United States Patent

Neeb et al.

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[54] SHEET SEPARATOR FOR COPYING MACHINES

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[52] **U.S. Cl.** **271/64**, 271/18

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

[58] **Field of Search** 271/64, 74, 18, 28

[56] **References Cited**

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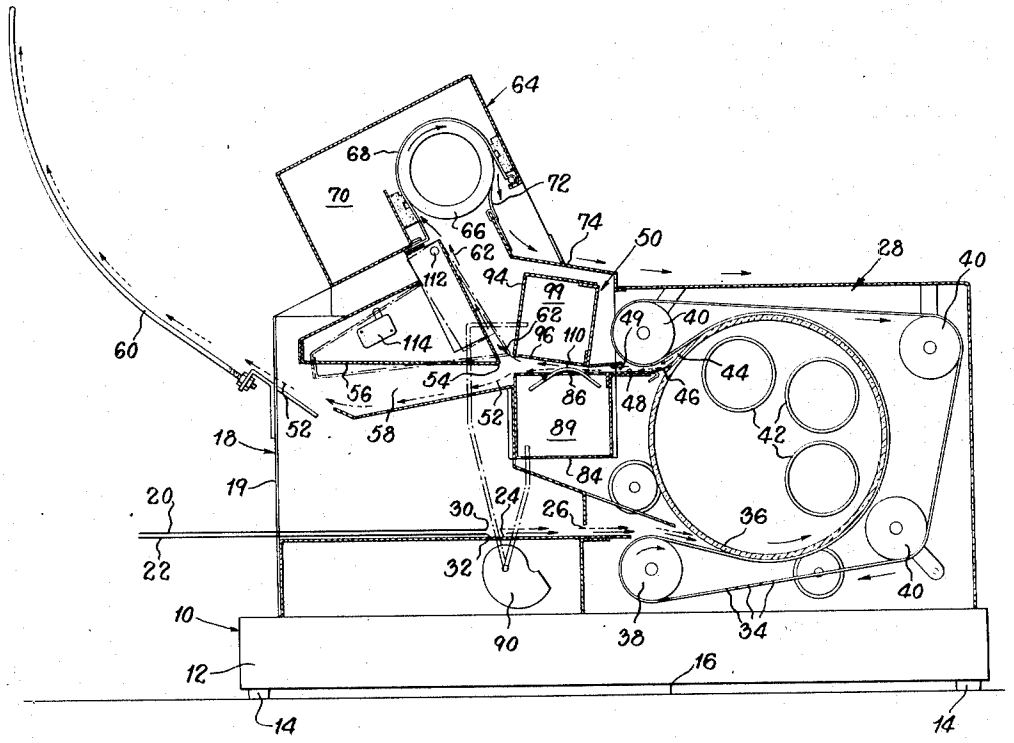
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[57] **ABSTRACT**

A sheet separator for separating an original sheet from a juxtaposed copy sheet as the sheets are advanced longitudinally through a copying machine, the sheet separator including means for establishing opposite areas of reduced air pressure, one such area adjacent each sheet, tending to pull the sheets from one another and a plurality of guides for deflecting the juxtaposed sheets from one such area toward the other area at spaced lateral locations such that the sheets are effectively separated.

