F. A. DRURY.

SHEET FEEDING APPARATUS.

APPLICATION FILED APR. 26, 1920.

1,394,613. Patented Oct. 25, 1921.

2 SHEETS—SHEET 1.

Fig. 1,

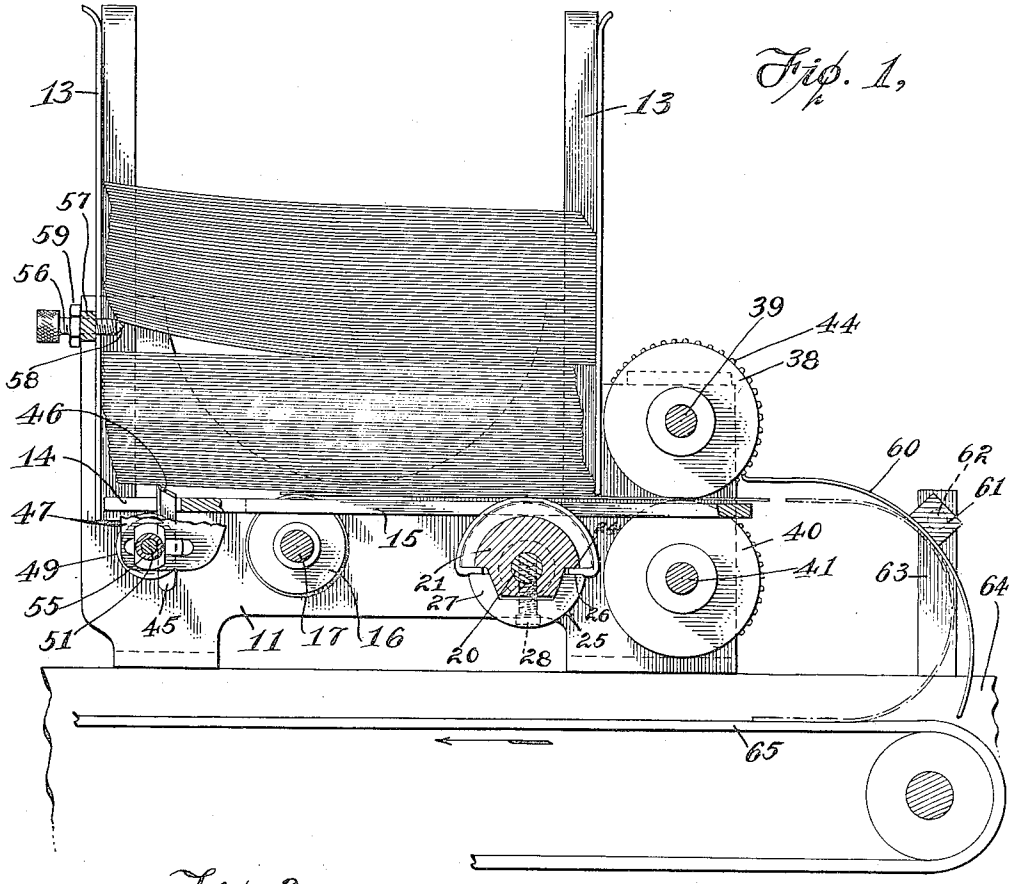
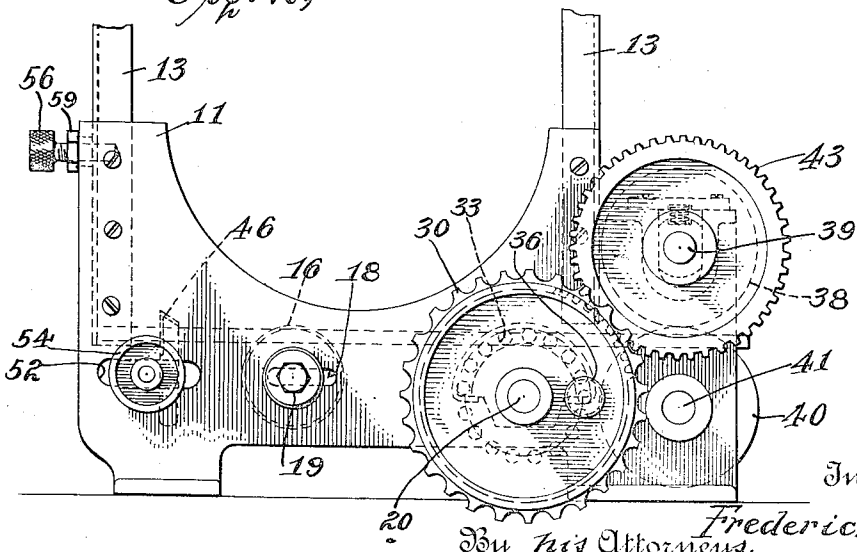


Fig. 2,



Inventor

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By his Attorneys.

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2 SHEETS—SHEET 2.

