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Limberger

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[54] COMBINED SEPARATING AND DEFLECTING DEVICE FOR COPYING MATERIALS, MORE PARTICULARLY FOR COPYING MACHINES

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[52] **U.S. Cl.** **271/64**

[51] **Int. Cl.** **B65h 29/64**

[58] **Field of Search** 271/64, 18

[56] **References Cited**

UNITED STATES PATENTS

3,348,839 10/1967 Stievenart et al. 271/64

3,304,081 2/1967 Limberger ..... 271/64 X

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[57] **ABSTRACT**

An improved combined separating and deflecting device for copying materials, more particularly for copying machines, wherein a combination of two superimposed sheets is applied at a certain velocity, the improvement comprises that the sheet to be deflected has a lead and is guided between two cooperating separating rollers of which at least one is mounted pivotably and is driven at a higher peripheral speed that the speed of the transport means for the copying materials, comprising a guide adapted to be pivoted towards the sheet to be deflected in accordance with the state of engagement of the separating rollers, the guide guiding the other sheet in its direction and being fixed resiliently in its end positions by an overcentering device.

11 Claims, 4 Drawing Figures

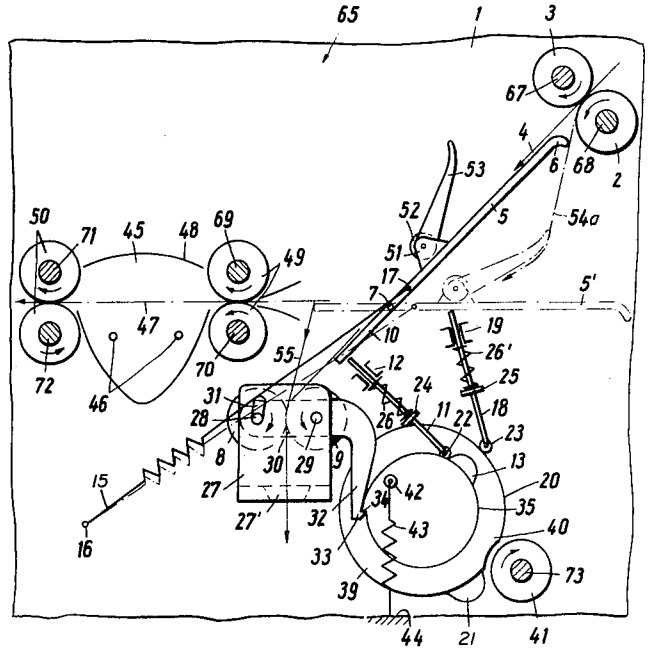
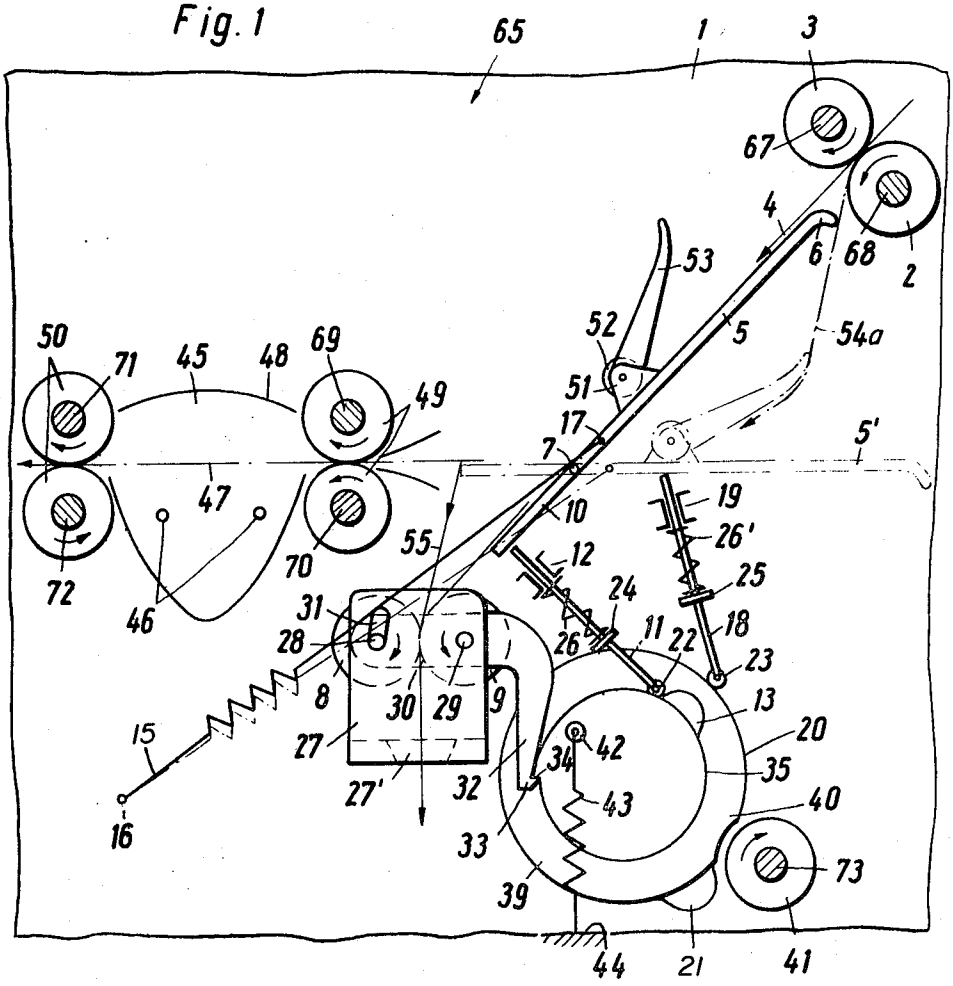