10 Claims, 3 Drawing Figures

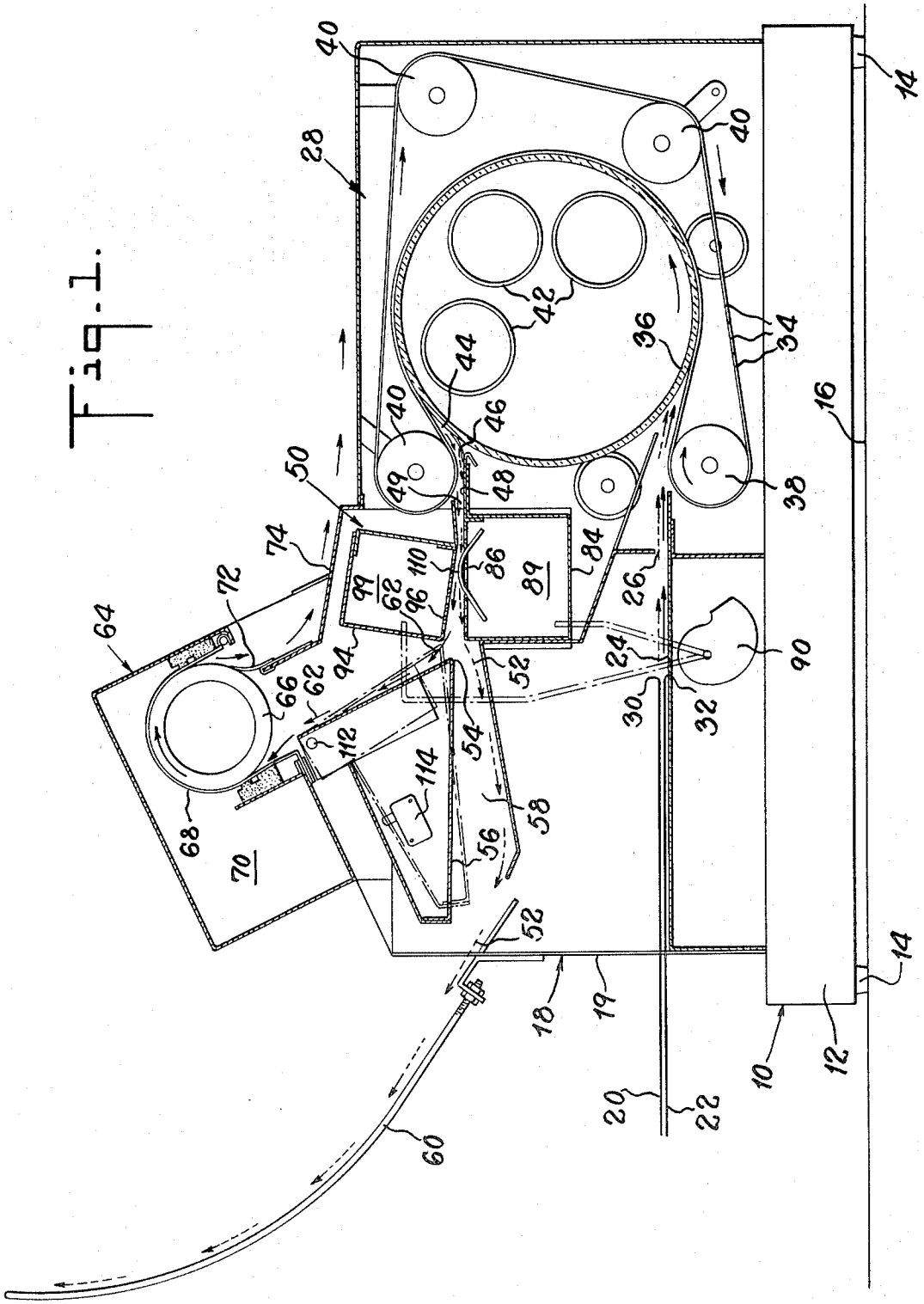


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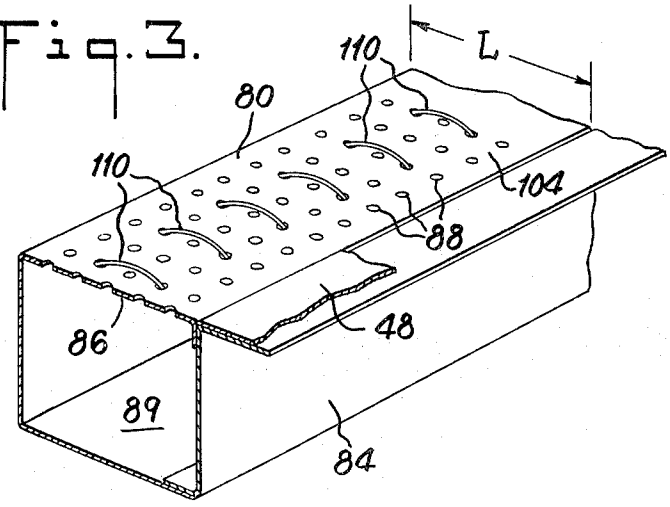
SHEET 1 OF 2

Fig. 1.



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Fig. 3.



