Oct. 11, 1966 H. FENGLER ET AL 3,278,181

SHEET FEEDING APPARATUS FOR DUPLICATORS

Filed Dec. 16, 1964 6 Sheets-Sheet 1

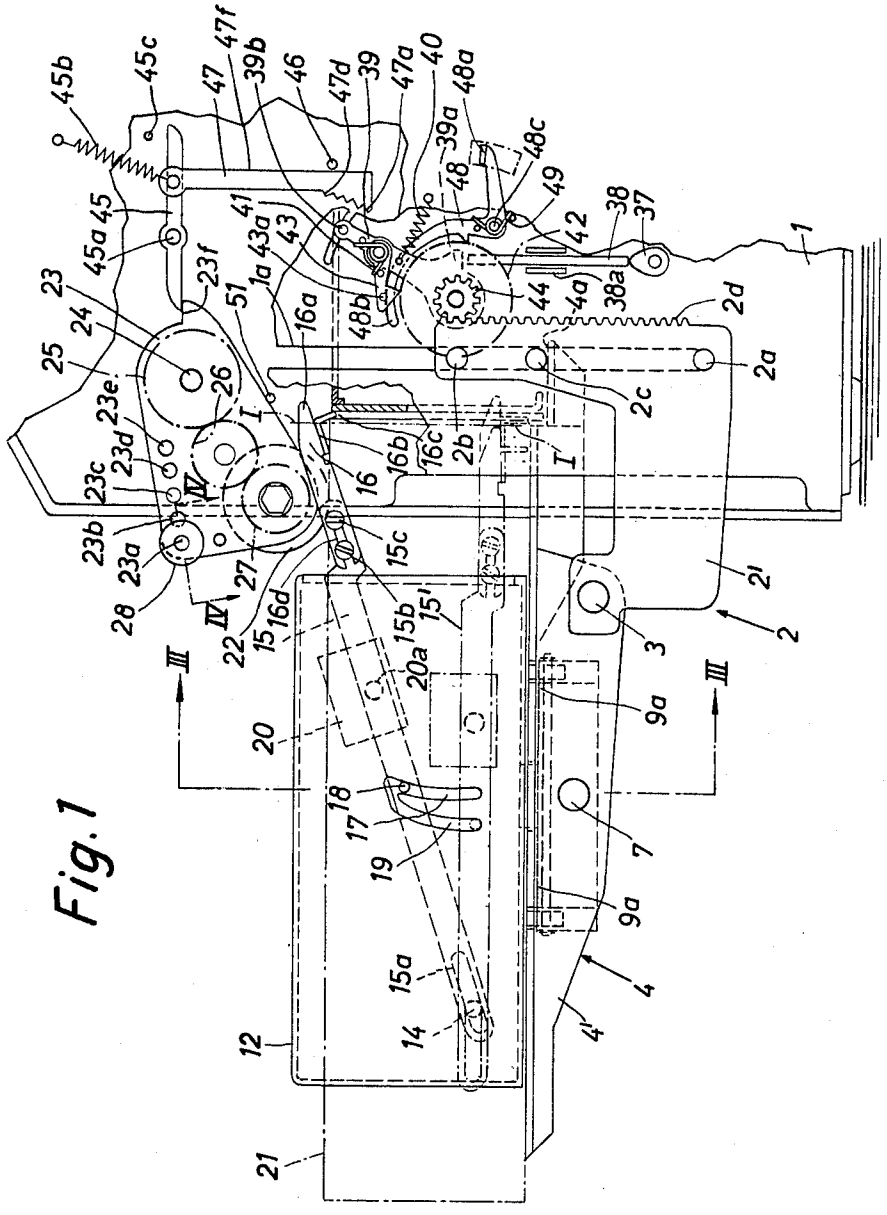


Fig. 1

INVENTOR.
HARALD FENGLER
KONRAD PHLEPS
GÜNTHER SCHNALL

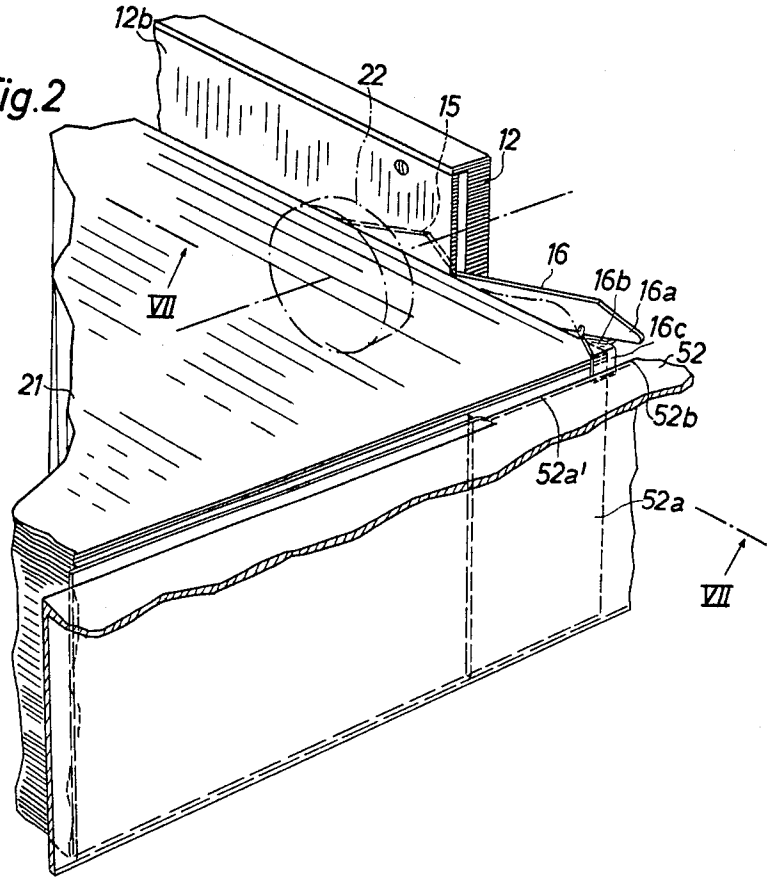
BY Michael S. Striker
Atty

Oct. 11, 1966 H. FENGLER ET AL 3,278,181

SHEET FEEDING APPARATUS FOR DUPLICATORS

Filed Dec. 16, 1964 6 Sheets-Sheet 2

Fig.2



INVENTOR.
HARALD FENGLER
KONRAD PHLEPS
GUNTHER SCHNALL

BY

Michael J. Striker
Atty

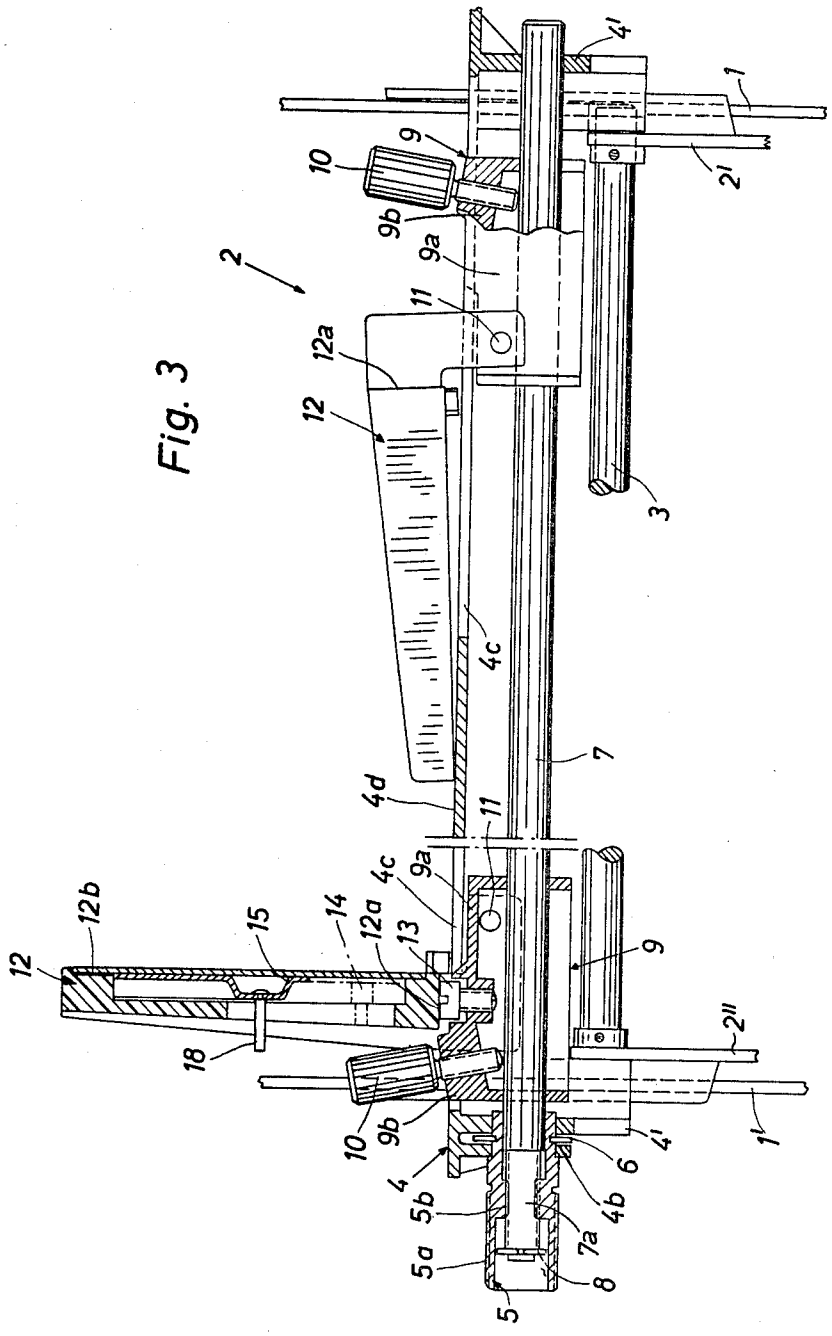
Oct. 11, 1966 H. FENGLER ET AL 3,278,181

SHEET FEEDING APPARATUS FOR DUPLICATORS

