

Oct. 12, 1965

C. S. MASTERSON

3,211,451

SHEET SEPARATOR

Original Filed April 27, 1959

3 Sheets-Sheet 1

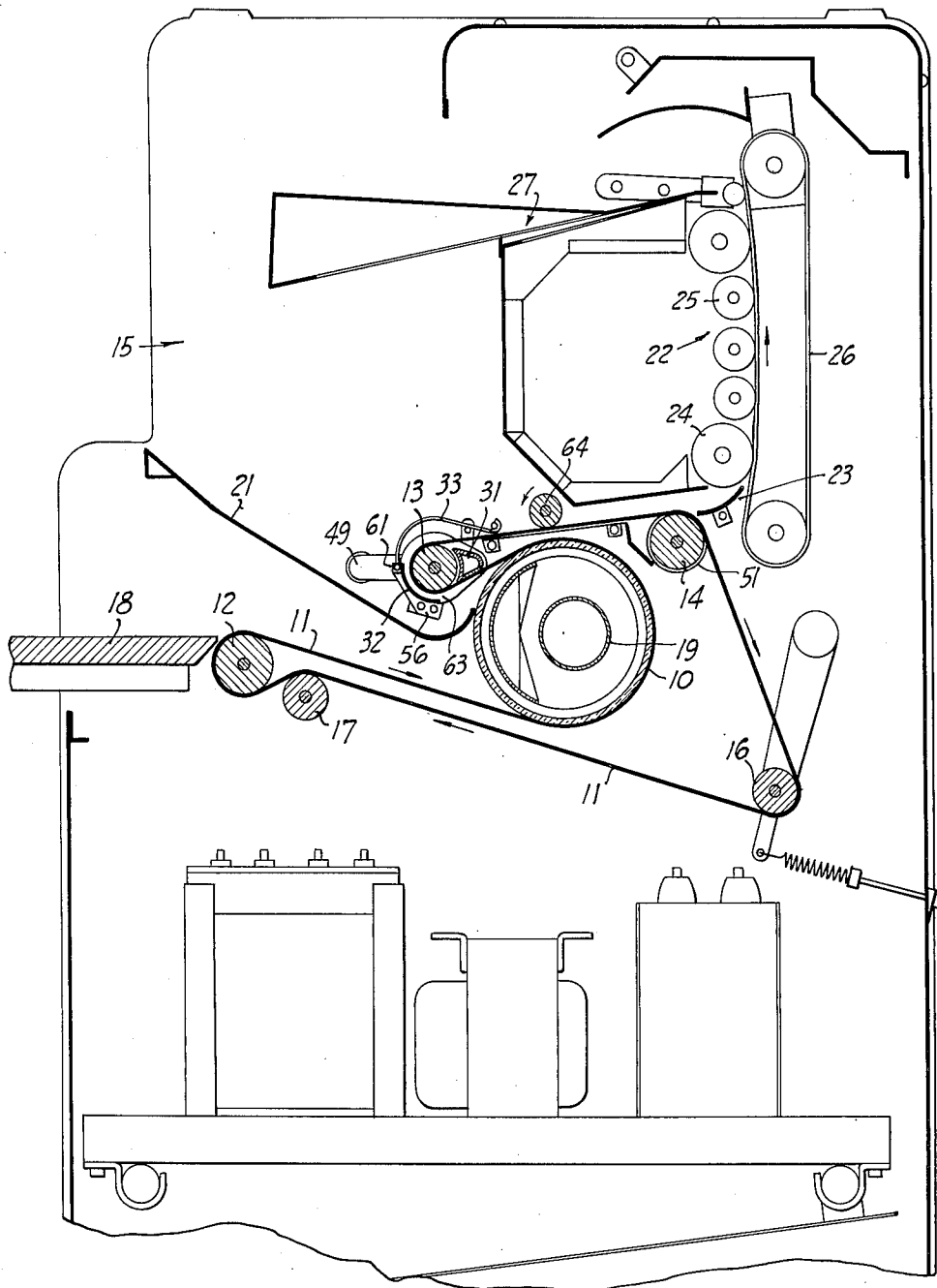


FIG. 1

