

Nov. 15, 1966

K. G. ZEUTHEN
SHEET SEPARATING MECHANISM PARTICULARLY
FOR PRINTING MACHINES AND DUPLICATORS

3,285,601

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2 Sheets-Sheet 1

FIG. 1

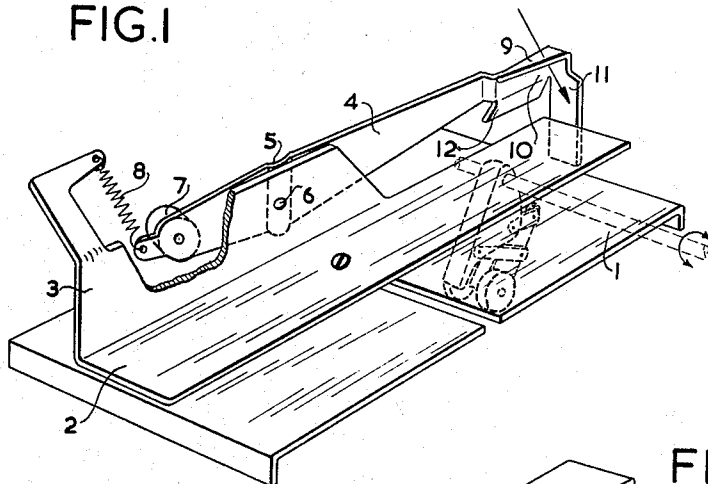


FIG. 2

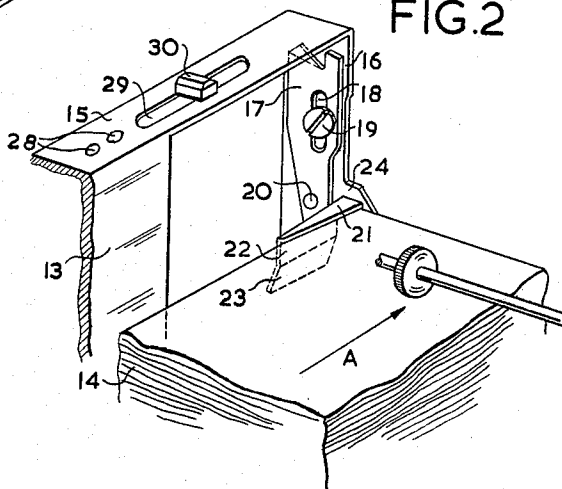


FIG. 5

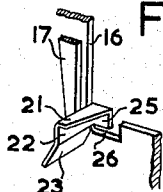


FIG. 3

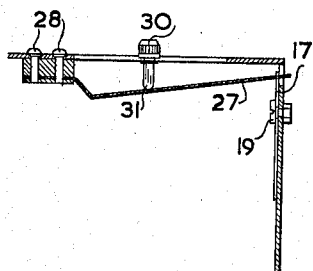
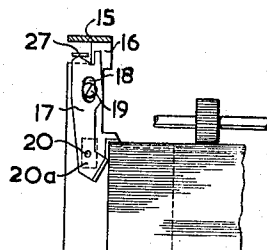