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6 Sheets-Sheet 3

Fig. 3



INVENTOR.
HARALD FENGLER
KONRAD PHLEPS
GÜNTHER SCHNALL

BY

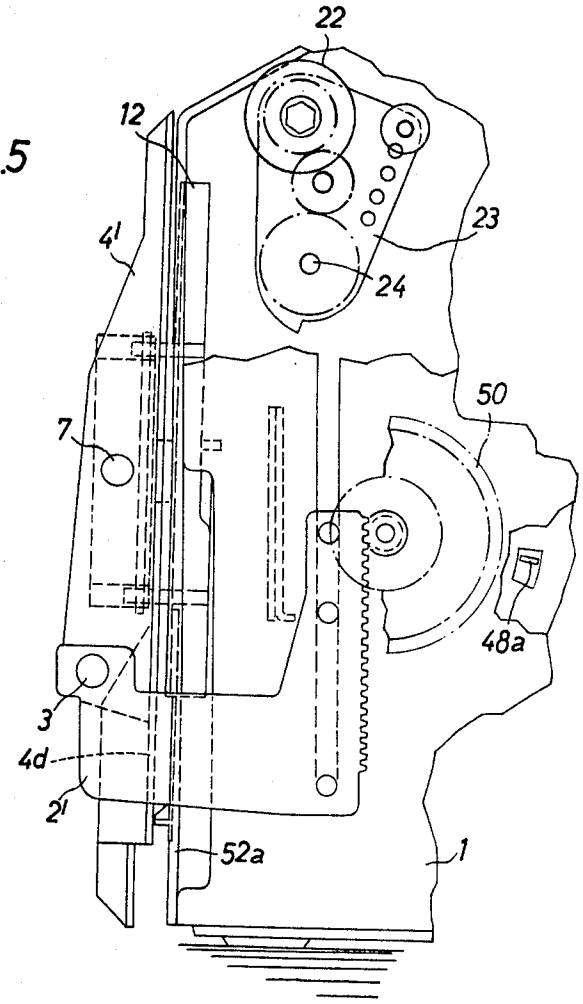
Michael J. Striker
Atty

Oct. 11, 1966 H. FENGLER ET AL 3,278,181

SHEET FEEDING APPARATUS FOR DUPLICATORS

Filed Dec. 16, 1964 6 Sheets-Sheet 4

Fig.5



BY

INVENTOR.
HARALD FENGLER
KONRAD PHLEPS
GÜNTHER SCHNALL

Michael J. Striker
Atty

Oct. 11, 1966 H. FENGLER ET AL 3,278,181

SHEET FEEDING APPARATUS FOR DUPLICATORS

Filed Dec. 16, 1964

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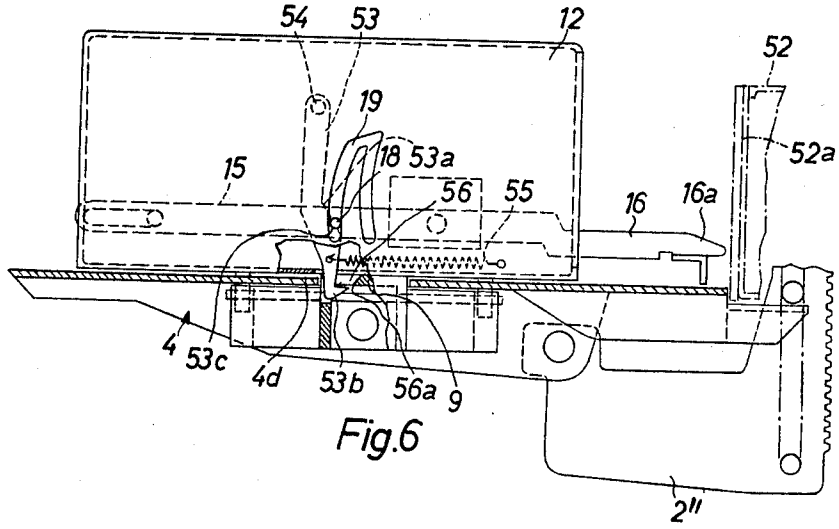