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3 Sheets-Sheet 2

FIG. 2

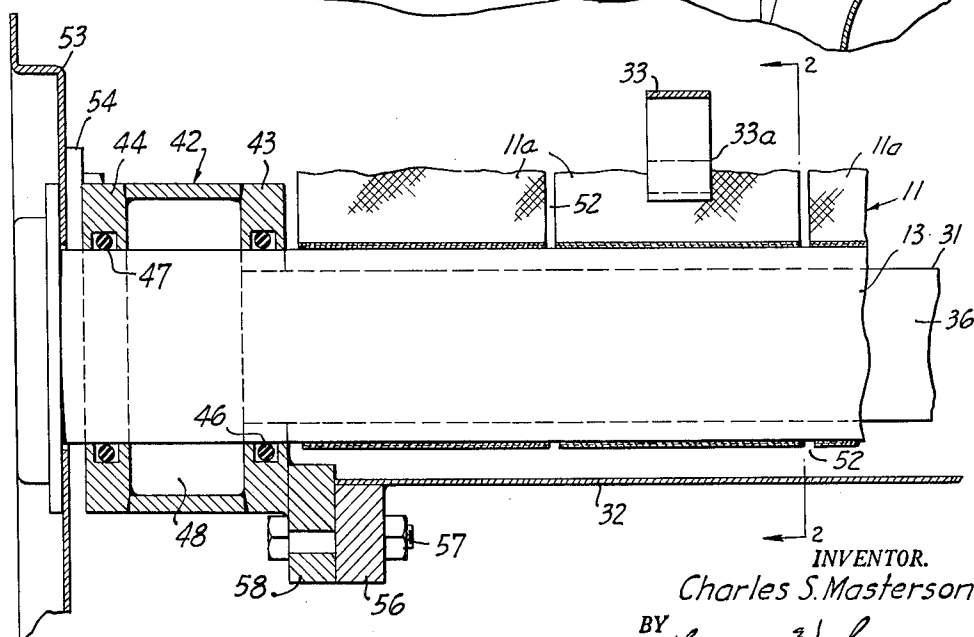
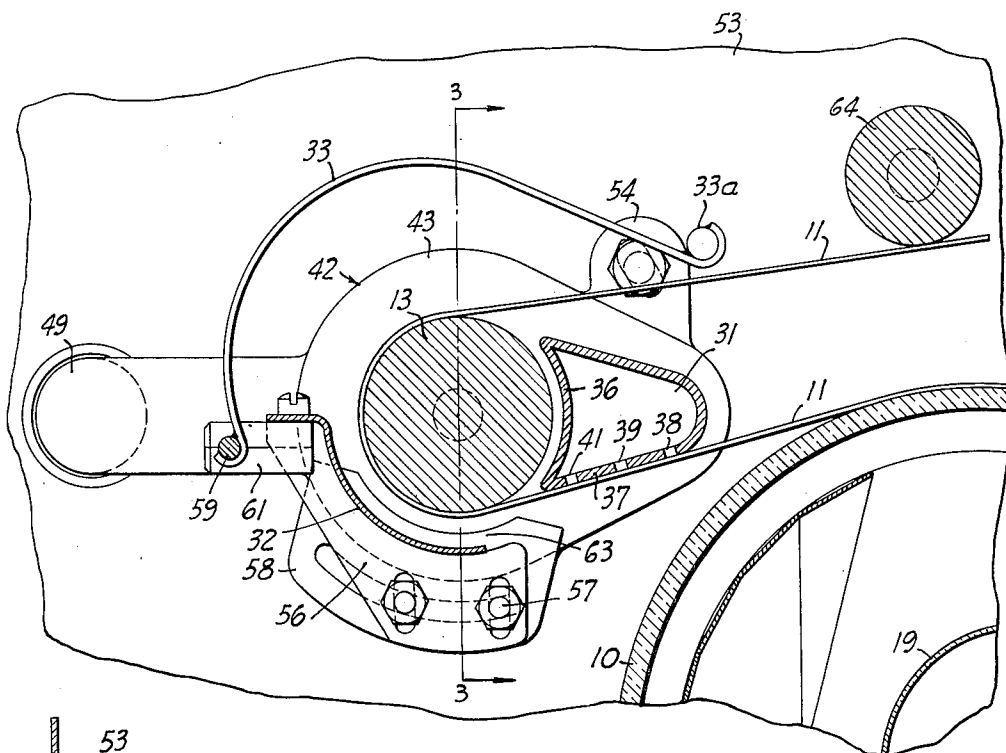