Fig. 3.

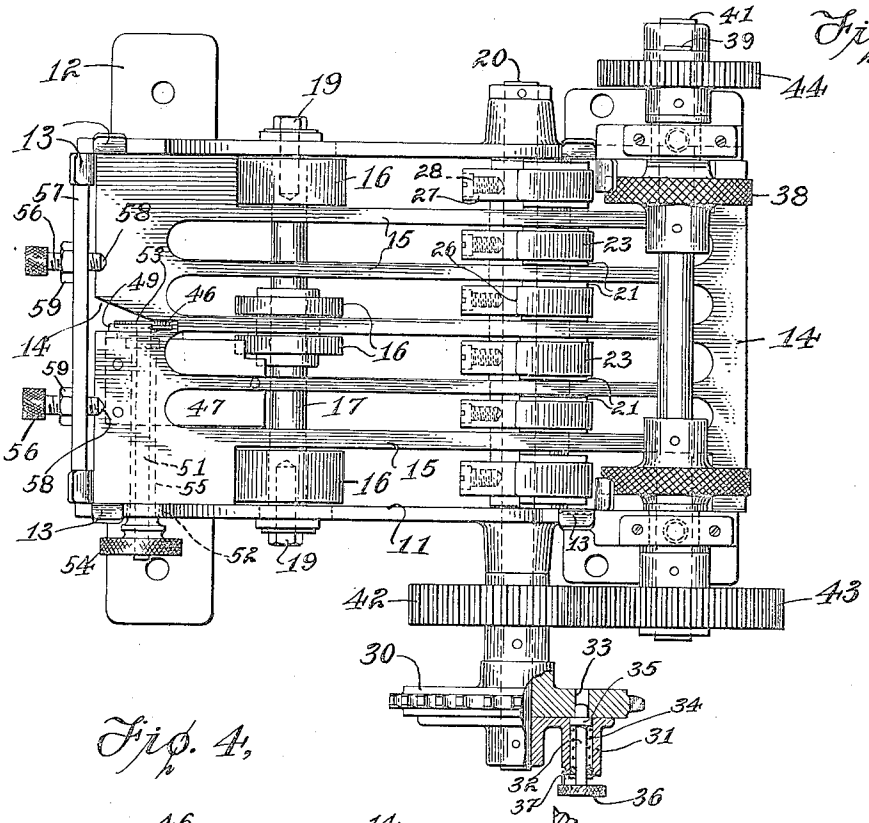


Fig. 4.

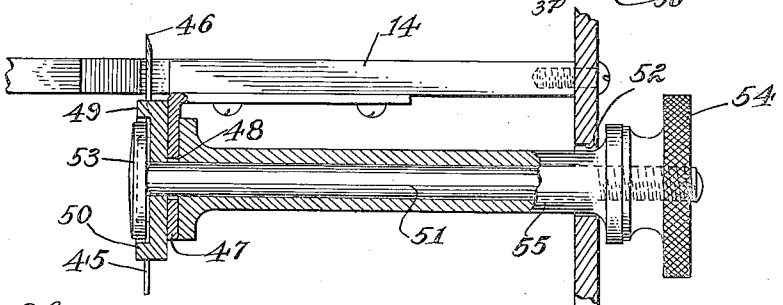
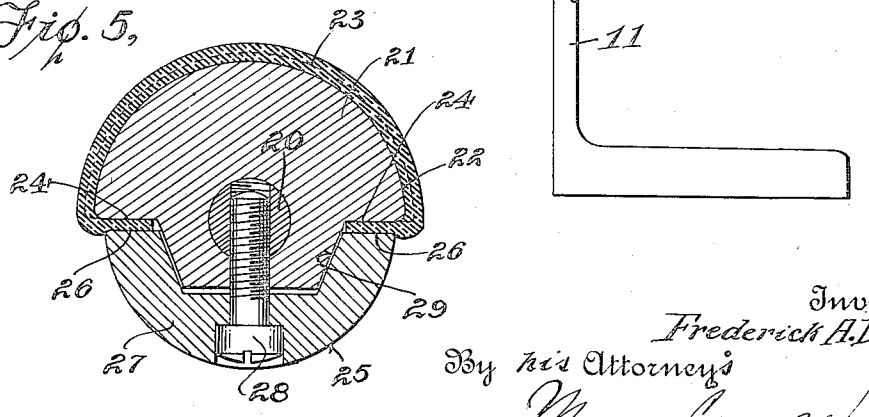


Fig. 5.



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UNITED STATES PATENT OFFICE.

FREDERICK A. DRURY, OF JERSEY CITY, NEW JERSEY, ASSIGNOR TO P. LORILLARD COMPANY, OF NEW YORK, N. Y., A CORPORATION OF NEW JERSEY.

SHEET-FEEDING APPARATUS.

1,394,613. Specification of Letters Patent. Patented Oct. 25, 1921.