Fig.6

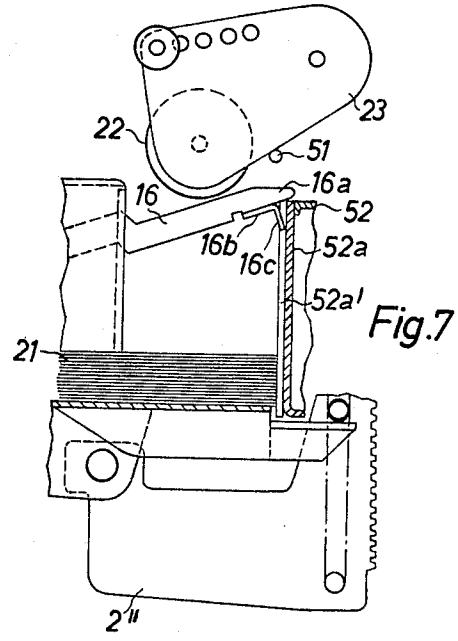


Fig.7

BY

INVENTOR.
HARALD FENGLER
KONRAD PHLEPS
GUNTHER SCHNALL

Michael J. Strauss
Atty

Oct. 11, 1966 H. FENGLER ET AL 3,278,181

SHEET FEEDING APPARATUS FOR DUPLICATORS

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Fig.8

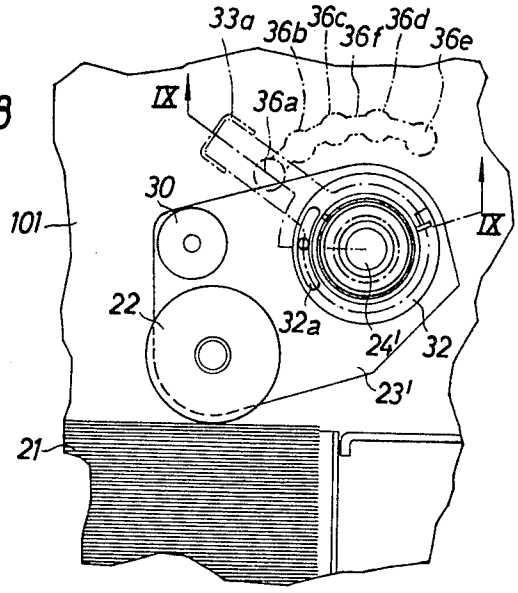
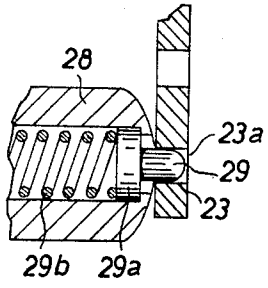


Fig.4



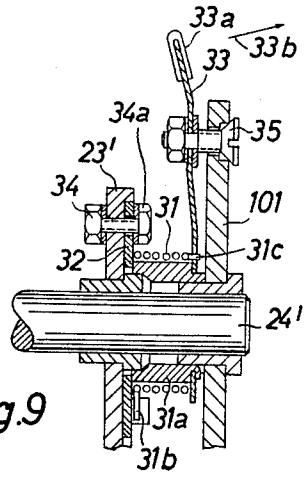


Fig.9

INVENTOR.
HARALD FENGLER
KONRAD PHLEPS
GUNTHER SCHNALL

BY

Michael J. Striker
Atty

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3,278,181

SHEET FEEDING APPARATUS FOR DUPLICATORS

Harald Fengler, Munich, Konrad Phleps, Grunwald, and Günther Schnall, Munich, Germany, assignors to Agfa Aktiengesellschaft, Leverkusen, Germany

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Claims priority, application Germany, Dec. 20, 1963, A 44,853
30 Claims. (Cl. 271—22)

The present invention relates to printing machines in general, and more particularly to an improved sheet feeding apparatus for duplicators and similar printing or reproducing machines.

An important object of the invention is to provide a relatively simple apparatus which can be readily adjusted to accommodate stacks of different height, width or length and which can be adjusted to feed sheets of different consistency.

Another object of the invention is to provide a sheet feeding apparatus whose parts may be collapsed to form a compact unit which may be stored in a small area and which may be collapsed only when its corner separators and other sensitive components are protected against deformation and/or other damage.

A further object of the invention is to provide a sheet feeding apparatus wherein the corner separators are guided and mounted in such a way that each thereof assumes an optimum position with reference to the uppermost sheet of a stack regardless of the height and other dimensions of the stack.

An additional object of the invention is to provide improved supports for the corner separators of a sheet feeding apparatus.

A concomitant object of our invention is to provide improved carriers for the elements which feed the sheets from the stack on to the printing mechanism of a duplicator.

Still another object of the invention is to provide improved adjusting mechanisms which regulate the pressure between the uppermost sheet of a stack and the elements which feed sheets from the stack on to the printing mechanism.

Another object of the invention is to provide a sheet feeding apparatus wherein the corner separators are assembled, configurated and mounted in such a way that they automatically move to optimum positions of engagement with the uppermost sheet when the operator decides to insert a fresh stack of sheets into the space from which the sheets are being fed seriatim to the printing mechanism of a duplicator or another printing or reproducing machine.

A further object of our invention is to provide a sheet feeding apparatus wherein the elements which actually displace the uppermost sheets of a stack control such movements of the sheet feeding apparatus which are necessary to compensate for gradual reduction in the height of a stack when the printing machine is in actual use and recieves sheets from the feeding apparatus.

Still another object of our invention is to provide a sheet feeding apparatus wherein the supports for the corner separators are readily detachable and/or adjustable into optimum positions for engagement with the sheets of a fresh stack.

Another object of the invention is to provide a sheet feeding apparatus which can be readily attached to or otherwise combined with many types of presently utilized printing mechanisms in a duplicator or another printing machine.

A further object of the present invention is to provide an improved feed table which may be used in a sheet feeding apparatus of the above outlined characteristics and to assemble the feed table in such a way that it may be readily moved with reference to and/or detached from the housing of a duplicator.

Briefly stated, one feature of our invention resides in the provision of an apparatus for feeding sheets to the printing mechanism of a printing machine. The apparatus comprises a feed table having a platform for supporting a stack of sheets, a pair of side rails mounted on the feed table for lateral movement toward and away from the sides of a stack therebetween, feeding means preferably including one or more roller-shaped feed members for feeding the uppermost sheets from the stack which rests on the platform, a pair of corner separators each including a substantially horizontal lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a substantially vertical stop disposed ahead of the corresponding front corner of the uppermost sheet, and coupling assemblies articulately connecting each corner separator to one of the side rails in such a way that the corner separators descend by gravity in a plane which is substantially normal to the platform when the height of the stack on the platform decreases.

In accordance with a more specific feature of our invention, each coupling assembly may include an elongated supporting arm which is detachably secured to the corresponding corner separator and is provided with an elongated slot which receives a pivot pin mounted on the respective side rail so that the supporting arms are pivotable about and may perform at least some longitudinal movements with reference to the pivot pins. Each supporting arm carries a follower which extends into a suitable cam slot provided in the corresponding side rail and serving to allow for automatic gravitational descent of the corner separators in response to decreasing height of the stack on the platform whereby the cam slots guide the supporting arms in such a way that the corner separators descend in a plane which is substantially normal to the platform, i.e., the position of the stops on the corner separators with reference to the uppermost sheet of the stack will remain substantially unchanged regardless of the momentary height of the stack. It is clear that the followers may be mounted on the side rails and that the cam slots may be provided on the supporting arms. This would amount to a simple reversal of functions.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved printing machine itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawings, in which:

FIG. 1 is a fragmentary side elevational view of a portion of a printing machine whose sheet feeding apparatus is constructed and assembled in accordance with a first embodiment of our invention, certain parts of the machine being shown in part diagrammatically and in part broken away;

FIG. 2 is an enlarged fragmentary perspective view of the front portion of a feed table which forms part of the improved sheet feeding apparatus;

FIG. 3 is a transverse vertical section through the feed table substantially as seen in the direction of arrows from the line III—III of FIG. 1 and shows one of the side rails in folded position;

FIG. 4 is a fragmentary transverse section as seen in the direction of arrows from the line IV—IV of FIG. 1 and illustrates one form of adjustable mechanism which serves to regulate the pressure between the feed members and the uppermost sheet of a paper stack;

FIG. 5 illustrates the feed table in idle position in which its platform is located in a substantially vertical plane;

FIG. 6 illustrates a safety device which serves to prevent folding of the associated side rail when the corner separator is still in operative position;

FIG. 7 is a fragmentary longitudinal vertical section substantially as seen in the direction of arrows from the line VII—VII of FIG. 2 and illustrates one of the corner separators in operative position while the feed table assumes its lower end position in which the platform may receive a fresh stack of paper sheets on top of the remainder of the preceding stack;

FIG. 8 is a fragmentary side elevational view of a modified printing machine wherein the feed members are biased by adjustable torsion springs; and

FIG. 9 is a section as seen in the direction of arrows from the line IX—IX of FIG. 8.