FIG. 4



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2 Sheets-Sheet 2

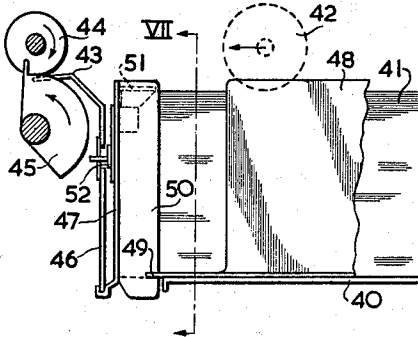


FIG. 6

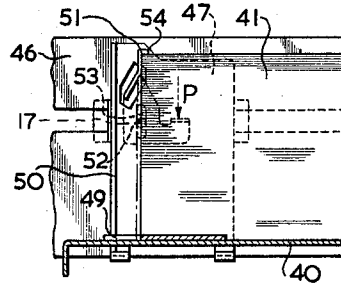


FIG. 7

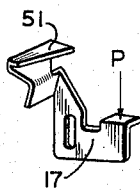


FIG. 9



FIG. 10

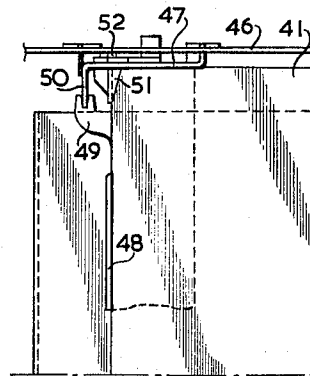


FIG. 8

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SHEET SEPARATING MECHANISM PARTICULARLY FOR PRINTING MACHINES AND DUPLICATORS

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4,622/64

15 Claims. (Cl. 271-17)

This invention relates to a sheet separating mechanism particularly for printing machines and duplicators comprising a table for a supply stack of sheets, side rails, which are preferably adjustable to different sheet widths, at least one front stop, with which the front edge in the corner of a sheet can engage during the advance of the sheet by means of a sheet advancing mechanism, at least one angular finger, one angle part of which bears against the said corner of the sheet and which is movable at least approximately in a plane at right angles to the table.

Front separator members are known consisting only of fixed abutments, one at either corner of the front edge of the paper. When advanced the sheet abuts on these members and buckles so that the topmost sheet is hereby separated from the underlying sheets in the supply stack. At a certain point of the advance the corners of the sheet are released and go clear of the abutment members, whereupon the sheet straightens and is led further on towards the place of printing. This primitive way of effecting a separation of the sheets is not satisfactory under the strongly varying conditions prevailing in practice where papers of widely varying thickness and stiffness are to be handled. With a view to this, sheet separating mechanisms have been constructed comprising a finger which presses down against the topmost sheet of paper and which is built together with a front stop which the front edge of the sheet of paper engages during its advance. In one of the previously known constructions the finger with the front stop is mounted so as to be vertically displaceable and is furthermore connected mechanically to the side rail so that a width adjustment of the side rail will entail a corresponding positive displacement of the finger. Thus the position of the finger is defined by the position of the side rail to which it is connected. On the face of it, this measure should be able to ensure that there will always be an overlapping of the topmost sheet of paper with a constant part of the finger. In practice, however, it turns out that this is not the case, and it is inter alia this recognition that forms the basis for the present invention. To attain a correct and faultless advance of the sheets it is necessary that the finger constantly lies accurately in relation to the sheet which during the sheet separation on the whole behaves as if it were clamped at both ends, the clamping at the front end occurring by the finger resting against the sheet, while at the other end the clamping is represented by the sheet advancing mechanism, generally a rubber roller, which advances the sheet and which may be laterally adjustable. In the case of stiff paper or board the finger should be pressed down with a comparatively great force, while on the other hand in the case of e.g. air-mail paper it should bear against the sheet with a very light pressure.

It is one object of the invention to provide a new and improved sheet separating mechanism having a self adjustment in order to correct certain inaccuracies occurring in practical use of a duplicator or other machine requiring sheet separation.

It has been found that irregularities in the advance of the sheets are due to inaccuracies in the size of the sheets, and to the fact that a lateral adjustment made on the

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basis of a full stack of sheets placed on the table is not and often cannot be performed with such an accuracy that the finger will be placed correctly in all cases. This may be due to the fact that the side of the stack is not plane or it may be due to the fact that the operator is not sufficiently careful or that the sheets have been cut aslant. Moreover, the sheets in a stack may have different widths. This may be illustrated to best advantage by supposing that during normal printing it be desired to supplement a stack with paper taken from another package. Between these packages it may be a question of variations in width of up to 4 mm., considering the tolerances suggested by the International Standardization Organization (ISO) for the widths of paper sheets in ISO Recommendation R101.

A further object of the present invention is to provide a new and improved sheet separating mechanism that is well adaptable to duplicators having a fixed table for the supply of sheets as well as to duplicators having a table that raises the supply of sheets.