FIG. 3

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3 Sheets-Sheet 3

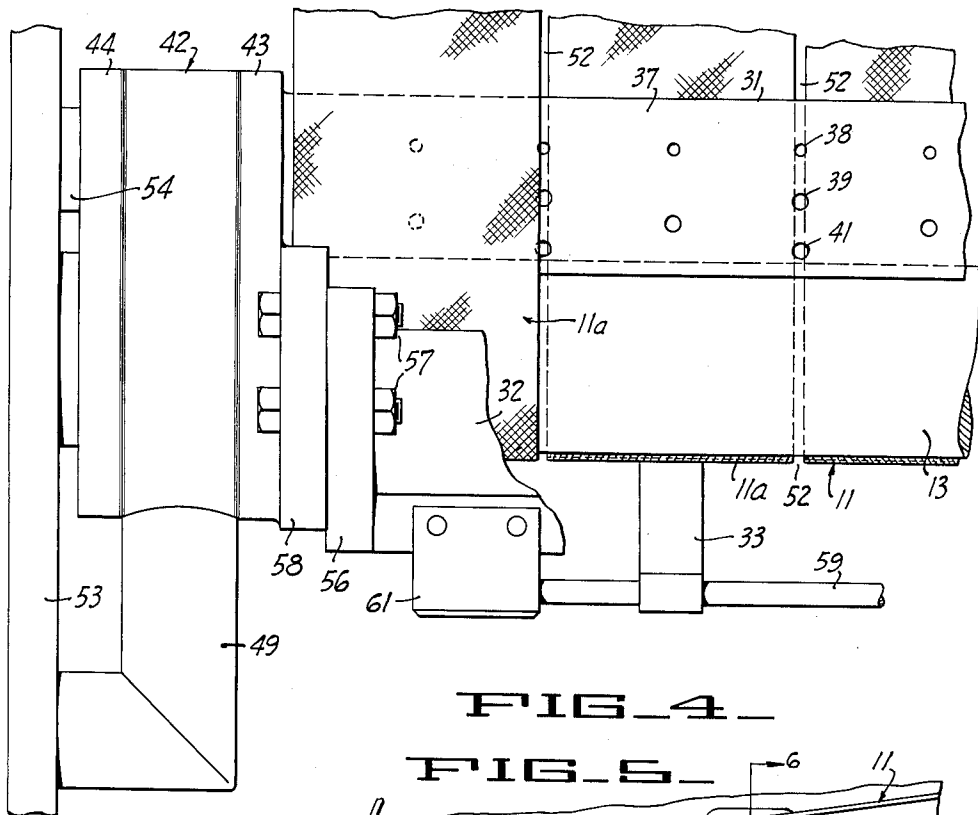


FIG. 4

FIG. 5

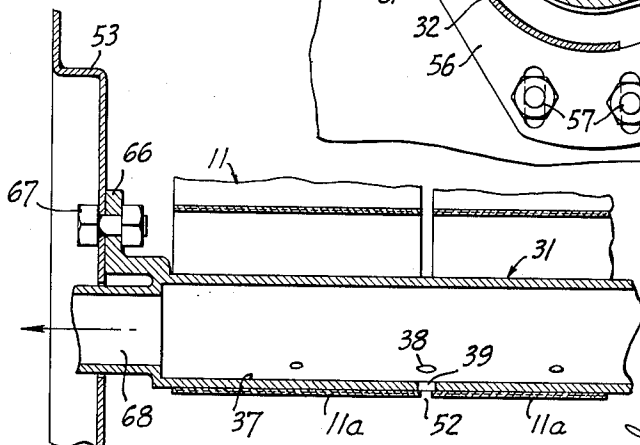
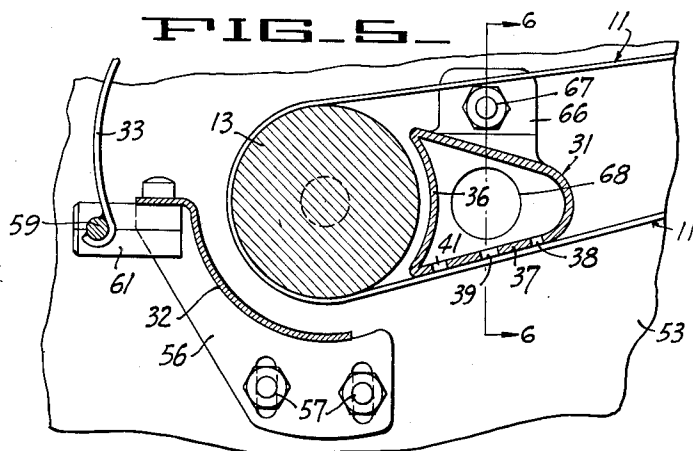