Application filed April 26, 1920. Serial No. 376,794.

To all whom it may concern:

Be it known that I, FREDERICK A. DRURY, a subject of Great Britain, and resident of Jersey City, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements in Sheet-Feeding Apparatus, of which the following is a specification.

My invention relates to sheet feeding apparatus of the type adapted to feed sheets in succession from one end of a stack.

A standard form of apparatus of this type includes a hopper in which the sheets are stacked, successive sheets being fed from the bottom of the stack by an intermittently active member frictionally engaging the bottom sheet and sliding it from beneath the pile and between constantly rotating rollers, which continue the withdrawal of the sheet and feed it to conveying or other mechanism. A well known form of intermittent sheet engaging device includes a continuously rotating shaft located just beneath the pile and carrying one or more segments having friction surfaces adapted to engage the bottom sheet and feed it forward beneath the rollers.

Sheet feeding devices of this type are generally used in connection with continuously operating automatic machines adapted to receive and manipulate successive sheets; and it is therefore necessary that the sheet feeding apparatus should operate with the maximum regularity and reliability, as otherwise the operation of the automatic sheet manipulating machinery is seriously interfered with.

In order to be thoroughly efficient, the feeding device must not only feed a sheet at every cycle of operation without missing or skipping, but it also must feed only a single sheet at a time. For insuring regularity of feed without skipping, it is necessary to provide thorough and effective frictional contact between the rotating segment or other intermittent feeding element and the bottom sheet of the stack, the segment being generally composed of or surfaced with a material, such as rubber, which will grip the sheet strongly.

The feeding of more than one sheet at a time is avoided in certain types of sheet feeding apparatus by the employment of a sharpened point upon which the rear of the stack rests, the point penetrating the bottom sheet near its rear edge. When the sheet is withdrawn by the action of the intermittent feeding element, the point tears through a margin of such sheet, and pierces the next sheet, preventing it from following the bottom sheet as the latter is withdrawn.

An object of my invention is to improve the reliability of operation and simplicity of construction of this type of sheet feeding apparatus. To accomplish this object, I have provided an improved construction for the friction-surfaced segmental feed element, and have improved the construction and operation of the sharpened point.

Segmental feeding elements of this type have generally been constructed either with a rubber band extending completely around the element, or with solid segments of a suitable material, such as rubber, clamped in position on a shaft. Constructions of this type, however, are somewhat complicated, due to the necessity for providing securing means for the friction element. Furthermore, such constructions require the expenditure of considerable time and effort in removing or changing friction elements.

An object of my invention is to provide a segment and a friction surfacing member therefor, so constructed and arranged that the member may be readily and rapidly attached and removed, and in which said element is positively and strongly held in position during operation.

A further object is to provide a construction in which the friction member may be reversed if one side thereof becomes damaged without requiring the use of a new member.

Furthermore, I have provided a construction adapted for the use of a friction member of sheet or strip form, greatly reducing the cost thereof as compared with other types in general use.

In order to increase the reliability of the sheet feeding apparatus by preventing the feeding of more than one sheet at a time, I have also improved the pointed sheet-holding device by providing simple means for adjusting the pointed member as to height, angle and location longitudinally of the sheets, thus permitting complete adjustment for all conditions.

In the preferred form, I have provided

a construction in which the pointed member is released for adjustment, and is clamped in adjusted position, by manipulation of a single member, thus greatly simplifying and facilitating adjustment.

I have, furthermore, improved the reliability of operation of the pointed sheet-restraining device by regulating the weight of the pack which rests upon the point. It will be apparent that the extent to which such point penetrates the bottom sheet or sheets is determined not only by the shape of the point and the position of the sheets, but also by the weight thereof bearing against the point. I have provided means whereby such weight will remain substantially the same regardless of the number of sheets contained in the hopper beyond a fixed amount, thus permitting the use of a relatively long hopper without interfering with the effectiveness of the apparatus.

In the preferred form, I accomplish this regulation of the weight on the restraining point without restricting the weight of the pack on the feeding segment, as the efficiency of operation of said segment with certain types of work is increased by added weight.

While my invention may be employed in the feeding of sheets of various types, it is particularly adapted to solve the problems connected with the feeding of two ply sheets composed of paper on one side and metal foil on the other, such as are used in the packaging of tobacco. Sheets of this type are relatively heavy and somewhat bulky, and the difference in the nature of the two sides thereof presents problems different from those connected with the feeding of homogeneous sheets.

One feature of sheets of this type which must be considered in devising a suitable feeding apparatus is the fact that the foil side of the sheet is relatively slippery and much less susceptible to frictional engagement than the opposite side, being also more liable to tear, wrinkle or mar than the paper portion.