Further objects and advantages of the present invention will appear from the following description.

According to the invention the other angle part of the abovementioned finger is at least approximately parallel to the side rail and arranged for contacting the side of the stack of sheets at the front corner of the latter, further the finger is mounted movable in relation to the side rail in a direction substantially at right angles to the plane of the side rail, and still further the finger is actuated by a force tending to lead it in the direction towards the plane of the opposite side rail and thereby towards the stack of sheets. By the combination of these measures, the finger will under all conditions press with a small vertical part against the side of the stack of sheets, but only against comparatively few sheets at the top of the stack, so that the overlapping of the top sheet by the horizontal part of the finger is not influenced by the manner in which the remaining sheets in the stack are located or cut. The fact that the position of the finger is not determined by the more or less accurate location of the side rail, but may on the contrary be moved freely in relation to the latter and parallel to the table eliminates the drawback otherwise asserting itself due to the fact that the paper width varies during the duplication process.

The double possibility of mobility for the finger indicated may according to the invention be effected by the finger being in fixed connection with one end of a tiltable double armed lever which is rotatably and tiltably connected to the side rail and which at its other end is spring-biased in the direction away from the side rail. As the tiltable lever functions as a double-armed lever which during its operation is disposed horizontally and which can be moved in the horizontal as well as in the vertical plane, it may in a simple way be so arranged as to produce a desired pressure against the sheet.

Constructively, the double mobility or two degrees of freedom may according to the invention be achieved in a simple way of the tiltable lever being provided with a transverse convexity with which it abuts on the side rail and, incidentally has its axis of rotation disposed in the convexity at right angles to the longitudinal direction of the latter. Roughly speaking the line of contact between the convexity and the side rail here functions as one axis of rotation, around which the tiltable lever rotates in the horizontal plane, while the other axis of rotation is formed by e.g., a pin passing through the side rail and the tiltable lever.

In this embodiment, when moving in the vertical plane the finger describes part of a circular arc. This is not desirable under all conditions, and with a view to avoiding such a movement, particularly in the case of large heights of paper stacks, the finger may according to the

invention be carried by a guided rail which is mounted freely movably on a front rail connected to the side rail. Hereby any point in the finger is bound to move in a plane parallel to the front face of the stack of sheets. This embodiment is applicable in machines comprising a table which is vertically displaceable independently of the side rails.

The finger may in the usual manner comprise a front stop, but certain advantages are obtained if instead the front rail is provided with a front stop for the corner of the front edge of the sheet. The fact is that during the advance of the paper a forward-directed force will be exerted against the front stop, and this may reduce the free mobility of the finger. The friction may even become so great that the finger remains stuck without getting its horizontal part into contact with the topmost sheet in the stack. This drawback may be completely avoided by the front stop and the finger being made independent of each other. Another drawback is also avoided which in duplicators with vertically displaceable tables and without secondary paper advance has asserted itself during the printing, viz. that jumps in the printing height may occur at irregular intervals. The experiments forming the basis for the invention have proved that this is due to the front edge of the paper not always being led all the way up to the front stop on the finger, that is being stopped by the stop plate for the sheet stack in front of it. The possibility of dispensing with a front stop on the finger and nevertheless ensuring the correct contact of the latter with the topmost sheet in the stack is produced by the correct position of the finger being ensured by means of the vertical angle part pressing against the side of the topmost sheets.

Even if the finger is freely movable in relation to the side rail, means should, however, according to the invention be provided to limit the movement of the guided rail, so that the finger will not get in the way when a new stack of sheets is inserted.

In a preferred embodiment of the sheet separating mechanism according to the invention the guided rail is connected to the front rail by means of a pin-slot connection and is stressed downwardly and for turning by means of a spring which, when the finger is not influenced by sheets, presses it against a limitation stop in the direction towards the opposite side rail. In this manner, the pressure from the spring gives the finger the necessary abutment pressure downwards from above against the topmost sheet, and presses the vertical part of the finger in against the stack of sheets to ensure a correct placing of the horizontal part of the finger in relation to the sheet. According to the invention, means are conveniently provided for adjusting the spring pressure so that an adjustment according to the stiffness of the sheets used may easily be performed.