Referring first to FIGS. 1 to 3, there is shown a printing machine which comprises a housing including an upright wall **1** provided with a vertical slot **1***a* which guides two pins or studs **2***a*, **2***b* mounted on a depending side wall or skirt **2'** forming part of a vertically reciprocable feed table **2**. The feed table comprises a second side wall or skirt **2''** whose pins are guided in the vertical slot of a second upright wall **1'**, and this second side wall **2''** is connected to the side wall **2'** by a series of spacer bolts (not shown) as well as by a transversely extending horizontal shaft **3**. The feed table **2** further includes a tiltable platform **4** having two depending lateral panels **4'** and being rockable about the axis of the shaft **3**. The platform **4** is provided with forwardly extending projections **4***a* which normally engage stop pins **2***c* mounted on the side walls **2'**, **2''**. When the projections **4***a* engage the corresponding stop pins **2***c*, the platform **4** is in proper position to receive a stack of sheets. The side walls **2'**, **2''** and the shaft **3** form a frame or substructure of the feed table **2** whose superstructure consists of the platform **4**.

A manually operable actuating member or knob **5** is provided with a knurled peripheral portion **5***a* and includes an internally threaded cylindrical portion **5***b* which meshes with the externally threaded end portion **7***a* of a transversely extending horizontal spindle **7**. The actuating knob **5** is rotatable in one of the panels **4'** and is retained therein by a split ring **6**, shown in FIG. 3. The ring **6** may be inserted or removed through a slot **4***b* provided in the left-hand panel **4'**, as the parts appear in FIG. 3, and serves to prevent axial displacements of the actuating knob **5**. A second split ring **8** is mounted at that end of the threaded portion **7***a* which extends beyond the threaded portion **5***b* of the actuating knob **5** and serves to prevent complete withdrawal of the spindle **7**. This spindle supports two mounting brackets **9** in such a way that each mounting bracket can be made to move axially of and to rotate about the spindle or, better to say, that the spindle can rotate in the mounting brackets. The upper portions or heads **9***b* of the mounting brackets **9** extend upwardly and through transverse apertures **4***c* provided in the top plate **4***d* of the platform **4**. The apertures **4***c* are configurated in such a way that they guide the heads **9***b* of the corresponding mounting brackets during axial movement with reference to the spindle **7**. The legs **9***a* of the mounting brackets **9** are located at a level beneath the top plate **4***d* and are mounted directly on the spindle **7**. Clamping screws **10** serve to secure the mounting brackets **9** to the spindle **7**, and the milled heads of these clamping screws extend above the top plate **4***d* to be readily accessible for manipulation by the operator of the printing machine. The tips of the screws **10** may engage the spindle with sufficient friction to prevent any uncontrolled movements of the mounting brackets.

Each arm **9***a* carries a horizontal pivot pin **11** for one of two side rails **12** which may be rotated in vertical planes about horizontal axes extending at right angles to the axis of the spindle **7**, see FIG. 3. The means for detachably securing the pivot pins **11** to the corresponding arms **9***a* comprises suitable split rings or the like, not shown in the drawings. When the side rails **12** are moved to their operative positions as shown for the left-hand side rail **12** of FIG. 3, their lower edge faces **12***a* abut against the heads of stop screws **13** which are driven into the corresponding mounting brackets **9** and are rather difficult to turn so as to provide reliable abutments for the associated side rails and to hold them in operative positions. When a side rail **12** is pivoted to the inoperative or folded position, shown in the right-hand portion of FIG. 3, it may come in actual abutment with the upper side of the top plate **4***d*.

By releasing the clamping screws **10**, the operator is in a position to move the mounting brackets **9** toward or away from each other by shifting the arms **9***a* along the spindle **7**. Such adjustment will be necessary in order to move the side rails **12** laterally and into actual abutment with the sides of a stack **21** which rests on the top plate **4***d* between the mounting brackets **9**. When the clamping screws **10** are applied with requisite force, the spindle **7** cannot rotate and, by rotating the actuating knob **5**, the operator is in a position to shaft the spindle axially, together with the mounting brackets **9**, screws **10**, pivot pins **11** and side rails **12**.

Each side rail **12** carries a horizontal pivot pin **14** which is coupled with the rear end portion of an elongated supporting arm **15**. The rear end portions of the arms **15** are provided with elongated closed slots **15***a* which receive the pins **14** so that each supporting arm may pivot about and is free to move, within limits, radially of the corresponding pin **14**. The front end portions of the supporting arms **15** carry corner separators **16**. Each supporting arm includes a pin-shaped follower **18** which extends into and tracks the walls surrounding an arcuate cam slot **17** provided in the corresponding side rail **12**. The configuration of each cam slot **17** is such that the corresponding corner separator **16** moves in a vertical plane when the follower **18** tracks the walls surrounding the respective slot **17** while the rear end portion of the arm **15** simultaneously pivots and slides with reference to the pin **14**. In other words, the corner separators **16** will move up or down in response to a composite movement of the associated supporting arms **15**, and such composite movement includes a pivotal movement about the pin **14** and simultaneous longitudinal displacement with reference to this pin. Lateral movements of the supporting arms **15** are restricted by plate-like guides **12***b* which are mounted on or form part of the corresponding side rails **12**.

Each cam slot **17** communicates with a further cam slot **19** which may receive the corresponding follower **18** when the supporting arms **15** are to be moved into retracted or inoperative positions indicated in FIG. 1 by phantom lines **15'**. When the operative position, i.e., when the followers **18** extend into the cam slots **17**, the corner separators **16** will travel up and down in a vertical plane indicated in FIG. 1 by a heavy phantom line I—I. More particularly, the corner separators will move in a plane which is substantially normal to the plane of the top plate **4***d*. When in inoperative position, the tips **16***a* of the corner separators **16** are withdrawn sufficiently to bypass the adjoining stationary parts of the printing machine when the side rails **12** are pivoted to their collapsed or folded positions (see the right-hand portion of FIG. 3). As shown in FIG. 3, the followers **18** may extend outwardly and well beyond the outer sides of the rails **12** to serve as handgrip members which may be manipulated by fingers when the supporting arms **15** are to be moved into their phantom-line retracted or inoperative positions **15'**. As a rule, the cam slots **19** will be configurated in such a way that they insure smooth transfer of followers **18** from the corresponding cam slots **17** and equally smooth descent of supporting arms **15** toward the upper side of the top plate **4***d*. The lowermost portions of the slots **19** may be straight or substantially straight.