I have provided a feeding apparatus in which the various parts are particularly adapted to the feeding of this type of sheet, as I provide a segment or series of segments exerting even tension transversely of the sheet to prevent distortion and consequent separation of the layers. The restraining point is adjustable, so that it will penetrate to the proper extent through the paper side of composite sheets varying substantially in thickness and weight, such variation being much greater in such composite sheets than with the usual homogeneous sheets fed by machines of this general kind. Furthermore, the weight of sheets containing metal foil is so great that it is difficult to provide proper adjustment of said point to prevent undue penetration, and the means provided by me for limiting the weight on said point coöperates to produce efficient and even action of the latter.

For the reasons indicated above, it is desirable to have the paper portion of each sheet exposed at the bottom of the stack for engagement by the feeding and restraining mechanisms; but the usual automatic wrapping machinery which manipulates sheets of this type is generally designed to receive such sheets with the paper side upward. Consequently, I have devised and arranged parts of my apparatus so that the sheets may be reversed after leaving the stack to deliver them to the wrapping machinery in the proper position.

Furthermore, the sheet manipulating machinery operates in a predetermined cycle, and it is necessary to deliver each successive sheet in accurately timed relation to such cycle. In the operation of sheet feeding means of the type herein described, it is extremely difficult to compute the exact time consumed in the travel of a sheet from the delivery rolls of the feeding mechanism to the receiving devices of the manipulating machinery, when the sheet is not delivered directly to the receiving devices before leaving said rolls of the sheet feed.

This difficulty is caused by the friction factors affecting the exact position of the sheet on the conveying mechanism. Positive sheet gripping devices are sometimes employed, but such an arrangement increases the complexity of the construction very substantially. I have avoided the use of such devices, and at the same time have provided for accurate timed delivery of the successive sheets by connecting the sheet feed drive with the driving mechanism of the manipulating apparatus, insuring perfect synchronism between drives, and have also provided means for adjusting at will the relation of the intermittent sheet feeding device to the sheet feed drive, so that the latter may be adjusted for perfectly timed operation under actual working conditions, regardless of frictional or other factors.

Other objects and advantages of my invention will be apparent from the following description, taken in connection with the accompanying drawings, in which:

Figure 1 is a vertical longitudinal section,

Fig. 2 is a side elevation, parts being broken away,

Fig. 3 is a plan view with parts broken away,

Fig. 4 is a detail partly in section of the restraining point clamp, and

Fig. 5 is a detail sectional view of a segment, showing the friction strip clamp.

My apparatus includes a hopper or chute of any desired form, preferably vertical, and mounted on a suitable supporting frame-

work. In the form disclosed, I employ side frames 11 adapted to be mounted in fixed position, as by mounting lugs 12, and each carrying a pair of spaced hopper members or stack guides 13, preferably in the general form of angle irons, four guides 13 forming the hopper. While I have shown them as mounted in fixed position adapted for use with sheets of substantially the same size, it will be apparent that my invention is not restricted to such a construction, as many other hopper constructions are well known.

I also provide a suitable base plate 14 at the bottom of the hopper, preferably slotted longitudinally to form a series of spaced supporting bars 15 upon which the pack may rest, the reduced area of the bars decreasing the frictional resistance thereof to the movement of the bottom sheet during feeding.

Suitable rotating supports for the rear portion of the pack may also be employed, the form disclosed having a plurality of spaced rollers 16 rotatably mounted on a shaft 17 carried by frames 11, the rollers 16 extending slightly above the upper surface of base plate 14 through apertures therein, and being adapted to receive a part of the weight of the stack. In the construction shown, shaft 17 is provided with a reduced threaded portion passed through longitudinal slots 18 (Fig. 2) in frames 11 and held in place by nuts 19 providing for longitudinal adjustment of rollers 16 to vary the proportion of the weight carried thereby and the point of engagement with the pack necessary to produce efficient operation with different types of sheet. With this arrangement, shaft 17 also acts as a tie rod and brace for frames 11.

The intermittently operating sheet feeding device of the segment type is preferably located adjacent the front end of the pack, and includes a shaft 20 journaled in frames 11 and continuously rotated in any desired way. Upon shaft 20 I mount one or more segment members each having a friction surface adapted to engage the bottom sheet. For this purpose, I may employ a segment block 21 mounted on shaft 20 and provided with one or more segment faces 22 adapted to carry a friction strip which will project slightly above the upper face of base plate 14 into engagement with the bottom sheet of the stack. In the form disclosed, I have provided a plurality of segment faces 22 located between the bars 15 of the base plate and preferably spaced across the width of the sheet in such a way that a substantially even tension will be exerted throughout the sheet width, preventing wrinkling or distortion thereof, this construction being particularly necessary with composite sheets because of the danger of separating one sheet from the other by distortion.

I employ an improved friction element 23 which preferably is composed of rubber, and which in the construction herein disclosed may be in sheet or strip form. I provide the segment block 21 with inwardly directed shoulders 24 at the end of each segment surface 22, friction strip 23 being so proportioned that it will overlie segment surface 22 with its ends extending inwardly along shoulders 24.