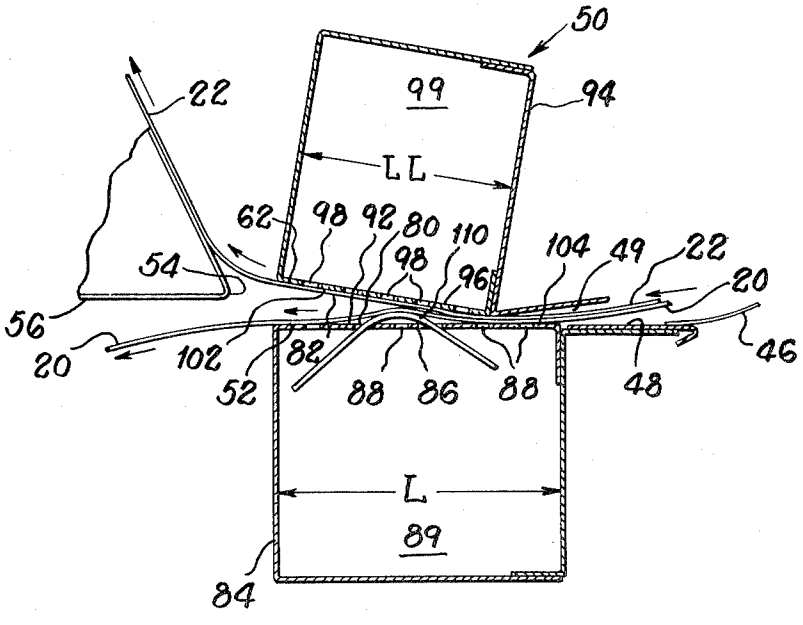


Fig. 2.

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SHEET SEPARATOR FOR COPYING MACHINES

The present invention relates generally to copying machines and pertains, more specifically, to sheet separators for separating juxtaposed original and copy sheets as the juxtaposed sheets are advanced through a copying machine.

A wide variety of copying machines are presently available for making duplicate copies of original documents such as letters, charts, drawings, and the like. Among the various types of copying machines available today, the diazo-type copying machine has had a long history, marked by wide commercial acceptance. More recent developments in diazo copying machines have rendered such machines much more compact than those of the past, making it advantageous to employ a greater number of such machines in more locations, and for more diverse uses.

In a diazo-type copying machine, as well as in certain other copying machines, the document to be copied, or the original sheet, is juxtaposed with a copy sheet and the juxtaposed sheets are advanced through the machine to first expose the juxtaposed sheets to light and thus form a latent image of the original material upon the copy sheet. The sheets are then separated and the copy sheet is further processed to develop the latent image into a fully visible image.

Because the juxtaposed original and copy sheets are placed in intimate contact for the exposure portion of the above sequence, separation of the sheets can pose a problem, particularly in diazo copying machines, where the original sheet is in the form of a light-weight transparency and tends to cling to the heavier weight copy sheet. The problem of separation is compounded further in modern compact diazo copying machines where very little space is available for separation devices and very little time is available within which separation must be accomplished prior to advancing the copy sheet for further processing. It would be advantageous, then, to have available a compact sheet separator which can accomplish the separation of juxtaposed original and copy sheets quickly and effectively as the sheets are advanced through a copying machine.

It is therefore an important object of the invention to provide a compact sheet separator which effectively will separate an original sheet from a juxtaposed copy sheet as the juxtaposed sheets are advanced through a copying machine.

Another object of the invention is to provide a sheet separator which requires relatively little space and which will act upon juxtaposed original and copy sheets to effect relatively quick and positive separation of the copy sheet from the original sheet.

Still another object of the invention is to provide a sheet separator which is simple in construction and is compatible with current compact diazo copying machines.

A further object of the invention is to provide a sheet separator which is simple in construction and dependable in operation and which is efficient in that it consumes relatively small amounts of power.

The above objects, as well as still further objects and advantages, are attained by the invention which may be described briefly as providing, in a copying machine wherein an original sheet is initially juxtaposed with a copy sheet, the juxtaposed sheets are advanced longitudinally in the machine along a first path of travel, and the original and copy sheets are subsequently separated from one another such that one of the sheets follows a second path of travel which diverges from the first path of travel, a sheet separator comprising first means for establishing a first area of reduced air pressure along the first path of travel, the first area extending longitudinally for a relatively short distance along the first path of travel and extending laterally over approximately the width of the advancing sheets, second means for establishing a second area of reduced air pressure along the second path of travel, the second area essentially overlapping at least a portion of the first area and diverging therefrom in the direction of advancement of the sheets, and a plurality of guides intercepting the first path of travel along a portion of the longitudinal extent of the first area and spaced laterally over the lateral extent of the first area, the guides being raised from the first area toward the second area to raise the advancing juxtaposed sheets from the first area toward the second area at laterally spaced locations to effect separation of the juxtaposed sheets such that one sheet follows one of the diverging paths of travel while the other sheet follows the other of the paths of travel as the sheets pass between the areas.

