount of drag exerted by the retard member as it is moved by the sheet from its initial position.

20. A friction feeder for separating sheets, including a driven advancing roll, and a retard roll assembly including a resiliently mounted bracket, a shaft fixed to the bracket, a bushing carried by the shaft, means for yieldably restraining rotation of the bushing, and a retard roll adjacent the advancing roll carried by the bushing and normally secured rigidly thereto.

21. A friction feeder for separating sheets, including a driven advancing roll, and a retard roll assembly including a resiliently mounted bracket, a shaft fixed to the bracket, a bushing carried by the shaft, means for yieldably restraining rotation of the bushing, a retard roll adjacent the advancing roll carried by the bushing and normally secured rigidly thereto, and means to adjust the normal spacing of the advancing and retard rolls.

22. A friction feeder for separating sheets, including a driven advancing roll, and a retard roll assembly including a resiliently mounted bracket, a shaft fixed to the bracket, a bushing carried by the shaft, a retard roll adjacent the advancing roll carried by the bushing and normally secured rigidly thereto, a spring urging the bushing and retard roll in a direction to oppose movement of the sheets by the advancing roll, and means for limiting the movement of the bushing and retard roll in said direction; said spring yielding under influence of a force which may be exerted frictionally upon the retard roll by the advancing roll acting through two sheets stuck together.

23. A friction feeder for separating sheets, including a driven advancing roll, and a retard roll assembly including a bracket, a shaft fixed to the bracket, a bushing carried by the shaft, a retard roll adjacent the advancing roll carried by the bushing and normally secured rigidly thereto, a spring urging the bushing and retard

roll in a direction to oppose movement of the sheets by the advancing roll, and means for limiting the movement of the bushing and retard roll in said direction; said spring yielding under influence of a force which may be exerted frictionally upon the retard roll by the advancing roll acting through two sheets stuck together.

24. A friction feeder for separating sheets, including a driven advancing roll, and a retard roll assembly including a bracket, a shaft fixed to the bracket, a bushing carried by the shaft, means for yieldably restraining rotation of the bushing, a retard roll adjacent the advancing roll carried by the bushing and normally secured rigidly thereto, and means to adjust the normal spacing of the advancing and retard rolls.

NILS TRYDAL.