Each corner separator **16** is provided with an elongated open slot **16***d* which receives the stems of two fastening screws **15***b*, **15***c* serving to secure it to the front end portion of the corresponding supporting arm **12**. Each corner separator further comprises a substantially horizontal separator lip **16***b* located rearwardly of the tip **16***a* and a generally vertical front stop **16***c*. The lips **16***b* overlie the front corners of the uppermost sheet of the stack **21** which is placed onto the top plate **4***d*, either due to the weight of the corresponding supporting arm **15** or due to the provision of a weight **20** which is detachably fastened to the supporting arm by a screw **20***a* or the like. Thus, each supporting arm **15** actually resembles a lever whose fulcrum is at **14** and whose right-hand end portion (carrying the coner septrator **16** and weight **20**) is so heavy that the lip **16***b* of the corner separator rests on the uppermost sheet of the stack **21** shown in FIG. 1. The screws **15***b*, **15***c* allow for adjustment of corner separators **16** longitudinally of the associated supporting arms **15** or for complete detachment of the corner separators. When the lips **16***b* rest on the front corners of the uppermost sheet of the stack **21**, the front stops **16***c* are located just ahead of the respective front corners at the front side of the stack and prevent any shifting of uppermost sheets in forward direction. Each corner separator **16** may be readily detached to be replaced by a different corner separator which might be better suited for use in connection with a certain type of paper. For example, the printing machine may be furnished with a set of corner separators having lips **16***b* of different length or area so that such lips will overlie a larger or smaller portion of the uppermost sheet in the stack **21**. The front stops **16***c* extend downwardly from the front edges of the lips **16***b*, see particularly FIG. 2.

The uppermost sheet of the stack **21** is engaged by a pair of feed rollers **22** (only one shown) which are mounted on plate-like carriers **23**. The carriers **23** are rockable on horizontal shafts **24** each of which supports a driver gear **25**. The gears **25** are rotated by the drive mechanism of the printing machine in a manner well known per se, for example, through the intermediary of a freewheel clutch, and each driver gear **25** meshes with an intermediate gear **26** which drives a pinion **27** on the shaft of the corresponding feed roller **22**. The feed rollers **22** are driven intermittently in synchronism with the operation of the printing mechanism so as to feed the sheets at requisite intervals as will be described later. Thus, whenever the feed rollers **22** rotate in a sense to shift the uppermost sheet of the stack **21** in a direction to the right, as the parts appear in FIG. 1, the front edge portion of the topmost sheet bulges upwardly because it is held by the lips **16***b* and front stops **16***c* of the corner separators **16** until its bulge increases sufficiently to snap out of the corner separators and to straighten out whereby the front edge portion advances beyond the front side of the stack **21** and is ready to be engaged by the transfer mechanism which feeds it on to the printing station.

The pressure of the feed rollers **22** and the pressure of the corner separators **16** will be adjusted to suit different grades of paper.

In accordance with a feature of the present invention, the pressure of feed rollers **22** upon topmost sheet of the stack **21** may be adjusted in a number of ways. As shown in FIGS. 1 and 4, the carriers **23** support an auxiliary weight in the form of a hollow cylindrical roll **28** whose end portions receive two outwardly extending pins **29** having pistons **29***a* biased by a helical expansion spring **29***b*. Each carrier **23** is provided with a series of holes **23***a*–**23***e* each of which may receive one of the pins **29**. Each of these holes is machined at a different distance from the corresponding shaft **24** so that the pressure of the feed rollers **22** upon the uppermost sheet of the stack **21** varies when the pins **29** are withdrawn from the holes **23***a* and are inserted into another pair of aligned holes **23***b*, **23***c*, **23***d* or **23***e*. In other words, by transposing the pins **29** into a different pair of aligned holes in the carriers **23**, the operator may select the pressure exerted by the feed rollers **22** upon the uppermost sheet of the stack **21**. Such pressure must be changed when the friction between the sheets of the fresh stack is different from the friction between the sheets of the preceding stack or when the friction between the peripheral surfaces of the feed rollers **22** and the sheets of two consecutive stacks is different. The rollers **22** may consist of rubber or other elastomeric material, either entirely or at least in part.

FIGS. 8 and 9 illustrate a different arrangement which enables the operator to change the pressure of feed rollers **22** upon the uppermost sheet of the stack. The shaft **24'** of the driver gear (not shown) supports a modified pivotable carrier **23'** which is connected with a permanently or detachably mounted weight **30** here shown as a roll located above the feed roller **22'**. The pressure transmitted by the weight **30** is constant but the pressure of the feed roller **22'** may be varied by a torsion spring **31** which is convoluted around a cylindrical sleeve or reel **31***a* surrounding the shaft **24'**. One end portion **31***b* of the spring **31** is secured to a disk **32** which is provided with a concentric arcuate slot **32***a* and is angularly adjustably fixed to the carrier **23'** by a bolt **34** and nut **34***a*. The other end portion **31***c* of the spring **31** engages an actuating lever **33** having a knob **33***a* which extends upwardly beyond a fixed supporting member **101**. The optimum initial pressure of the feed roller **22** is selected by angular adjustment of the disk **32** with reference to the carrier **23'**. Once the disk **32** is moved to requisite angular position, the bolt **34** is passed through a bore in the carrier **23'** and is fixed in position by the nut **34***a* so that the disk **32** remains attached to the carrier. In the meantime, the lever **33** remains in the starting position of FIG. 8 in which the head of a locating or arresting screw **35** extends into the leftmost enlarged portion **36***a* of an arcuate slot **36***f* provided in the supporting member **101**. It will be readily understood that the bias of the torsion spring **31** changes if the knob **33***a* is shifted in the direction indicated by the arrow **33***b* (see FIG. 3) to withdraw the head of the screw **35** from the enlarged portion **36***a*, and if the lever **33** is thereupon pivoted to move the head of the screw **35** into one of the enlarged portions **36***b*–**36***e*. The center of curvature of the slot **36***f* is located on the axis of the shaft **24'**. Thus, by manipulating the lever **33**, the operator may change the pressure between the feed roller **22'** and the uppermost sheet of the stack **21**. Such pressure will be varied for reasons which were explained in connection with FIG. 4. It is clear that the slot **36***f* may be provided with two, three, four or more than five enlarged portions, depending on the desired number of adjustments in the pressure of the feed rollers **22'**. The same holds true for the number of holes in the carrier **23** shown in FIGS. 1 and 4.

The lever **33** is resilient and tends to assume a position in which the head of the locating screw **35** extends into one of the enlarged portions **36***a*–**36***e*. It is further clear that the other carrier **23'** (not shown in FIGS. 8 and 9) is provided with a similar pressure adjusting arrangement including a second spring **31** and a second lever **33**.

Referring again to FIG. 1, the lifting mechanism for the feed table **2** is driven by a cam **37** which rotates at a constant speed to reciprocate a vertical push rod **38** guided in bearings **38***a*. The upper end of the push rod **38** engages a projection or nose **39***a* provided on a rockable lever **39** and can turn this lever in a counterclockwise direction against the bias of a return spring **40** which simultaneously compels the lower end of the push rod **38** to track the face of the cam **37**. When the spring **40** is free to contract (i.e., when the push rod **38** performs a return stroke in downward direction, as viewed in FIG. 1), the lever **39** may cause a ratchet wheel **42** to rotate by a step in a clockwise direction. The ratchet wheel **42** is engaged by the pallet of a pawl **43** which is pivotably secured to the lever **39** and is biased against the ratchet

wheel by a torsion spring **41**. The ratchet wheel **42** is connected with a coaxial pinion **44** which meshes with a vertical rack **2***d* provided on the downwardly extending side wall **2'** of the feed table **2**. The pinion **44** can lift the feed table whenever the push rod **38** performs a return stroke.