The spring may according to the invention be a leaf spring which at one end is secured to a rail and is disposed obliquely in relation to the rail and the other end of which presses against the guided, finger-provided rail, and the adjustment means may be formed by a contact member which is displaceable along the rail. By the displacement of the contact member the spring is forced more or less out into an arc, and by this means its pressure against the guided rail may be varied.

In an embodiment of the sheet separating mechanism suitable for duplicators and printing machines comprising a vertically movable table for the stacks of sheets and side rails mounted on the table and a carriage which is displaceable together with the side rail and which is disposed in front of the front edge of the sheet and is mounted so as to be displaceable on and along a carrying rail, which likewise lies in front of the front edge of the sheet, the finger is according to the invention mounted displaceably and rotatably on the carriage and is subjected to the stress from a preferably adjustable force which tends to turn the finger in the direction in towards

the stack of sheets. In this case the movement of the finger is also limited in such a way that each of its points is bound to move in a plane which during the operation will be substantially vertical.

The finger may according to the invention be part of a double-armed lever which can swing around an axis that is displaceable in relation to the finger. The shaft of rotation of the finger is expediently a pin which is in fixed connection with the carriage and which engages a slot in the finger which can thus perform a limited movement of displacement.

As was the case in the embodiments described above, a front stop may be mounted in connection with the finger or, with the advantages already mentioned, in connection with the carriage.

Even if in the above description reference is made to only one finger and one front stop, it should for the sake of completeness be mentioned that two sets of these members may be provided, one for either corner of the front edge of a sheet, and that both or only one of them may be movable in the lateral direction.

The invention will in the following be further described by examples on the basis of the diagrammatical drawings in which

FIG. 1 is a perspective view of an embodiment of a sheet separating machine according to the invention,

FIG. 2 is a perspective view of another embodiment of a sheet separating mechanism according to the invention suitable for a machine with a raiseable table and side rails independent of the latter,

FIG. 3 is a perspective view of part of the sheet separating mechanism shown in FIG. 2 with an adjustment member for spring pressure,

FIG. 4 is the part of the sheet separating mechanism shown in FIG. 3 viewed from the left in FIG. 3,

FIG. 5 is a modified embodiment of part of the sheet separating mechanism with a front stop mounted on the finger,

FIG. 6 is a view of the parts, necessary for understanding the invention, of a duplicator with a third embodiment of a sheet separating mechanism according to the invention adapted for use in a duplicator with a raiseable table for the supply stack of sheets and side rails mounted on the table,

FIG. 7 is a section on line VII—VII in FIG. 6,

FIG. 8 is a plan view of part of the duplicator in FIG. 6, FIG. 9 is a perspective view on a larger scale of a finger member for use in the construction according to FIGS. 6-8, and

FIG. 10 is a finger member for use in a modified embodiment of the construction in FIG. 8 with a front stop mounted on the finger.

FIG. 1 serves for explaining the idea of the invention, and all components unnecessary for understanding the invention have therefore been omitted. Thus the figure shows only a fixed table 1 of a duplicator for holding a supply stack and on said fixed table a displaceable side rail. In a duplicator there are two such rails but since they are symmetrical only one is shown. The side rail is substantially designed as an angle section, one part 2 of which rests on top of the fixed table which in normal use is horizontal, and the other part 3 of which is at right angles to the table and in normal use vertical. On the vertical part of the angle section a tiltable lever 4 is mounted in such a way that it can tilt in the vertical plane as well as in the horizontal plane. With a view to this, the tiltable lever is provided with a cylindrical convexity 5 with which it bears against the outside of the flat side rail 3. The arrangement can also be vice versa. A pin 6 through a suitable shaped hole in the side rail 3 and the convexity 5 enables the tiltable lever 4 to move in the vertical plane, i.e. parallel to vertical part of the side rail 3. The hole is of a shape which also permits a small rolling movement of the convexity 5 on the plane side rail. A counter weight 7 serves for balancing the tiltable lever 4.