I also provide a suitable clamping member mounted on segment block 21 or shaft 20 or both, and provided with suitable faces adapted to engage the ends of friction strip 23 and clamp them against shoulders 24. Various types of clamping member or members for this purpose may be employed. In the form disclosed, I form the clamping member 25 from a single piece of metal or other suitable material having end clamping faces 26 adapted to engage the ends of strip 23 and hold them against shoulders 24, and a central portion 27, suitably contoured to overlie the central portion of segment block 21 and shaft 20.

Suitable means for holding clamping member 25 in operative position is provided, such as screw 28 passing through the clamp and threaded into shaft 20, the head of the screw preferably being countersunk in clamp 25. If desired, segment block 21 may be provided with suitable inclined faces or guides 29 coöperating with similar faces on clamp 25 to maintain the clamp ends 26 in suitable position to engage the ends of friction strip 23.

In the form disclosed, I have employed a single segment block 21 with a plurality of segment faces 22, and I utilize one clamp member 25 for each segment face 22, this construction being simple and permitting the ready and rapid removal and replacement of each friction strip 23 without disturbing the other strips; but it is understood that I do not consider my invention as limited to a single segment block 21, to a plurality of faces 22, nor to separate clamps 25, as these features may obviously be varied within the scope of my invention.

It will also be noted that with this arrangement, the clamp screws 28 serve to maintain segment block 21 and shaft 20 in fixed relation during the operation of the machine; but block 21 may be readily and rapidly replaced by removing screws 28 and withdrawing shaft 20, which preferably is not connected permanently to segment block 21.

Any preferred means for driving shaft 20 may be employed, such as sprocket 30 mounted on said shaft. In order to permit angular adjustment of the segments so as to determine the time at which each sheet is delivered in relation to the driving mechanism for sprocket 30, I preferably provide an adjustable connection between shaft 20

and said sprocket. With this arrangement, sprocket 30, which is connected to the driving system of the sheet manipulating mechanism, rotates in synchronism therewith; and consequently the feeding of successive sheets may be perfectly synchronized with the manipulating mechanism by regulating the position of the segment relative to sprockets 30. For this purpose, I preferably mount said sprocket loosely on shaft 20 and provide means for releasably engaging said sprocket at a plurality of points thereon, said means being connected to and rotating with the shaft, so as to permit accurate adjustment of said shaft relative to sprocket 30.

One arrangement suitable for this purpose is disclosed, and includes a barrel 31 mounted on shaft 20, with a plunger 32 located in the barrel and held in one of a plurality of concentrically arranged recesses 33 in sprocket 30, as by spring 34 bearing against a shoulder or collar 35 on plunger 32. For retracting the plunger to disconnect shaft 20 from sprocket 30, I may employ a knurled head 36 carried by said plunger and bearing against the outer end of barrel 31. If desired, head 36 may carry a pin 37 fitting in a suitable socket in the barrel and of sufficient length to hold plunger 32 out of engagement with recess 33 when head 36 is retracted and turned sufficiently to shift said pin 37 out of register with its socket, so that it will bear against the end of barrel 31.

Any suitable form of sheet feeding means may be provided for engaging the end of a sheet partially projected from the stack by segment action, to complete the removal thereof and advance said sheet to the sheet manipulating mechanism. I prefer to employ the continuously rotating roller type of feed, various forms of which are well known. In the form disclosed, I employ spaced upper feed rollers 38 mounted on a shaft 39 suitably journaled in frames 11, each roller 38 bearing against a corresponding lower roller 40 mounted on shaft 41 journaled in said frames. Any suitable arrangement for driving the rollers may be employed, such as pinion 42 mounted on shaft 20 and meshing with pinion 43 on shaft 39. If desired, both roller shafts may be positively driven, as by providing intermeshing pinions 44 adjacent one end of said shafts.

I also provide a pointed member for engaging the sheets adjacent the rear end thereof to prevent the feeding of more than one sheet at a time. For this purpose, I employ a blade 45 having a sharpened point 46 at the upper end thereof, blade 45 preferably being sharpened along the top and rear edges to facilitate the tearing or cutting of the bottom sheet when fed against the resistance of point 46. I provide means for clamping blade 45 in position, so constructed that the blade may be adjusted as to height, angle and location longitudinally of the stack. In the preferred form disclosed, I mount the blade clamp on a bracket 47 connected to and projecting below bed plate 14 and provided with a horizontal slot 48. A clamping plate 49 normally rests against bracket 47 and is provided with suitable guideways in which blade 45 is longitudinally slidable. One form of clamp plate 49 is provided with a flat central portion and upturned marginal flanges 50 recessed at opposite sides to accommodate blade 45 resting against the central portion of the clamp plate 49 along a line off-set from the center of the blade. A clamping bolt 51 passes through the center of clamp plate 49, slot 48, and a registering slot 52 in a frame plate 11, said bolt having a head 53 adapted to be located within the marginal flange 50 of the clamp plate 49 and in engagement with blade 45. Said blade and clamp plate 49 are maintained in position against bracket 47 by means of the knurled nut 54 threaded on the opposite end of bolt 51. This arrangement permits angular adjustment of blade 45 by rotation of clamp plate 49 about bolt 51, and also permits vertical adjustment of said blade by sliding it longitudinally in its guide recesses in clamp plate flange 50 when nut 54 is released. The tightening of said nut will bind the blade 45 in its angularly and vertically adjusted position.