Fig. 1



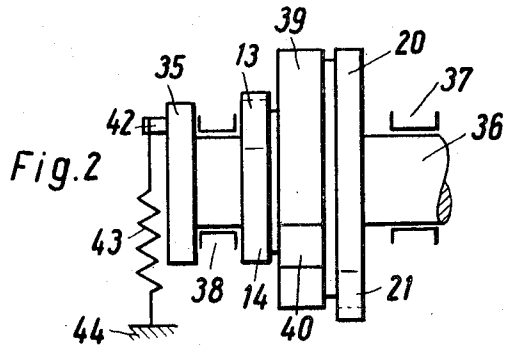


Fig. 2

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Fig. 3

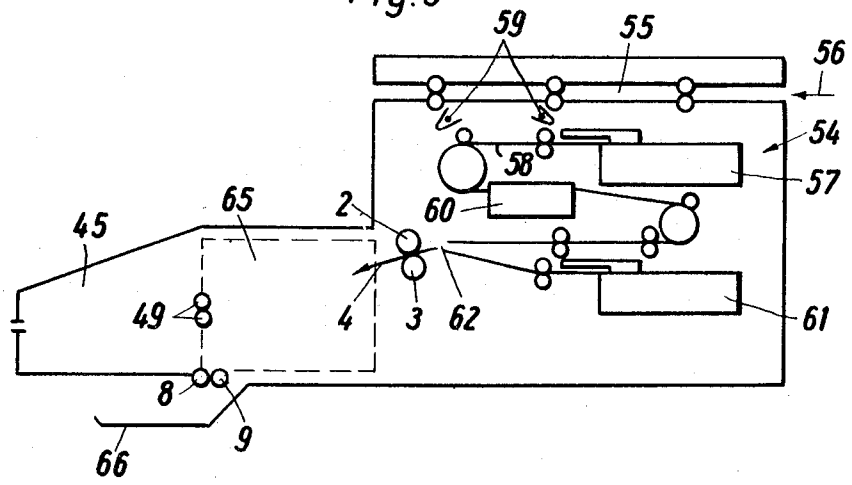
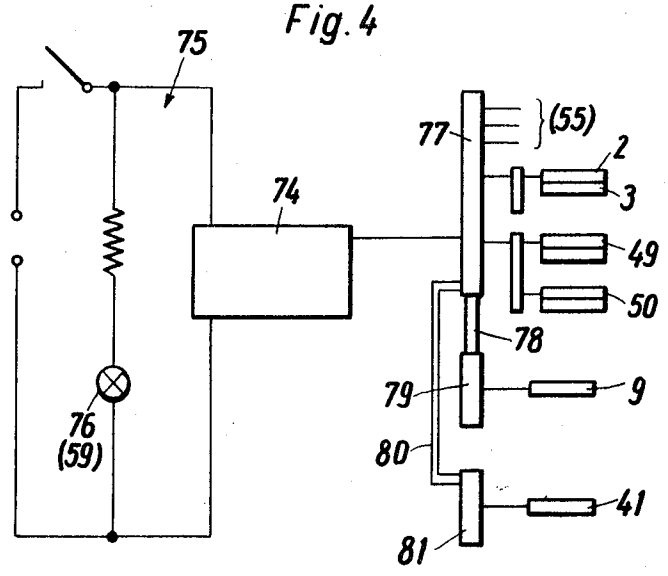


Fig. 4



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COMBINED SEPARATING AND DEFLECTING DEVICE FOR COPYING MATERIALS, MORE PARTICULARLY FOR COPYING MACHINES

DESCRIPTION

Known constructions of combined separating and deflecting devices for copying materials, particularly for copying machines in which a leading edge of a sheet is deflected, have the disadvantage that the materials must be treated comparatively roughly if the sheet is to be pulled off with sufficient force. However, an excessive pulling off action may be transferred to upstream transport means and may cause damage to the materials. Apart from that with known pairs of separating rollers, there occur comparatively large mass forces which may lead to vibration. Although it is advantageous to deflect the sheet to be deflected substantially at a right angle to the guide, the pivoting path of the separating roller arrangement must be comparatively large, so that also the lead of the one sheet must be comparatively large even if the separating rollers run at a considerable speed.

Copying materials, the layers of which adhere, may be joined together fairly strongly so that a separation cannot be guaranteed if the leading edge passes about the end of the guide track.

It is an object of the invention to provide a combined separating and deflecting device, using separating rollers with lower mass forces.

It is a further object of the invention to provide a separating and deflecting device of the kind hereinbefore mentioned, in which the separating rollers run at a lower speed than in hitherto known devices.

It is yet another object of the invention to provide a separating and deflecting device in which the separating rollers have a definite starting position, facilitating the application of the leading edge and thereby a shorter lead.

It is yet another object of the invention to provide a combined separating and deflecting device in which the materials are preliminarily loosened by action thereon within the guide track prior to the deflection of the leading sheet.

According to the invention, the guide face forms a guide element guiding the other sheet in its direction, and is retained by a spring mounted in spaced-apart relationship behind the pivoting axis of the guide face on the guide face and resiliently fixes the guide face in its terminal positions, wherein during the pivoting the guide face passes, in conjunction with the spring, through an over center point.

By using the spring in an over center arrangement it is possible for the combination of the two superimposed sheets to run with its trailing end between the transport rollers of a copier, even after the leading edge has been gripped by the separating rollers. The edge of the guide moving elastically under the action of the spring slides along the underside of the sheet to be deflected in the direction opposite its advance, so as to produce particularly favorable conditions for separating the other sheet which is being deflected into its new direction by the guide.

Preferably, a movable cage of separating rollers forms a locking element for a biased drive, acting by means of a cam control on the guide, causing the same to be pivoted or to pass through the over center after its release. This provides a simple and effective solution for the collaboration of the separating rollers and the guide.