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A spring 8 subjects the tiltable lever 4 to a force which at the end of the tiltable lever, where an angular finger 9, 10 is provided, has a direction extending downwards and in towards the stack of sheets, not shown, disposed between the vertical parts of the adjustable side rails. The force direction is indicated with an arrow.

The horizontal part 9 of the finger 9, 10 is intended for abutting on top of the corner of the topmost sheet in the stack, while the vertical part 10, which is substantially parallel to the vertical part of the side rail 3, is adapted to abut on the side of the stack of sheets in the vicinity of the corner. A front stop 11 is in the example shown provided in connection with the finger. In connection with the vertical part 10 of the finger a guide face 12 is provided which ensures that the finger although the side rail is kept in the once adjusted position will slide into place when a stack of sheets has been inserted and the finger which has been raised during the insertion of a supply of sheets is again lowered over the front corner of the stack. During the insertion of the stack of sheets the finger may be raised by a pressure being exerted downwards against the opposite end of the tiltable lever. A handle, not shown, may be provided which by means of a rod, not shown, disposed under the table 1 operates the tiltable levers at both sides of the table.

The spring 8 may be adjustable with a view to regulating the actuating force. The point of attack and direction of attack of the spring are chosen with a view to obtaining the desired distribution of the pressure between the two angle parts of the finger and insensitivity to variations due to alterations in the position of the tiltable lever while the size of the stack of sheets is being reduced. The suspension of the tiltable lever can be of any suitable type. The linear contact can e.g. be substituted by a point contact, or a suitable form of ball joint connection may be used.

In the embodiment described, the movement of the finger is of such a nature that any point on it is bound to describe a curved surface. In certain cases this may be undesirable. FIGS. 2-5 show embodiments in which any point on the finger is bound to describe a plane which is substantially at right angles to the table upon which the supply stack of sheets is placed. In duplicators or the like, of which the sheet separating mechanism forms a part, there has only been shown a side rail 13, and furthermore a stack of sheets 14 which rests on the table. Parts not shown include the opposite side rail, which in the machine here referred to, is movable horizontally with respect to side rail 13. This construction is known and therefore need not be further described here.

The side rail 13 carries a top rail 15 and at right angles to the latter a front rail 16 which extends in front of the front side of the stack of sheets 14. On the front rail a guided rail or carrier 17 is mounted which by means of a slot-pin connection 18, 19 is guided to move only in a plane parallel to the plane of the front rail. A pin 20 on the guided rail 17 and a cut 20a, shown dotted in FIG. 4, in the front rail 16 limit the movement of the guided rail. With this connection the guided rail 17 can perform a movement in the vertical direction within certain bounds and a rotation around the pin 19, likewise within certain bounds, and a combination of these movements in relation to the side rail 13. The guided rail 17 carries an angle-bent finger 21, 22 which is provided with a guide face 23 facilitating the insertion of a stack of sheets. Furthermore, a common operation member, not shown, may be provided for simultaneously lifting two fingers, one at either side rail. In the example shown in FIG. 2 the front stop is not mounted on the finger, but is instead formed by part 24 of the front rail 16, which involves the advantages described above. FIG. 5 shows that it is also possible to provide a front stop 25 on the finger 21, 22, in which case a corresponding cut 26 is provided in the front rail 16.

The guided rail 17 with the finger 21, 22 is subjected

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to the stress from a spring 27 shown in FIGS. 3 and 4. The spring 27 forces the horizontal part 21 of the finger into contact down against the topmost sheet in the stack of sheets. The point of contact of the spring against the guided rail 17 is displaced so much in relation to a vertical line through the pin 19, which serves as axis of rotation for the guided rail 17, that a moment is produced which forces the vertical part 22 of the finger in against the side of the stack of sheets.

The spring 27 is secured by rivets 28 to the underside of the rail 15 and is so disposed as to form an angle with the rail 15, the spring towards its free end converging in towards the rail. In the rail 15 a guide slot 29 is provided, in which an adjustment member 30 can be moved which is provided with an abutment member 31 which, when the adjustment member 30 is displaced in the guide slot 29, is brought to abut on different places on the spring. Hereby the arm of the moment is changed, and the spring is tightened more or less and thereby exerts a higher or lower pressure on the guided rail 17.