The invention will be more fully understood, while still further objects and advantages will be made apparent, in the following detailed description of an embodiment of the invention illustrated in the accompanying drawing, in which:

FIG. 1 is an elevational, partially diagrammatic, cross-sectional view of a diazo-type copying machine employing a sheet separator constructed in accordance with the invention;

FIG. 2 is an enlarged fragmentary cross-sectional view of the sheet separator of FIG. 1; and

FIG. 3 is a fragmentary perspective view of a portion of the sheet separator.

Referring now to the drawing, and expecially to FIG. 1 thereof, a diazo copying machine is illustrated, at least partially in diagrammatic fashion, at **10** and is shown to be of a compact variety having a base **12** with depending feet **14** enabling the machine **10** to be placed upon a table top **16** or a like stand. The housing **18** of copying machine **10** is open at the front **19** to enable an operator of the machine **10** to place a sheet **22** of copy paper with a transparent original sheet **20** juxtaposed with the copy sheet **22** upon an entrance platform **24** within the housing **18** and then manually advance the juxtaposed original sheet **20** and copy sheet **22** through an entrance slot **26** and into the printer section **28** of the machine.

The aligned leading edges **30** and **32** of the original and copy sheets **20** and **22**, respectively, will then be gripped between a plurality of printer belts **34** and a transparent printer cylinder **36** which is rotated in a counterclockwise direction by movement of the belts **34** in the direction indicated in FIG. 1. The belts **34** are driven by a drive roller **38** and pass around a plurality of idler rollers **40**. A plurality of tubular fluorescent lamps **42** are mounted within the printer cylinder **36** and serve as a source of light which will pass through the transparent wall of the cylinder **36** and through the transparent original sheet **20** as the juxtaposed sheets **20** and **22** are carried along between the cylinder **36** and the belts **34** to establish a latent image of the original material upon the copy sheet. The juxtaposed original and copy sheets **20** and **22** will emerge from between the printer belts **34** and the printer cylinder **36** at **44** where the leading edges **30** and **32** of the juxtaposed sheets will engage a pick-off strip **46** and follow a path of travel across a relatively short platform **48** to pass into the entrance chute **49** of a sheet separator illustrated generally at **50**.

The sheet separator **50** serves to separate the original sheet **20** from the copy sheet **22** so that the original sheet will follow a first path of travel **52** passing below the apex **54** of a diverter **56** and through an exit chute **58** so that the original sheet **20** will emerge from the front **19** of the housing **18** and will be passed to a holder **60** mounted upon the housing **18** of the machine **10**. The copy sheet **22** will follow a second path of travel **62** which diverges upwardly from the first path of travel **52** so that the copy sheet **22** will engage the diverter **56** above the apex **54** thereof and will be led into the developer section **64** of machine **10**. In the developer section **64**, the leading edge **32** of the copy sheet **22** will be gripped between a developer drive roller **66**, which is rotated in a clockwise direction as shown in FIG. 1, and a fixed web **68** which is perforated so that as the copy sheet **22** passes between the developer drive roller **66** and the fixed web **68** the latent image upon the copy sheet will be exposed to the developer medium within the developer chamber **70**, in this instance the medium being gaseous ammonia, to develop the latent image into a visible image on the copy sheet. As the copy sheet **22** emerges from between the developer drive roller **66** and the fixed web **68**, the leading edge **32** of the copy sheet **22** will en-

gage a pick-off strip **72** so as to be diverted from the developer drive roller **66** to an exit platform **74**. Continued movement of the copy sheet **22** along the exit platform **74** will enable the copy sheet to exit from the rear of housing **18** to be collected by the operator.