In the preferred embodiment, the cam control is a single speed drive, the speed of which matches the throughput speed of one sheet length, wherein the cam control pivots during its revolution the guide first in the deflecting or separating position and later into the starting position. This achieves an automatic resetting in conjunction with the over center arrangement, and this is essential because a continuous force may be provided for pivoting the guide to its end position in the new direction, so as to provide a stripping effect.

According to a particularly preferred embodiment of the invention, the speed of the single speed drive is so matched to the throughput speed of a sheet length that during the passage of a sheet the guide is pivoted to and fro several times, providing a multiple and differential deflection of the combination of the superimposed sheets.

Preferably the sheet to be deflected is pulled off by the separating rollers substantially at a right angle from the edge of the pivoted guide.

Preferably, the cam control is provided with two cam tracks, the cams of which act through spring loaded plungers on one or the other side of the pivot on the guide in order to pivot or to reset the same.

In a particularly preferred embodiment, the single speed drive of the cam control consists of a drive disk or pulley with a concave circumferential recess and a roller freely revolving in the concave recess, but engaging the periphery of the drive disk when the same is deflected. In this embodiment an actuating spring, mounted on a crank, is tensioned when the drive roller is aligned to the recess, whilst the drive disk is retained by a locking device formed by the separating roller cage. This arrangement provides a particularly advantageous combination between the function of the separating roller device and the single speed drive.

Preferably, when the separating roller device is relieved the locking device engages into a step in the periphery of the drive disk, wherein the association between locking device and step is such that the spring is held under tension when these two parts interengage.

Preferably, a separating roller is mounted on a pivoting lever of the separating roller cage in arcuate oblong holes of a bearing block; the lever is pivotable about the actuating shaft of the other separating roller and forms the locking device. This provides a certain impulse for unlocking the single speed drive.

In a particularly preferred embodiment, the guide carries, spaced apart from the separating rollers and preferably behind the pivot, a guide roller under which the sheets are guided. This guide roller has the action of deflecting the assembly of two sheets from its normal path, and thereby achieving a preliminary detachment. The arrangement of a freely revolving roller prevents friction, whilst producing a separation by guiding the sheets along a curved surface. Preferably an arcuate guide face is provided at the bearing mountings of the guide roller, extending obliquely from the guide face to the separating rollers and impinging on the sheets when the guide is deflected. This achieves a repeated deflection in front of the guide roller; obviously a further deflection is accomplished in an upstream pair of transport rollers of the apparatus, so that separation is reliably achieved. In this connection it should be mentioned that, so long as the combination of two sheets is still guided by this pair of transport rollers, the spring according to the invention, acting on the guide, ensures the positive guiding action under gradual increase of deflecting actions.

The invention will be further described with reference to the accompanying drawings, showing an embodiment thereof and in which:

FIG. 1 is a side elevation showing the parts essential for the functional explanation of the invention;

FIG. 2 is an end elevation of the single speed drive, viewed from the right-hand side, with the drive roller omitted;

FIG. 3 shows diagrammatically a copier and explains the arrangement of the separating and deflecting device according to the invention;

FIG. 4 is a diagram showing the the drive.

FIGS. 1 and 2 show the essential features of the invention. FIG. 3 shows, by way of example, the arrangement in a copier and will be discussed first.

A copying section 54 contains, for example, a path 55 for inserting and passing through an original in the direction indicated by an arrow 56. By means of switches, well known in the art, the original releases a sheet of copying material from a stack 57, on to which the passing original is exposed at 58 by means of a light source 59. The copying material is deflected, developed at 60 and releases, by means of switches and trans-

port devices, the application of another receiving sheet from a stack 61, forming a combination of two sheets at 62; this combination enters in the direction of the arrow 4 a unit 65 which will be explained further below in detail with reference to FIG. 1. At the inlet of this unit is a first pair of transport rollers 2, 3, at the outlet a second pair of transport rollers 49, or the pair of separating rollers 8, 9, underneath which is a trough 66 adapted to receive the deflected sheet, whilst the other sheet enters a drying section 45 which will also be explained with reference to FIG. 1.