The lever **39** also performs a second function, namely, it causes the feed table **2** to rise at a rate which is proportional to changes in angular position of the carrier **23** such as will result from a reduction in the height of the stack **21**. The carrier **23** comprises a projection or nose **23***f* which extends forwardly and is engaged by the left-hand arm of a two-armed lever **45** mounted on a pivot pin **45***a* which is secured to the wall **1** or to another stationary part of the housing. The right-hand arm of the lever **45** is biased by a spring **45***b* which tends to maintain the lever in abutment with a stop pin **45***c* mounted on the wall **1**. The right-hand arm of the lever **45** is articulately connected with a substantially vertical link **47** having a vertical face **47***f* which abuts against a stationary stop pin **46**. When the feed roller **22** is raised, i.e., when the stack **21** is high, a pin or stud **39***b* at the upper end of the lever **39** engages the lowermost (left-most) serration **47***a* at the lower end of the link **47**. When the height of the stack **21** is reduced and the feed roller **22** descends to a lower level, the projection **23***f* of the carrier **23** rocks the lever **45** in a clockwise direction, as viewed in FIG. 1, whereby the link **47** descends and the pin **39***b* comes in engagement with the next higher serration at the lower end of the link **47**. Consequently, the lever **39** may turn through a larger angle and effects a larger upward movement of the stack **31** by allowing the pinion **44** to rotate through a greater angle. The lifting action of the lever **39** will increase stepwise when the pin **39***b* will be free to engage the next higher seration and such lifting action will be greatest when the pin **39***b* engages the topmost serration **47***d*.

A locking pawl **48** is rockable about a pin **48***c* and is biased by a torsion spring **49** so that its pallet engages the ratchet wheel **42** and prevents rotation of the pinion **44** when the lever **39** rotates in a counterclockwise direction. During such rotation of the lever **39**, the pallet of the pawl **43** simply rides over the teeth of the ratchet wheel **42**. The pawl **48** is provided with an outwardly extending tongue **48***a* which serves as a handgrip member and is used to disengage the pawl **48** from the ratchet wheel **42** so that the feed table **2** may descend to its lower end position when the operator desires to insert a fresh stack **21**. When the tongue **48***a* is depressed, a sickle-shaped motion transmitting portion **48***b* of the pawl **48** engages a pin **43***a* on the pawl **43** and moves the latter out of engagement with the ratchet wheel **42**. When the feed table **2** returns to the lower end position, the pin **2***a* abuts against the bottom wall of the vertical slot **1***a*. If the just described mechanism is equipped with a friction brake or with another device which prevents automatic descent of the feed table **2** in response to disengagement of pawls **43**, **48** from the ratchet wheel **42**, the shaft of the pinion **44** is rotated by a handwheel **50** shown in FIG. 5 or by another suitable manually operated device. Once the feed table **2** reaches its lower end position in which the pin **2***a* is moved to the position shown in FIG. 1, the operator is free to place a fresh stack **21** onto the top plate **4***d* of the platform **4**.

In response to rotation of the handwheel **50** in the opposite direction, the feed table **2** is returned to an intermediate position in which the feed rollers **22** bear against the uppermost sheet of the freshly inserted stack **21** while the corner separators **16** engage the front corners of the uppermost sheet. Alternatively, the mechanism shown in the right-hand part of FIG. 1 will automatically lift the stack to a predetermined level when the printing machine is started. When the feed rollers **22** are out of contact with the stack **21**, the carriers **23** rest on stop pins **51** which are secured to the housing of the printing machine and the pin **39***b* of the lever **39** cooperates with the topmost serration **47***d* on the link **47**. Consequently, the feed table **2** rises rapidly to move the uppermost sheet to a predetermined level and into actual engagement with the feed rollers. It is clear that such lifting of the feed table **2** is necessary only when the height of a fresh stack **21** does not suffice to keep the uppermost sheet in contact with the feed rollers **22** while the pin **2***a* is moved to the position shown in FIG. 1.

The insertion of a fresh stack **21** is further facilitated by the provision of a stop for the front side of the stack. This stop is provided on the vertical front wall **52***a* of the housing. Thus, even if the operator is careless and simply shoves a fresh stack into the space between the side rails **12**, the front side of the stack will come in abutment with the front wall **52***a* and all of the sheets will remain in proper overlapping position with reference to each other. It will be noted that at least a portion of the front wall **52***a* is nearer to the front side of the stack **21** than the vertical stops **16***c*. The height of the front wall **52***a* is less than the height of a fresh stack **21** (see FIG. 2) so that the uppermost sheet, and a few sheets which are located directly below the uppermost sheet, will abut solely against the vertical front stops **16***c* of the corner separators **16**. Once the uppermost sheet is caused to skid over the lips **16***b* of the corner separators, its front edge portion overlies the rearmost part of a horizontal plate **52** which extends forwardly from the upper end of the front wall **52***a*. The lateral portions **52***a'* of the front wall **52***a* are offset forwardly with reference to the remainder of the front wall to provide room for the corner separators when the height of the stack **21** decreases. However, when the height of the stack **21** decreases below a minimum permissible level, the tips **16***a* of the corner separators come to rest on the laterally extending end portions **52***b* of the horizontal plate **52** and prevent further descent of the corner separators. Thus, when inserting a fresh stack, the operator need not lift the corner separators **16** because they are lifted automatically by the uppermost sheet of the fresh stack which slides beneath the lips **16***b*. The same applies for the feed rollers **22** which are held against further descent when the corresponding carriers **23** abut against the fixed stop pins **51** shown in FIG. 1. When the operator inserts a fresh stack, the feed rollers **22** are lifted in a fully automatic way and come to rest on the uppermost sheet. Of course, this holds true only if the height of the freshly inserted stack is sufficient to rise to the level at which the feed rollers **22** are located when the carriers **23** abut against the stop pins **51**.

The printing machine of our invention further comprises locking or blocking means to prevent folding of side rails **12** over the top plate **4***d* of the platform **4** when the tips **16***a* of the corner separators **16** rest on the end portions **52***b* of the horizontal plate **52**. Such folding could destroy or deform the corner separators, and the just mentioned blocking means serves as a safety device to insure that the operator is free to fold the side rails **12** only at the time the supporting arms **15** are retracted to the phantom-line positions **15'**. Each safety device includes a lever **53**, shown in FIGS. 6 and 7, which is pivotable about a horizontal pin **54** mounted on the corresponding side rail **12**. The lever **53** has a cam face **53***a* which is located in the path of the follower **18** when the latter is caused to advance toward the lower end of the cam slot **19**. The tip of the lever **53** carries a hook **53***b* which normally extends into a cutout **56** of the corresponding mounting bracket **9** and engages the underside **56***a* of this bracket. The lever **53** is biased by a spring **55** so that its hook **53***b* is normally in engagement with the underside **56***a* but is disengaged therefrom when the follower **18** slides along the cam face **53***a*. In FIG. 6, the hook **53***b* is disengaged from the underside **56***a* because the follower **18** approaches the lower end of the cam slot **19**.

FIG. 3 shows that the pivot pins **11** for the side rails **12** are offset inwardly with reference to the general planes of the corresponding side rails so that, when a side rail begins to move to the folded position shown for the right-hand side rail of FIG. 3, its lower edge face **12***a* first travels substantially vertically upwardly (because it is located at a distance from and outwardly of the pivot pin **11**) and thereupon begins to move toward a vertical plane. Since the levers **53** are immediately adjacent to the major portions of the side rails **12**, they are spaced outwardly from the pivot pins **11** when the corresponding side rails are held in vertical positions so that their hooks **53***b* prevent any pivoting of the side rails before the followers **18** are moved into the lower ends of the cam slots **19**.

The lower end of each cam face **53***a* is adjacent to a substantially semicircular recess or dwell formation **53***c* which receives the corresponding follower **18** when the associated supporting arm **15** is moved to the retracted position **15'**. The levers **53** then lock the supporting arms **15** in such positions but may be disengaged therefrom if the operator applies a sufficient force to overcome the bias of the springs **55** by causing the followers **18** to travel upwardly toward the junctions between the cam slots **17**, **19**. This will be done after the side rails **12** are folded back to their operative vertical positions and when the operator wishes to move the tips **16***a* of the corner separators into abutment with the end portions **52***b* of the horizontal plate **52**.