Turning now to FIGS. **2** and **3**, as well as to FIG. **1**, the sheet separator **50** operates to separate the copy sheet **22** from the original sheet **20** by exposing the advancing juxtaposed sheets to opposite areas **80** and **82** of reduced air pressure which are spaced from one another and which, by suction forces, tend to draw the sheets **20** and **22** away from one another. Thus, the sheet separator **50** includes a lower chamber **84** having an uppermost wall **86** which is horizontal and extends laterally across the entire width of the juxtaposed sheets below the first path of travel **52** and has a longitudinal length L which is relatively short compared to the total length of travel of each of the machine **10**. The wall **86** of the lower chamber **84** is provided with a plurality of apertures **88** and the interior **89** of the chamber **84** communicates with a blower **90** (shown schematically in FIG. **1**) which draws air from the interior of the chamber, thereby establishing the area **80** of reduced air pressure along the outer surface **92** of the upper wall **86** of the chamber **84**. Suction forces are thus established which tend to draw and maintain the juxtaposed sheets **20** and **22** against the outer surface **92** of the upper wall **86**.

Immediately above the lower chamber **84** is an upper chamber **94** having a lowermost wall **96** which is located above the second path of travel **62** and is likewise provided with a plurality of apertures **98**. The interior **99** of the upper chamber **94** is also connected to the blower **90** so that air will be drawn from the upper chamber **94** in order to establish the area **82** of reduced air pressure along the outer surface **102** of the lowermost wall **96** of the upper chamber **94**. The lowermost wall **96** also extends laterally in a horizontal direction across the entire width of the juxtaposed sheets **20** and **22** and extends longitudinally over a relatively short length LL which is even shorter than the corresponding length L of the uppermost wall **86** of the lower chamber **84**. Thus, the second area **82** of reduced air pressure is provided by the upper chamber **94** and overlaps the first area **80** of reduced pressure provided by the lower chamber **84**.

By virtue of the orientation and the relative dimensions of the upper wall **86** of the lower chamber **84** and the lower wall **96** of the upper chamber **94**, the first area **80** of reduced air pressure provided by the uppermost wall **86** of the lower chamber **84** extends beyond the second area **82** of reduced air pressure, provided by the lower wall **96** of the upper chamber **94**, in the direction of the oncoming juxtaposed sheets **20** and **22** so that the oncoming sheets are first drawn toward the upper wall **86** of the lower chamber **84**, along a forward portion **104** of the upper wall **86** which extends along the entrance chute **49** of separator **50** beyond lower wall **96**. As the juxtaposed sheets pass between the diverging walls **86** and **96** of the chambers **84** and **94**, both the original sheet **20** and the copy sheet **22** will tend to continue to travel along the upper wall **86** of the lower chamber **84** since the tendency of the sheets to cling together may not necessarily be overcome by the divergent opposite areas **80** and **82** of reduced air pressure. In order to overcome the tendency of the sheets to cling together and to achieve a relatively quick separation of the copy sheet **22** from the original sheet **20**, a plurality of guides **110** extend upwardly from the upper wall **86** of the lower chamber **84** and intercept the first path of travel **52** along a portion of the longitudinal extent of the first area **80**. The guides **110** are spaced laterally over the lateral extent of the upper wall **86**, as seen in FIG. **3**, so that the advancing juxtaposed sheets **20** and **22** are raised from the upper wall **86** of the lower chamber **84** toward the lower wall **96** of the upper chamber **94**, as seen in FIG. **2**, at laterally spaced locations. In this manner the copy sheet **22** is picked up by the suction provided at the outer surface **102** of the lower wall **96** of the upper chamber **94** so as to follow the second path of travel **62** while the original sheet **20** conforms to the curvature of the guides **110** and follows the first path of travel **52**. The guides **110** are preferably constructed of wire and are curved, or arched upwardly, so that each guide wire is easily located and secured in the upper wall **86** of the lower chamber **84** as shown.

It has been found that in the absence of guides **110** the juxtaposed sheets **20** and **22** would tend to cling to one another and follow either the upper or second path of travel or the lower or first path of travel; however, by first drawing both sheets toward the first path of travel **52** along portion **104** of upper wall **86** and then employing the guides **110** to raise the sheets toward the second path of travel **62**, relatively quick and effective separation has been attained. Such separation has been attained over a relatively short longitudinal travel of the sheets and with a minimal reduction of air pressure within the chambers **84** and **94**. While ordinarily it would be expected that a considerable reduction in air pressure would be necessary in the upper chamber **94** to raise the copy sheet **22** from the lower path of travel **52**, the presence of the guides **110** enables separation with a minimal reduction of the air pressure within the upper chamber, while requiring a minimal reduction of air pressure within the lower chamber to assure that the original sheet **20** follows the first path of travel **52**. Thus, the illustrated sheet separator **50** may be operated with the air pressure within the chambers being reduced below ambient air pressure by an amount of only 4 to 6 inches of water column, rendering the sheet separator efficient in that only small amounts of power are necessary to attain the desired results.