Referring now to FIG. 1, the wall portion 1 is merely a mounting wall of the frame with two mounting walls, between which the elements shown are arranged. The distance between the mounting walls corresponds to the width of the copying material. For example, the guide 5 and the rollers 2, 3, 49, 50, 8, 9 have an appropriate width.

Bearing means are arranged in these wall portions, the outsides of which may be provided with drive means such as motors, gears and the like, adapted to drive the part in the direction of the arrows shown.

The frame with the wall 1 is preferably integral with the unit 55 to 62 and is arranged at the end of an apparatus, adapted to deliver two sheets.

A pair of transport rollers 2, 3 is mounted in the wall section 1; these rollers are driven, by means not shown, in the direction of the arrows indicated. By means of this pair of transport rollers a combination of two sheet is applied in the direction of arrow 4, extending tangentially between the two rollers 2, 3; of these two sheets, the lower leads the upper sheet. These sheets are sheets of copying material coming from a developing device and in this case, a negative or transfer sheet must be separated from a positive or receiving sheet which is to be treated further. In view of a preceding chemical reaction, these sheets may firmly adhere to each other.

A guide 5 extends parallel to the direction of advance of the combination of two sheets in the direction of the arrow 4; in order to ensure the uninhibited passage, the end 6 of the guide, facing rollers 2, 3, is curved. This guide is freely pivotable about a pivot 7 mounted in the frame 1, and extends, as viewed from the rollers 2, 3, beyond the pivot and is directed towards the zone of contact between the separating rollers 8, 9. In this position, the end cam of the guide, facing the separating rollers, abuts on a plunger 11. This plunger rests in a guide 12, mounted on the frame 1, on a cam 13 of cam disk 14 which is stationery and locked in the starting position. The end 10 of the guide is pulled towards the plunger 11 by a spring 15 which is fixed to the frame as at 16, and to the guide 5 as at 17 behind the pivot 7. The guide 5 is adapted to be pivoted into a position 5'. In this latter position, the guide is retained by a plunger 18, guided in a guide 19, mounted on the frame 1 and resting on a cam disk 20 with a cam 21, which does not at this moment make contact with the plunger. Both plungers 11 and 18 run on the associated cam disks by means of rollers 22, 23. The plungers are equipped with annular abutments 24, 25 on which rest springs 26, 26'; the other ends of the springs rest on the guides 12, 19 and urge the plungers against the cam disks.

The separating rollers 8, 9 are guided in a bearing block 27 located in the main frame 1 and having an opening 27' under the separating rollers for removing one sheet. The shafts or spindles 28, 29 of the separating rollers are located in a pivoting lever 30 of a separating roller cage; the shaft 29 which extends into the bearing block 27, forms simultaneously the pivot for the pivoting lever 30. The shaft 28 extends beyond the cage with the pivoting lever 30 and is located in oblong holes 31 of the bearing block, extending concentrically to the shaft 29, permitting the pivoting lever to be pivoted along this oblong hole. The separating rollers are driven by a separate drive, not shown in detail in the drawing, in the direction of the arrows at a circumferential speed which is greater than that of the transport rollers 2, 3.