The fact that the finger 21, 22 is not bound to follow the movement of the side rail 13, but can adjust itself independently in the direction of movement of the side rails, even after the latter by the usual means, not shown, have been clamped in a given position, so that even in the case of inaccurate adjustment of the side rails, or in the case of inaccurate stacks of paper, a safe contact between the angle-bent finger and the front corner of the stack of sheets is attained with greater safety in the sheet separating function.

In the embodiment in FIG. 2 the angular finger 21, 22 is shown without a front stop, and is shown in FIG. 5, with a front stop. In either embodiment the finger 21, 22 and the guided rail 17 move practically without friction, as these parts should not absorb the pressure from the stack of sheets during the sheet advance movement which occurs in the direction of the arrow A in FIG. 2. The angle part of the finger resting against the topmost sheet in the stack need not be horizontal, but may form a slight angle to the horizontal plane.

The embodiment of a sheet separating mechanism according to the invention shown in FIGS. 6-10 is adapted for use in a duplicator having a raiseable table, i.e. is of the type where the topmost sheet in the supply stack will practically always be located at the same level, and side rails which are placed on the table and therefore follow the up- and downward movement of the table. The table is designated by 40 and is raised by means of a mechanism not shown. On the table is a sheet stack 41, the topmost sheet of which can be advanced in the direction to the left in the figure by means of an advancing mechanism 42 shown diagrammatically. This advancing mechanism is of a construction well known to the man skilled in the art and need not be described in detail. In a simple embodiment it is a roller having a rubber surface and being rotated to grip and feed the topmost sheet. The sheet advanced is guided by a guiding face 43 up to the place of printing between rollers 44 and 45 in a mechanism intended for ensuring an accurate advance of the paper to the place of printing, not shown.

On a carrying rail 46 a carriage 47 is mounted which is connected to a horizontally adjustable side rail 48 by means of a fork 49 engaging a rail 50. On the carriage 47 a finger member 51 is mounted rotatably and displaceably by means of a pin and slot connection 52, 53. A point on the finger member is bound to move in a plane parallel to the plane of the carriage. A spring, not shown, is mounted for exerting a pressure in the direction of the arrow P whereby a torque is exerted on the finger member the vertical part of which therefore presses against the side of the stack of sheets, while the horizontal part presses down against the topmost sheet in the stack of sheets irrespective whether the side rails have been adjusted correctly or not and irrespective whether the side face of the stack is plane or not.

The spring arrangement can be similar to that shown in FIGS. 3 and 4. However, it is also possible to obtain the necessary pressure on the finger by means of a weight slidable along a one armed lever the free end of which contacts the finger for instance in a way similar to that of the spring.

As already described above, the finger member may be provided with a front stop as shown in FIG. 10 or the front stop can be dispensed with as shown in FIG. 9, in which latter case the carriage 47 is provided with a front stop at 54 in FIG. 7.

The invention is not limited to the embodiments and applications described which should be regarded only as a representative selection from many possibilities.

I claim:

1. A sheet separating mechanism comprising a feed table for supporting a stack of sheets, a pair of laterally adjustable side rails for limiting the space available for the stack of sheets in the lateral direction, means for feeding the topmost sheet from said stack, a front stop to be engaged by the front edge of a corner of an advanced sheet, at least one angular finger having a top angle part for resting upon the front corner of the topmost sheet and a side angle part for engaging the upper part of the side of the stack of sheets, means for supporting said angular finger movably in relation to said side rails in the vertical direction as well as in a direction substantially perpendicular to said side rails and means for pressing said side angle part against the side of the stack of sheets.