Returning now to FIG. **1**, where it may be desired to separate the juxtaposed original and copy sheets **20** and **22** manually without passing the copy sheet **22** automatically to the developer section **64**, both the original sheet and the juxtaposed copy sheet may be made to exit through the exit chute **58** by manually depressing the diverter **56**, which is mounted for pivotal movement at **112** between a first position, shown in full lines in FIG. **1**, and a second position, shown in phantom in FIG. **1**. By manually depressing the diverter **56** to locate the diverter in the second position, the apex **54** thereof is raised to close the path to the developer section **64**. At the same time, a switch **114** is activated to shut off the blower **90** so that the sheet separator **50** is rendered inoperative. The juxtaposed original and copy sheets **20** and **22** will then merely follow the lower path of travel **52** and exit together through the exit chute **58**.

It is to be understood that the above detailed description of an embodiment of the invention is provided by way of example only. Various details of design and construction may be modified without departing from the true spirit and scope of the invention as set forth in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a copying machine wherein an original sheet is initially juxtaposed with a copy sheet, the juxtaposed sheets are advanced longitudinally in the machine along a first path of travel, and the original and copy sheets are subsequently separated from one another such that one of said sheets follows a second path of travel which diverges from said first path of travel, a sheet separator comprising:

first means for establishing a first area of reduced air pressure along said first path of travel, said first area extending longitudinally for a relatively short distance along the first path of travel and extending laterally over approximately the width of the advancing sheets;

second means for establishing a second area of reduced air pressure along the second path of travel, said second area essentially overlapping at least a portion of the first area and diverging therefrom in the direction of advancement of said sheets; and

a plurality of guides intercepting the first path of travel along a portion of the longitudinal extent of the first area and spaced laterally over the lateral extent of said first area, said guides being raised from said first area toward

the second area to raise the advancing juxtaposed sheets from said first area toward said second area at laterally spaced locations to effect separation of said juxtaposed sheets such that one sheet follows one of said diverging paths of travel while the other sheet follows the other of said paths of travel as the sheets pass between said areas.

2. The invention of claim 1 wherein said first area of reduced air pressure extends beyond the second area of reduced air pressure in the direction of the oncoming juxtaposed sheets.

3. The invention of claim 1 wherein said first means includes:

a first chamber having a wall including an outer surface juxtaposed with said first path of travel;

means for drawing air from said first chamber to reduce the air pressure therein; and

a plurality of apertures in said wall for establishing said first area of reduced air pressure at the outer surface of the wall.

4. The invention of claim 3 wherein said second means includes:

a second chamber having a wall including an outer surface juxtaposed with said second path of travel;

means for drawing air from said second chamber to reduce the air pressure therein; and

a plurality of apertures in said wall of the second chamber for establishing said second area of reduced air pressure at the outer surface of the wall of the second chamber.

5. The invention of claim 4 wherein said wall of the first chamber extends beyond said wall of the second chamber in the direction of the oncoming juxtaposed sheets.

6. The invention of claim 4 wherein said guides extend from the wall of the first chamber toward the overlapping wall of the section chamber.

7. The invention of claim 6 wherein each guide is a wire affixed to the wall of the first chamber.

8. The invention of claim 4 wherein:

the first chamber extends horizontally over the width of the advancing sheets below the first path of travel with the outer surface of the wall of the first chamber facing upwardly;

the second chamber extends horizontally over the width of the advancing sheets above the second path of travel with the outer surface of the wall of the second chamber facing downwardly; and

said guides are raised upwardly from the wall of the first chamber toward the wall of the second chamber.

9. The invention of claim 8 wherein each guide is a wire affixed to and arched upwardly from the wall of the first chamber.

10. The invention of claim 9 wherein said wall of the first chamber extends beyond said wall of the second chamber in the direction of the oncoming juxtaposed sheets.

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