When the side rails **12** are folded over the top plate **4***d* of the platform **4**, the entire platform may be pivoted about the axis of the shaft **3** and takes the position shown in FIG. 5 in which the top plate **4***d* is located in a substantially vertical plane and is adjacent to the front wall **52***a* of the stationary housing. In order to further reduce the dimensions of the printing machine and to allow the platform **4** to move to the position of FIG. 5, the carriers **23** are rotated in a clockwise direction, as viewed in FIG. 1, to reach the positions shown for the carrier **23** of FIG. 5. In such position, the corresponding feed roller **22** is located at the upper end of the associated carrier **23**.

If necessary, the entire feed table **2** may be detached from the walls **1**, **1'** merely by sliding the plins **2***a*, **2***b* upwardly and through and beyond the open upper ends of the corresponding vertical slots **1***a*. In other words, the feed table may be stored separately or it may be replaced by a differently dimensioned feed table with little waste in time and in an exceptionally simple and convenient manner.

Alternatively, the feed table **2** may be removed only in part, for example, by withdrawing the shaft **3** so that the platform **4** may be separated from the side walls **2'**, **2''**. In the position shown in FIG. 5, the printing machine forms a very compact and completely closed unit which protects many of its movable parts against entry of dust, moisture or other foreign matter and which can be stored in a small area or covered by a comparatively small hood or the like, not shown.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a feed table having a platform for supporting a stack of sheets; a pair of side rails mounted on said feed table for lateral movement toward and away from the sides of a stack therebetween; means for feeding the uppermost sheets from the stack on the platform of said feed table; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform when the height of the stack on the platform of said feed table decreases.

2. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a feed table having a platform for supporting a stack of sheets; a pair of side rails mounted on said feed table for lateral movement toward and away from the sides of a stack therebetween; means for feeding the uppermost sheets from the stack on the platform of said feed table; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform when the height of the stack on the platform of said feed table decreases, each coupling means comprising a supporting arm having a front end portion connected with the respective corner separator and a rear end portion articulately connected with the corresponding side rail so that said supporting arms are free to move longitudinally and to pivot with reference to the side rails, and cooperating cam and follower means provided on said supporting arms and on said side rails for moving said rear end portions longitudinally when the front end portions descend by gravity in response to decreasing height of the stack.

3. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a feed table having a platform for supporting a stack of sheets; a pair of side rails mounted on said feed table for lateral movement toward and away from the sides of a stack therebetween; means for feeding the uppermost sheets from the stack on the platform of said feed table; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform when the height of the stack on the platform of said feed table decreases, each coupling means comprising a horizontal pivot pin secured to the corresponding side rail and extending at right angles to the sides of the stack, cam means provided on each side rail forwardly of the respective pin, an elongated supporting arm having a front end portion connected with the corresponding corner separator and a rear end portion provided with an elongated slot receiving the corresponding pin so that said supporting arms are movable longitudinally and are free to pivot about said pins, and a follower provided on each arm and arranged to track the corresponding cam means to thereby guide the respective corner separator in said plane when the corner separators descend by gravity in response to decreasing height of the stack.

4. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a feed table having a platform for supporting a stack of sheets; a pair of side rails mounted on said feed table for lateral movement toward and away from the sides of a stcak therebetween; means for feeding the uppermost sheets from the stack on the platform of said feed table including feed roller means arranged to rest by gravity on the uppermost sheet of the stack and carrier means for said feed roller means; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front

corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend by gravity in a plane which is substantially normal to said platform when the height of the stack on the platform of said feed table decreases.

5. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a feed table having a platform for supporting a stack of sheets; a pair of side rails mounted on said feed table for lateral movement toward and away from the sides of a stack therebetween; means for feeding the uppermost sheets from the stack on the platform of said feed table; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner sepaartor to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform in response to decreasing height of the stack, said coupling means comprising elongated supporting arms having rear end portions articulately connected with said side rails and front end portions connected with the respective corner separators, and a weight provided on each of said supporting arms to maintain said lips in contact with the uppermost sheet of the stack.

6. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a feed table having a platform for supporting a stack of sheets; a pair of side rails mounted on said feed table for lateral movement toward and away from the sides of a stack therebetween; means for feeding the uppermost sheets from the stack on the platform of said feed table; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform in response to decreasing height of the stack, said coupling means comprising elongated supporting arms having rear end portions articulately connected with said side rails and front end portions adjacent to the corresponding corner separators, and means for detachably securing said corner separators to the front end portions of the respective supporting arms.

7. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a housing; a feed table having a platform for supporting a stack of sheets, said feed table being mounted in said housing to move up and down between a lower end position and a plurality of additional positions; a pair of side rails extending above said platform and mounted on said feed table for lateral movement toward and away from a stack therebetween; at least one feed member for removing the uppermost sheets from the stack on said platform; carrier means movably secured to said housing and supportingly connected with said feed member so as to allow the feed member to remain in contact with the uppermost sheet when the hegiht of the stack decreases; a lifting mechanism operatively connected with said feed member and arranged to lift the feed table in response to descent of said feed member so that the uppermost sheet of the stack is normally located at a predetermined level corresponding to an additional position of said feed table; stationary stop means provided on said housing for arresting said carrier means when the feed member descends below said predetermined level; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform when the height of the stack decreases.

8. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a housing; a feed table having a platform for supporting a stack of sheets, said feed table being mounted in said housing to move up and down between a lower end position and a plurality of additional positions; a pair of side rails extending above said platform and mounted on said feed table for lateral movement toward and away from a stack therebetween; at least one feed member for removing the uppermost sheets from the stack on said platform; carrier means movably secured to said housing and supportingly connected with said feed member so as to allow the feed member to remain in contact with the uppermost sheet when the height of the stack decreases; a lifting mechanism operatively connected with said feed member and arranged to lift the feed table in response to descent of said feed member so that the upper most sheet of the stack is normally located at a predetermined level corresponding to an additional position of said feed table; stationary stop means provided on said housing for arresting said carrier means when the feed member descends below said predetermined level; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform when the height of the stack decreases; and additional stop means provided on said housing for arresting said corner separators when said lips descend below said predetermined level.

9. In an apparatus for feeding sheets to the printing mechanism of a printing machine; a housing; a feed table including a subframe detachably mounted on said housing and a platform for supporting a stack of sheets, said platform being rotatable in said subframe about a transverse horizontal axis between a substantially vertical idle position and a substantially horizontal operative position; a pair of side rails extending above said platform and mounted on said feed table for lateral movement toward and away from the sides of a stack therebetween; means for feeding the uppermost sheets from the stack on said platform; a pair of corner separators each including a substantially horizontal lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a substantially vertical stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform when the height of the stack on said platform decreases.

10. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a feed table having a platform for supporting a stack of sheets; a pair of mounting means installed on said feed table for lateral movement toward and away from the sides of a stack therebetween; a side rail pivotally secured to each of said mounting means, each of said side rails being movable between an operative position in a substantially vertical plane and a folded position in which it overlies said platform; means for feeding the uppermost sheets from the stack on said platform; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner in operative positions of said side rails; and coupling means articulately

connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform in response to decreasing height of the stack.

11. A structure as set forth in claim 10, wherein said platform is normally located in a substantially horizontal plane and wherein said side rails extend upwardly and beyond said platform at least in said operative positions thereof.

12. A structure as set forth in claim 10, wherein each of said corner separators is movable between an operative position and an inoperative position and wherein said coupling means comprises manually operable handgrip means for facilitating such movements of said corner separators.