The pivoting lever 30 extends at an angle and forms a locking bolt 32, the end of which has a hook 33. This hook engages in the starting position into a step 34 of a disk 35 of a single speed drive which also comprises the cam disks 14, 20. The single speed drive is mounted freely rotatably on the frame 1 by means of a shaft 36. The mountings are indicated at 37, 38; where the drive means are arranged, as in the drawing, under the guide 5 the mounting 37 corresponds to a mounting device in the frame member shown in FIG. 1. The single speed drive has a drive disk 39 with a circumferential recess 40. In the inoperative position, a drive roller 41, mounted in the frame and having a curvature matching that of the recess 40, is located concentrically thereto. The arrangement is such that the periphery of the drive disk 39 makes engagement with the drive roller adjacent to the recess 40. The drive roller 41 is driven in the sense indicated by an arrow by a continuous drive which may be, for example, the same drive as that actuating the transport rollers 2, 3. The bearing block 27 may be affected by a weak compression spring urging the hook 33 against the periphery of the disk 35. However, the weight of the bearing block 27 is sufficient to produce this contact pressure by pivoting about the shaft 29.

In addition, the disk 35 carriers a crank arm 42 to which is fitted a spring 43, the other end of which is mounted on the frame as at 44.

In the starting position fixed by the locking bolt 32, the spring 43 passes over the top of the disk 35 in the direction of rotation, and is tensioned so that, on release, the spring 43 actuates the single speed drive.

The positive or receiving sheet is to be transported into a drying section, shown generally at 45. This section comprises thermal radiators 46 under a guide track (arrow 47) and a reflector 48 above the same. The parts 46 and 48 are mounted between pairs of transport rollers 49, 50 which may be driven, for example, by the same drive as the transport rollers 2,3 in the direction indicated by the arrows.

A guide roller 52 is mounted freely rotatably between the pivot 17 and the end 6 on the guide 5 between bearing lugs 51. The spacing from the guide is so large that the combination of the two sheets may pass without obstruction under the guide roller 52. The bearing lugs 51 carry also an upwardly arcuate guide face 53 facing the transport rollers 2, 3 and extending across the guide 5.

Concerning the position 5 and 5' and the mounting 17 of the spring 15 relative to the pivot 7, it may be seen that, when the guide passes from one position to the other, it must pass across an additional tensioning position of the spring 15, forming a type of over center arrangement, the end positions of which are defined by the plungers 11 and 18. In this connection it should be noted that, for passing through an over center, only an initial impulse is necessary which exceeds the over center position, whilst the movement into the final position is accomplished by the spring 15.

If the leading edge of the lower sheet of a combination of two sheets advancing on the guide under the guide roller 52, i.e., the leading edge of the sheet located on the guide 5, reaches the position between the separating rollers 8, 9, the higher driving speed of these rollers produces a force which rotates the separating roller cage with the pivoting lever 30 in a clockwise direction about the shaft 29 (in accordance with the oblong hole 31). In consequence the locking bolt 32, with its hook 33, is disengaged from the step 34 and the spring 43 rotates the single speed drive in an anticlockwise direction, thereby engaging the drive roller 41 with the periphery of the drive disk 39 and moving the same. During this movement, the cam 13 on the cam disk 14 actuates the plunger 11 and pivots the guide through the over center position, causing the edge at the end 10 of the guide to rest on the sheets, and to press, by means of spring 15, so long under increasing deflection of the lower sheet, now gripped by the separating rollers 8, 9, until the guide has reached the position 5'. Meanwhile, the cam 13 has passed under the roller 22. The end position parallel to the arrow 47 is achieved by means of the plunger 18 associated

with the cam disk. In consequence of the pivoting, the end of the guide face **53** makes contact with the combination of sheets which are deflected as indicated by the dash-dot line **54a**. It follows, therefore, that a first deflection occurs at the roller **2**, a second deflection along the guide face **53**, and a third at the guide roller **52**. The lower sheet is deflected at the edge of the end **10** of the guide substantially at a right angle, and removed towards the bottom by the pair of separating rollers **8, 9**.

According to the dimensioning of the single speed drive, but certainly not later than after the trailing edge of the combination of sheets has left the transport rollers **2, 3**, the separating roller cage and the pivoting lever **30** return in the starting position, so that the hook **33** of the locking bolt engages the step **34** and stops the drive **35, 39, 14, 20** in the position shown in the drawing, with the spring **43** tensioned.