I also preferably provide means for adjusting said blade longitudinally of the stack. For this purpose, I employ a clamping shank 55 passing through slot 52, one end of said shank engaging bracket 47 and the other end being engaged by nut 54. With this arrangement, the clamping plate 49 is held in position against bracket 47 at any point longitudinally of slot 48, the release of nut 54 permitting adjustment of said plate longitudinally and, as heretofore indicated, also permitting the angular and vertical adjustment of blade 45. When shank 55 is employed, nut 54 does not bear against the adjacent frame 11, the entire construction being preferably independent of said frame, and supported entirely by bracket 47.

I also provide means for preventing the full weight of the portion of the stack located above blade point 46 from bearing against said point when more than a maximum number of sheets is placed in the hopper. For this purpose, I provide means projecting into the hopper in the path of the end portion of the sheet located over the blade 45, so that said end portion cannot pass the obstructing projection until the opposite end of each sheet has descended be-

low the obstruction sufficiently to bend the sheet until it can pass around the obstruction.

With this arrangement, a substantial part of the rear of the stack located above the obstruction will be tilted upwardly thereby, the weight of the pack resting upon such obstruction. Obviously, a very great variety of obstructing elements may be readily devised and employed, and they may be mounted in different ways. Consequently, I do not consider my invention as limited to the form disclosed herein, nor to slight modifications thereof, as such form merely shows one of a large number of constructions adapted for the purpose.

In the form shown, I employ one or more screw members 56 threaded through a suitable support 57 and projecting into the path of that portion of the stack lying above blade 45. The end 58 of member 56 is preferably pointed or rounded to permit the sheets to slip thereover when in proper position; and if desired, a lock nut 59 may be used to hold said member in adjustment. The support 57 may be mounted in any desired way, being carried by adjacent hopper uprights 13 in the form illustrated; and while I have shown support 57 as mounted in fixed position, I do not consider my invention limited to such a construction.

As has already been noted, the sheets are preferably placed in the hopper paper side downward, as this arrangement increases the frictional engagement between friction strips 23 on the segments, and each bottom sheet; but in order to adapt the feeding apparatus for use with standard machines to which the sheet must be delivered paper side upward, I provide delivery apparatus adapted to reverse the sheet upon leaving rollers 38, and to deliver it in reverse position. For this purpose, I preferably employ a guide plate 60 located in the path of each sheet as it leaves rollers 38 and 40, and adapted to direct each sheet downwardly and preferably rearwardly to reverse its position.

Plate 60 may be mounted in various ways, the form disclosed including a mounting rod 61 carrying plate 60 and preferably having cylindrical end portions 62 passing through supports 63 mounted in fixed relation to the rollers 38 and 40 in any desired way, as by mounting supports 63 on a frame 64 to which supporting lugs 12 are also connected. The cylindrical extension 62 may be held in fixed position against supports 63 in any desired way, as by set screws (not shown), this arrangement permitting axial adjustment of guide plate 60. In connection with said plate, I also preferably employ a continuously moving endless delivery belt 65 having an upper flight located below guide plate 60 and traveling rearwardly beneath the sheet feeding mechanism heretofore described, the construction of which has been so devised and arranged as to permit the sheet to travel in this path. With this arrangement, the forward end of each sheet directed downwardly by guide plate 60 contacts with belt 65, which carries said end rearwardly.

The construction preferably is such that the rearward movement of the forward end of a sheet is produced primarily by belt 65 rather than by guide plate 60, this arrangement insuring the accurate registration of each sheet on the belt since the weight of the sheet holds it against the belt; and the angle of meeting between said sheet end and the belt is sufficiently great to insure accurate location of said end on the belt, avoiding sliding or slipping.

When the machine is in operation, the stack of sheets in the chute will be in the position shown in Fig. 1, with the rear end of all sheets above a certain point supported by screw 58. The rear end of the bottom sheet rests on point 46, rollers 16 and rails 15, except when the friction strip 23 is in engagement therewith, when the front end of the pack is entirely or substantially supported by strips 23. Segment block 21 is rotated in synchronism with the sheet manipulating machinery (not shown), the advance end of strips 23 engaging the bottom sheet and feeding it forward at the proper time between rollers 38 and 40, point 46 tearing through the rear margin of the bottom sheet and immediately engaging the next sheet, holding it in position against the friction of said bottom sheet.