13. A structure as set forth in claim 12, wherein each of said coupling means further comprises a supporting arm articulately connected with the corresponding side rail and secured to the respective corner separator, and cooperating cam and follower means provided on said side rails and on said supporting arms for guiding the supporting arms during movement of corner separators between said operative and inoperative positions thereof.

14. A structure as set forth in claim 13, wherein said handgrip means constitute said follower means and extend outwardly from the respective side rails.

15. A structure as set forth in claim 12, further comprising blocking means for holding said side rails against movement to said folded positions in response to movement of corner separators into said operative positions thereof.

16. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a housing; a feed table detachably mounted on said housing and having a platform for supporting a stack of sheets thereon; a pair of side rails mounted on said feed table for lateral movement toward and away from the sides of a stack therebetween; means mounted on said housing for feeding the uppermost sheets from the stack on said platform; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform in response to decreasing height of the stack.

17. In an apparatus for feeding sheets to the printing mechanism of a printing machine; a feed table having a platform for supporting a stack of sheets; a transversely extending horizontal spindle axially movably mounted in said feed table; means mounted on said housing for feeding the uppermost sheets from the stack on said platform; actuating means operatively connected with and arranged to move said spindle axially; a pair of mounting members mounted on said spindle at the opposite sides of a stack on said platform and movable laterally toward and away from a stack therebetween; a side rail mounted on each of said mounting members and extending upwardly along the corresponding side of the stack; disengageable clamping means for normally securing said mounting members to said spindle so as to fix said mounting members and said side rails in selected positions with reference to said spindle; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform in response to decreasing height of the stack.

18. A structure as set forth in claim 17, wherein said spindle comprises an externally threaded portion and wherein said actuating means comprises a knob rotatably mounted in said housing and having an internally threaded portion mating with said externally threaded portion.

19. A structure as set forth in claim 17, wherein each of said clamping means comprises a screw meshing with the corresponding mounting member and having a tip movable into and out of frictional engagement with said spindle.

20. A structure as set forth in claim 17, wherein each of said mounting members comprises a horizontal pin normal to said spindle and pivotally supporting the corresponding side rail so that said side rails are foldable over said platform when a stack is removed therefrom.

21. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a feed table having a platform for supporting a stack of sheets; a pair of mounting means installed on said feed table for lateral movement toward and away from the sides of a stack therebetween; a side rail pivotally secured to each of said mounting means and being movable between an operative position in a substantially vertical plane and a folded position in which it overlies said platform; means for feeding the uppermost sheets from the stack on said platform; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner in operative positions of said side rails; coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators descend in a plane which is substantially normal to said platform in response to decreasing height of the stack, each of said coupling means comprising an elongated supporting arm having a front end portion connected with the respective corner separator and a rear end portion articulately secured to the corresponding side rail, each of said supporting arms being movable with reference to the corresponding side rail between an operative position and a retracted position; and blocking means provided on said side rails and arranged to engage the corresponding mounting means to prevent folding of side rails in operative positions of said supporting arms.

22. A structure as set forth in claim 21, wherein each of said coupling means comprises a follower mounted on the corresponding supporting arm and cam means provided on the respective side rail for guiding the follower when the associated supporting arm is moved to said retracted position thereof, said blocking means comprising levers pivotally secured to said side rails and normally engaging the corresponding mounting means to prevent movement of side rails to said folded positions thereof, said levers being located in the pathway of the corresponding followers to be disengaged from the associated mounting means in response to retraction of said supporting arms.

23. A structure as set forth in claim 22, wherein each of said levers is provided with a dwell formation which receives the corresponding follower in retracted position of said supporting arms.

24. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a housing including a front wall; a feed table having a platform for supporting a stack of sheets so that the front side of the stack abuts against said front wall, said feed table being mounted in said housing to move up and down between a lower end position and a plurality of additional positions; a pair of side rails extending above said platform and mounted on said feed table for lateral movement toward and away from a stack therebetween; at least one feed member for removing the uppermost sheets from the stack on said platform; carrier means movably secured to said housing and supportingly connected with said feed member so as to allow the feed member to remain in contact with the uppermost sheet when the height of the stack decreases;

a lifting mechanism operatively connected with said feed member and arranged to lift the feed table in response to descent of said feed member so that the uppermost sheet of the stack is normally located at a predetermined level corresponding to an additional position of said feed table; stationary stop means provided on said housing for arresting said carrier means when the feed member descends below said predetermined level; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner, said stops being located in a plane located forwardly of said front wall so that the front wall is nearer to the front side of the stack; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby descend in a plane which is substantially normal to said platform when the height of the stack decreases.

25. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a housing; a feed table mounted in said housing and having a platform for supporting a stack of sheets; a pair of side rails mounted on said feed table for lateral movement toward and away from the sides of a stack therebetween; a pair of carrier means pivotally supported by said housing means above the uppermost sheet of the stack so as to be rotatable about a fixed transverse horizontal axis; at least one intermittently driven feed member mounted between said carrier means for feeding the uppermost sheets from the stack on said platform, said feed member being rotatable about a transverse axis spaced from said fixed axis and each of said carrier means having a plurality of holes located at different distances from said fixed axis, the holes in one of said carrier means being aligned with the holes in the other carrier means; a weight having end portions removably received in a pair of aligned holes to bias said feed member against the uppermost sheet of the stack whereby the pressure upon the uppermost sheet changes when the end portions of said weight are inserted into another pair of aligned holes; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators descend in a plane which is substantially normal to said platform when the height of the stack on said platform decreases.

26. In an apparatus for feeding sheets to the printing mechanism of a printing machine, a housing; a feed table mounted on said housing and having a platform for supporting a stack of sheets; a pair of carriers supported by said housing for pivotal movement about a fixed transverse horizontal axis which is located at a level above the uppermost sheet of the stack; at least one intermittently driven feed roller mounted between said carriers for feeding the uppermost sheets from the stack on said platform, said feed roller being rotatable about a second transverse horizontal axis spaced from said fixed axis, each of said carriers having a plurality of holes located at different distances from said fixed axis and each hole of one carrier being aligned with a hole of the other carrier; and a weight having end portions removably received in a pair of aligned holes to bias said feed roller against the uppermost sheet of the stack, said weight being insertable into any selected pair of aligned holes to thereby determine the pressure between said roller and the uppermost sheet of the stack.

27. A structure as set forth in claim **26**, wherein said end portions are pins extendable into selected pairs of aligned holes and wherein said weight comprises a spring for biasing said pins outwardly.

28. In an apparatus for feeding sheets to the printing mechanism of a printing machine, in combination, a feed table having a platform for supporting a stack of sheets; a pair of side rails mounted on said feed table, at least one of said side rails being movable toward and away from the corresponding side of the stack on said platform; a pair of corner separators each including a lip arranged to overlie the uppermost sheet of the stack at one front corner thereof and a stop disposed ahead of the corresponding front corner; and coupling means articulately connecting each corner separator to one of said side rails in such a way that the corner separators perform a composite pivotal and sliding movement to thereby be guided for movement in a plane which is substantially normal to the platform.

29. A structure as set forth in claim **28**, wherein each of said coupling means comprises a supporting arm having a front end portion connected with the respective corner separator and a rear end portion articulately connected with the corresponding side rail so that said supporting arms are free to move longitudinally and to pivot with reference to the side rails, and cooperating cam and follower means provided on said supporting arms and on said side rails for moving said supporting arms longitudinally in response to pivoting thereof or vice versa.

30. A structure as set forth in claim **29**, wherein said side rails are provided with additional cam means arranged to be tracked by said follower means for guiding said supporting arms into retracted positions in which said corner separators are adjacent to said platform.

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M. HENSON WOOD, JR., *Primary Examiner.*

R. A. SCHACHER, *Assistant Examiner.*