Although it has been said that the time of rotation of the single speed drive, that is to say the circumference of the drive disk **39** relative to the rotational speed of the drive roller **41** matches the throughput time of one sheet length, this condition is not essential. If the cycle of the single speed drive is shorter, the guide **5** is pivoted to and fro several times during the passage, thereby improving the separation between the two sheets. It must here be remembered that the application of the force is controlled in this case by the spring **15**.

This may be effected in that manner that the distance between the first pair of transport rollers **2, 3** and the separating rollers **8, 9** corresponds only to a fraction of the length of a sheet. In this manner the locking devices **33, 34** would remain disengaged after the single speed drive has performed one revolution. It is also possible to provide the circumferences of the disks **14, 20** with several cams such as **13, 21** in order to provide several actuations during one revolution.

Where the drive roller **41** has a fixed rotational speed, certain speed associations may be accomplished by suitably dimensioning the diameters of the disks **20, 35**.

It is obvious that the spindles **67, 68** of the rollers **2, 3**, the spindles **69, 70** of the rollers **49**, spindles **71, 72** of the rollers **50**, the shaft **29**, the pivot **7** of the guide **5**, and the shaft **73** of the drive roller **41**, are mounted in spaced-apart relationship between the wall **1** and pass through a wall portion where they engage with suitable drive elements.

The drive elements are shown in FIG. **4**. There may be provided a main motor **74** adapted to be switched through a circuit **75** which also contains the light source **76**. The drive motor actuates first drive means **77**, a transmission to which are connected the rollers **2, 3, 49, 50** and corresponding transport rollers in the exposure and developing sections. A transmission **78**, changing the transmission ration, connects second drive means for the separating roller **9**. By means of a further transmission **80**, a separate drive **81** is driven from the first drive means **77** for operating the drive roller **41**.

I claim:

1. An improved device for separating and deflecting two sheets, more particularly sheets of copying material, in a copying machine, wherein the sheets are guided one superposed on the other along a path for the copying materials with the leading edge of one sheet projecting beyond the leading edge of the other sheet, a guide path for the two sheets divided at a downstream point into two separate paths one for each of the sheets, a first pair of transport rollers located at the upstream end of said guide path, a second pair of transport rollers at the start of one of the separate paths with imaginary lines through both spindles of each said first and second pairs of transport rollers intersecting and forming an angle therebetween, a frame in which said pairs of transport rollers are rotatably mounted, first drive means in said frame driving at least one roller of each said pair of transport rollers at a certain circumferential speed, a separating device including two separating rollers positioned at the start of the other one of the separate paths, second drive means for said separating rollers for driving said separating rollers at a higher circumferential speed than the circumferential speed of said pairs of transport rollers driven by said first drive means, a guide located between said first pair of transport rollers and said separating rollers and mounted pivotally in said frame, a pivot for said guide in said frame so that said guide is pivotally displaceable between two end positions, and a spring attached under tension at one end to said frame and at its other end to said guide at a position spaced from said pivot for said guide, wherein the improvement comprises that said separating rollers are arranged so that they make contact substantially along a line extending perpendicularly to the line connecting the axes of said first pair of transport rollers which line extends through the point of contact of said first pair of transport rollers, at least one of said separating rollers is rotatably mounted in said frame, said pivot for said guide is located between the point of attachment of said spring to said frame and the point of attachment of said spring to said guide for fixing said guide elastically in its two end positions, a first abutment means for cooperating with said guide and defining one of its end positions, a second abutment means for cooperating with said guide and defining its other end position, and adjusting means in operative engagement between said separating rollers and said first and second abutment means so that when the leading edge of the one sheet which projects beyond the leading edge of the other sheet has been gripped by said separating rollers, a reacting force resulting from the higher circumferential speed of said separating rollers pivotally displaces said guide about said pivot from one end position, aligned substantially between said first pair of transport rollers and said separating rollers, into the other end position extending substantially perpendicularly to the line connecting the axes of said second pair of transport rollers, with said guide passing in conjunction with said spring through an over center point during each pivotal displacement and in which passage through the over center point the tensioning of said spring is greater than in the end positions of said guide.