It will be understood that while point 47 is relied on to prevent the feeding of more than one sheet, a suitable restraining wall or gate member may be employed engaging the front end of the pack and having a lower edge adjacent the path of the bottom sheet to prevent passage of additional sheets. In the form disclosed, this wall or gate is provided by hopper members 13, each of said members lying adjacent the front end of the pack having an inwardly extending wall normally engaging said stack end with its lower edge slightly spaced from bed plate 14, preferably by a distance sufficient only to permit the passage of one sheet. However, a great variety of restraining walls or gates of this type are well known, and my invention is not confined to the form shown.

The continuously rotating rollers 38 and 40 feed the bottom sheet against guide plate 60, which directs its forward end downward into contact with the rearwardly traveling upper flight of belt 65, which carries the sheet to the rear, the body of said sheet traveling naturally into contact with belt

65 as the latter advances without any substantial tendency to slip or slide thereon, owing to the relatively vertical direction of feed of the sheet against the belt and the consequent pressure of the sheet against said belt substantially at right angles thereto. The successive sheets are taken from belt 65 in any desired way.

The machine is so constructed and arranged that the various parts may readily be adjusted without taking down the machine, removing any substantial part thereof, or even removing the sheets from the hopper. The pack supporting screws 58 may be adjusted during the operation of the machine to vary the height of the pack below such screws and vary the weight of the pack on point 46 to insure accurate operation thereof. The position of blade 45 both as to height, angle and longitudinal location may be adjusted in a few seconds by releasing the knurled nut 54 and manipulating blade 45 directly, the tightening of said nut operating to clamp the blade in its adjusted position.

In case of wear, breakage or improper operation of the friction feed, strips 23 may be removed, replaced, repaired or reversed by releasing screws 28, each strip 23 being independently mounted. This operation may be performed without disturbing the remaining parts of the machine, and with a minimum of inconvenience and delay. In this connection, it may be noted that the detachable drive connection permits the adjustment of the feed without interfering with the drive of the sheet manipulating machine to which the feed is attached, as the retraction of plunger 32 by manipulating head 36 permits sprocket 30 to revolve, a slight rotation of head 36 maintaining the clutch in inoperative position while the feed is adjusted. It will be apparent that with this arrangement, the feeding mechanism may be very rapidly and readily adjusted in all its operative parts either without stoppage, or with the minimum of delay and without stopping the main machine. Furthermore, with the type of clutch shown, the feeding apparatus may be thrown into operation by using barrel 31 as a handle, rotating it manually until the timing is accurate, when a slight rotation of head 36 will engage the clutch in proper position, and the normal operation will continue.

It will be evident that this construction is highly advantageous, as stoppage of the machinery entails very considerable expense owing to reduction in output, especially when large automatic machines are involved.

While my invention includes the improvement of various parts of the standard type of sheet feeding mechanism disclosed, these improvements coöperating to produce efficient operation and being especially adapted to facilitate the feeding of certain types of sheets, it will be apparent that the improvements in certain of the parts may be employed in other types of apparatus; and I do not consider my invention restricted to the specific combination disclosed. For instance, while I have shown and described means for feeding from the bottom of a stack, it will be apparent that certain features are equally adapted to feed sheets from the top of a stack; and furthermore, some features may be used in devices which do not, strictly speaking, feed from a stack at all, but from a succession of sheets delivered to the feeding means by other apparatus.

Moreover, while I have shown and described a preferred form of apparatus embodying my invention and indicated certain variations therein, it will be apparent that many other changes may be made within the scope of my invention as set forth in this specification.

I claim:

1. In sheet feeding apparatus, a substantially horizontal, flat support for a stack of sheets, vertical guides for the stack, means for supporting the rear end of an upper portion of the stack, a sheet restraining member engaging below the stack near its rear end, a rotary feed member having a surface in the form of a segment of a cylinder engaging below the bottom of the stack near its front end, means supporting the feed member on a fixed axis of rotation and additional sheet gripping and feeding means for seizing and withdrawing from the stack a sheet started from the stack by the feed member.

2. In apparatus for feeding sheets from a stack, means for feeding single sheets in succession from one end of the stack, including means engaging an end sheet adjacent one end thereof for feeding it forward from the stack, a pointed member adapted to penetrate the rear end of the adjacent sheet to prevent feeding thereof when the end sheet is fed, and means for admitting of adjustment of said pointed member as to height, angular relation to said sheets, and longitudinal position relative to said sheets.

3. In apparatus for feeding sheets from a stack, means for feeding single sheets in succession from one end of the stack, including means engaging an end sheet adjacent one end thereof for feeding it forward from the stack, a pointed member adapted to penetrate the rear end of the adjacent sheet to prevent feeding thereof when the end sheet is fed, and means for admitting of adjustment of said pointed member as to height, angular relation to said sheets, and longitudinal position relative to said sheets.