2. A sheet separating mechanism comprising a feed table for supporting a stack of sheets, a pair of laterally adjustable side rails for limiting in the lateral direction the space available for the stack of sheets, means for feeding the topmost sheet from said stack, a lever mounted on one of said side rails with two degrees of freedom, a front stop at the end of said lever to be engaged by the front edge of a corner of an advanced sheet, an angular finger at the end of said lever having a top angle part for resting upon the front corner of the topmost sheet and a side angle part for engaging the upper part of the side of the stack of sheets, and a spring acting at the lever for pressing the top angle part of the angular finger downwards against the topmost sheet and for pressing the side angle part of the angular finger against the upper part of the side of the stack of sheets.

3. A sheet separating mechanism as claimed in claim 2, wherein said lever is provided with a transverse convexity with which it abuts on the side rail and has an axis of rotation disposed in the convexity at right angles to the longitudinal direction of the latter.

4. A sheet separating mechanism comprising a feed table for supporting a stack of sheets, a pair of adjustable side rails for limiting in the lateral direction the space available for the stack of sheets, means for feeding the topmost sheet from said stack, a front rail connected with one of said side rails, a carrier mounted slideably and rotatably on said front rail, an angular finger on said carrier and having a substantially horizontal angle part and a substantially vertical angle part which is substantially parallel with the feeding direction of the sheets, means for pressing said substantially vertical part of the angular finger against the side of the stack of sheets and a front stop to be engaged by the front edge of a corner of an advanced sheet.

5. A sheet separating mechanism as claimed in claim 4, wherein means are provided for adjusting the pressure of the side angle part of the angular finger against the side of the stack of sheets.

6. A sheet separating mechanism as claimed in claim 4, wherein said front stop is mounted on said angular finger.

7. A sheet separating mechanism as claimed in claim

4, wherein said front stop is mounted on said front rail.

8. A sheet separating mechanism as claimed in claim 4, wherein means are provided for limiting the movement of said carrier.

9. A sheet separating mechanism as claimed in claim 4, wherein said carrier is connected to the front rail by means of a pin and slot connection, a spring being provided for pressing downwards and turning said carrier and a stop being provided for limiting the movement of said finger.

10. A sheet separating mechanism comprising a feed table for supporting a stack of sheets, a pair of adjustable side rails for limiting in the lateral direction the space available for the stack of sheets, means for feeding the topmost sheet from said stack, a front rail movable together with said side rail, a front stop to be engaged by a front edge in a corner of an advanced sheet, a carrier for an angular finger comprising a top part for pressing against the front corner of the topmost sheet and a side part for engaging the upper part of the side of the stack of sheets, connecting means between said front rail and said carrier permitting said carrier to slide and turn in a plane parallel to said front rail, and adjustable means for pressing said top part of the finger against the topmost sheet and said side part of the finger against the side of the stack of sheets.

11. A sheet separating mechanism as claimed in claim 10, wherein said adjustable means is a leaf spring secured at one end to a horizontal part of said side rail and disposed obliquely in relation to said part, and pressing at the other end against said carrier, and an adjustment member displaceable along and pressing against said horizontal part for adjusting the spring pressure.

12. A sheet separating mechanism comprising a feed table for supporting a stack of sheets, a pair of adjustable side rails for limiting in the lateral direction the space available for the stack of sheets, means for feeding the topmost sheet from said stack, a front rail mounted in front of said feed table, a horizontally slideable carrier mounted on one of said front rails and releaseably connected to said side rail, a front stop to be engaged by the front edge of a corner of an advanced sheet, an angular finger member comprising a top angle part for resting upon the front corner of the topmost sheet and a side angle part for engaging the upper part of the stack of sheets, said finger member being mounted tiltable and slideable in the vertical direction on said slideable carrier and means for acting upon said angular finger member for pressing said top angle part against the front corner of the topmost sheet and said side angle part against the side of the stack of sheets.

13. A sheet separating mechanism as claimed in claim 11, wherein said front stop is mounted on said angular finger member.

14. A sheet separating mechanism as claimed in claim 11, wherein said front stop is mounted on said slideable carrier.

15. A sheet separating mechanism as claimed in claim 11, wherein said angular finger member is connected with said slideable carrier by means of a pin and slot connection.

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