2. A device as set forth in claim **1**, wherein at least one said separating roller is mounted movably concentrically to the axis of said other separating roller, a lever is mounted pivotably about the axis of said other separating roller, the axis of the one said separating roller being mounted in the frame, and the axis of said other separating roller being provided in said lever, and said lever having an extension which cooperates with said adjusting means which is in operative engagement with said abutment means.

3. A device as set forth in claim **2**, wherein said movably mounted separating roller has its axis mounted in said lever, a bearing block having arcuate oblong holes is mounted on said frame, the axis of said movably mounted separating roller is mounted in the arcuate oblong holes of said bearing block, and the oblong holes are concentric to the axis of the other said separating roller, the axis of which forms the drive shaft.

4. A device as set forth in claim **1**, wherein said lever forms a separating roller cage as bearing block for said separating rollers and said extension forms a locking element with said adjusting means, a spring for actuating said adjusting means, said adjusting means including a step for engagement with said locking element and cams which successively cooperate with said abutment means.

5. A device as set forth in claim **1**, wherein said first and second abutment means are plungers, fixed guide means for mounting said plungers in said frame so that their ends remote from said actuating means act on said guide on opposite sides of said pivot, said adjusting means having cam tracks, an annular abutment positioned on each said plunger, a spring arranged between each said fixed guide means annular abutment on said plungers for urging said plungers away from said guide towards said cam tracks on said adjusting means, and each said cam track having at least one cam which cooperates with one end of one of said plungers.

6. A device as set forth in claim **1**, wherein said adjusting means comprises a single speed drive including disks mounted in said frame and provided with actuating cams, said first abutment means are actuated after release of said adjusting means

by the leading sheet of the one sheet entering between said separating rollers for moving said guide from one end position into the other end position, and later said second abutment means are actuated by the engagement of one of said actuating cams, for returning said guide into its starting position.

7. A device as set forth in claim 6, wherein said single speed drive is constructed for a multiple revolution during the passage of one sheet length, and said guide is arranged to be pivoted to and fro several times during the passage of the sheets.

8. A device as set forth in claim 1, wherein said adjusting means comprise engaging devices arranged to interengage a drive disk with a concave circumferential recess and a drive roller which freely revolves in said concave recess but makes driving engagement with the periphery of said drive disk when the same is rotated, said drive disk contains a eccentrically arranged crank, an actuating spring attached at one end to said crank and at its other end to a fixed device on said frame, said actuating spring is tensioned when the concave recess is aligned to said drive roller and said engaging devices are arranged relative to said drive disk so that the concave recess thereof is aligned to said drive roller when said engaging devices interengage.

9. A device as set forth in claim 8, wherein one of said engaging devices comprises a lever having a hook and the other said engaging device comprises a disk connected to said drive disk and having a step arranged to receive said hook so that when the reaction force at said separating rollers is relieved said hook rests on the periphery of said disk in engagement with the step thereon, two other disks fixed to said drive disk and having cams thereon, and a common shaft positioned in said frame and mounting said drive disk and said disks fixed to said drive disk.

10. A device as set forth in claim 1, wherein said guide is provided in the center zone along its sides with mounting lugs spaced apart from the end facing said separating rollers, a freely rotatable guide roller supported by said mounting lugs in spaced-apart relationship from the upper side of said guide, said mounting lugs are arranged on that side of said pivot of said guide which is adjacent to said first pair of transport rollers.

11. A device as set forth in claim 10, including arcuate guide face supported on said mounting lugs and extending obliquely from said guide towards its end adjacent said first pair of transport rollers.

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