4. In apparatus for feeding sheets from a stack, means for feeding single sheets in succession from one end of the stack, including means engaging an end sheet adjacent one

end thereof for feeding it forward from the stack, a pointed member adapted to penetrate the rear end of the adjacent sheet to prevent feeding thereof when the end sheet is fed, a rotatable member in which said pointed member is slidably mounted for longitudinal adjustment, and means for simultaneously clamping the rotatable member and the pointed member in fixed position.

5. In apparatus for feeding sheets from a stack, means for feeding single sheets in succession from one end of the stack, including means engaging an end sheet adjacent one end thereof for feeding it forward from the stack, a pointed member adapted to penetrate the rear end of the adjacent sheet to prevent feeding thereof when the end sheet is fed, and means for adjusting said pointed member as to height and angular position, including a rotatable member, a socket carried thereby in which the pointed member is longitudinally slidable for adjustment, a shaft about which said rotatable member moves for angular adjustment, and means carried by the shaft for engaging said rotatable member and pointed member to clamp them simultaneously in adjusted position.

6. In apparatus for feeding sheets from a stack, means for feeding single sheets in succession from one end of the stack, including means engaging an end sheet adjacent one end thereof for feeding it forward from the stack, a pointed member adapted to penetrate the rear end of the adjacent sheet to prevent feeding thereof when the end sheet is fed, and means for adjusting said pointed member as to height and angular position, including a rotatable member, guide means on one side of said member for slidably holding the pointed member, a shaft about which the rotatable member revolves, a frame element engaging the other side of the rotatable member, an abutment on the shaft, and means for shifting the shaft longitudinally to clamp said pointed and rotatable members between the abutment and the frame member to hold the pointed member in adjusted position.

7. In apparatus for feeding sheets from a stack, means for feeding single sheets in succession from one end of the stack, including means engaging an end sheet adjacent one end thereof for feeding it forward from the stack, a pointed member adapted to penetrate the rear end of the adjacent sheet to prevent feeding thereof when the end sheet is fed, and means for adjusting the position of the pointed member, including a rotatable member, a socket carried thereby in which the pointed member is longitudinally slidable, and means for clamping said pointed and rotatable members in fixed position at a plurality of points longitudinally of the stack.

8. In apparatus for feeding sheets from a stack, means for feeding single sheets in succession from one end of the stack, including means engaging an end sheet adjacent one end thereof for feeding it forward from the stack, a pointed member adapted to penetrate the rear end of the adjacent sheet to prevent feeding thereof when the end sheet is fed, and means for adjusting the position of the pointed member, including a rotatable member, a socket carried thereby in which the pointed member is longitudinally slidable, and means for clamping said pointed and rotatable members in fixed position at a plurality of points longitudinally of the stack, said clamping means including a shaft, an abutment carried by the shaft, a fixed frame member, and means for shifting the shaft longitudinally to hold said pointed and rotating members in fixed position between the abutment and the fixed frame member.

9. In sheet feeding apparatus, sheet feeding means frictionally engaging the sheet face, including a rotatable segmental support having inwardly directed ends, a strip of friction material positioned thereon with its ends extending inwardly along the ends of the segmental support, said strip being adapted to engage a sheet face when the support is rotated, a clamping member for clamping said strip ends against the ends of the support, and screw means for releasably maintaining the clamping member in operative position.

10. In sheet feeding apparatus, rotatable means for feeding successive sheets to a sheet manipulating machine, drive means adapted to be connected to and operated by the driving mechanism of said sheet manipulating machine, and an adjustable connection between said rotatable sheet feeding means and the drive means for changing the angular relation between said means to adjust the timing of the sheet feeding relative to the sheet manipulating apparatus.

11. In sheet feed mechanism, an apertured table supporting a stack of sheets, vertical stack guides, a rotary segmental cylindrical feed member engaging below the stack near one end, a roll-support for the stack engaging below the stack at a point intermediate the ends, a retaining member engaging below the stack near the rear edge and piercing the lower sheet to retain the sheet next-above, and means supporting the rear end of an upward portion of the stack to relieve the retaining member of part of the stack weight.

12. In sheet feed mechanism, an apertured table supporting a stack of sheets, vertical stack guides, a rotary segmental cylindrical feed member engaging below the stack near one end, a roll-support for the stack engaging below the stack at a point intermediate

the ends, a retaining member engaging below the stack near the rear edge and piercing the lower sheet to retain the sheet next-above, and means supporting the rear end of an upward portion of the stack to relieve the retaining member of part of the stack weight, the forward end of the stack being unsupported except by the table and feed member so that full weight of the stack is available for the feeding action.

Signed at Jersey City in the county of Hudson and State of New Jersey this 19th day of April, A. D. 1920.

FREDERICK A. DRURY.