FIG. 6

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Continuation of application Ser. No. 809,147, Apr. 27, 1959. This application May 7, 1962, Ser. No. 193,904
6 Claims. (Cl. 271-64)

This application is a continuation of application Serial No. 809,147, filed April 27, 1959, now abandoned.

This invention relates generally to apparatus for separating superimposed sheets, and particularly for separating photocopies or prints from tracings.

A typical machine in which the invention is useful is a diazo printing machine having separate light exposure and dry print processing zones, together with conveying means for progressing the superposed tracing and photosensitive print sheets through the exposure or printing zone, and means for progressing the separated print sheet through the processing zone. With the particular type of printing machine described herein, the superposed tracing and print sheets, after being discharged following exposure, must be manually separated and the photosensitive print sheet fed back to the machine for processing. This involves considerable manual labor, which increases the over-all cost of making prints, and in general greatly reduces the capacity of the machine.

It is an object of the present invention to provide improved means for separating a pair of superimposed sheets.

It is another object of the present invention to improve printing machines of the above character whereby the superposed tracing and print sheets are automatically separated as they are discharged from the exposure zone, and the photosensitive print sheet automatically returned to the processing zone.

Another object of the invention is to provide an improved means of the above character which can be incorporated in present machines without radical alteration, and without undue expense.

Additional objects and features of the invention will appear from the following description in which the preferred embodiments have been set forth in detail in conjunction with the accompanying drawings.

Referring to the drawings:

FIGURE 1 is a schematic view illustrating my invention incorporated with a commercially available type of printing machine.

FIGURE 2 is a cross sectional view illustrating a portion of the conveying means of the machine illustrated in FIGURE 1, namely, that part which is provided for the return of exposed print sheets to the processing zone. This figure is a cross section taken along the line 2-2 of FIGURE 3.

FIGURE 3 is a cross sectional view taken along the line 3-3 of FIGURE 2.

FIGURE 4 is a fragmentary detail looking toward the bottom run of the conveyor loop shown in FIGURE 2.

FIGURE 5 is a cross sectional detail illustrating another embodiment of the invention.

FIGURE 6 is a cross sectional view taken along the line 6-6 of FIGURE 5.

The particular printing machine illustrated in FIGURE 1 corresponds to one manufactured by Paragon-Revolute Corporation, of Rochester, New York. However, it is deemed that the invention is applicable to other types of printing machines having similar characteristics. This machine is designed for printing and processing dry Diazo materials, and is constructed with conveying means to progress superposed Diazo print and tracing sheets through an exposure zone where it is exposed to light, after which

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the prints are discharged to the exterior of the machine for manual separation. After manual separation, conveying means serves to progress the print sheet to a dry processing zone, to produce the final permanent print or copy.

The principal operating parts of such machines, which carry on the exposure and processing operations, include the rotatable cylinder 10 formed of glass or other transparent material. An endless conveyor 11, consisting of a plurality of side-by-side endless belts, is looped over the rollers 12 and 13, which are located at the front side of the machine housing 15. The conveyor also engages over the guide rollers 14 and 16, and the tensioning idler roller 17. As illustrated, the upper run leaving the roller 12 advances into engagement with the periphery of the drum 10, and leaves the upper side of this run for the roller 13. From roller 13, the conveyor passes over the guide rollers 14 and 16 back to the roller 12.

Without the present improvement, an operator assembles superposed tracing and print sheets upon the work table 18, and feeds these sheets to the lower run of the conveyor leaving the roller 12. The sheets then pass between the belt and the periphery of the drum 10, and while in contact with the drum 10, they are exposed to light from the lamp 19. From the upper side of the drum 10, the superposed sheets are delivered to the receiving tray 21, where they are manually separated, and the print sheet then delivered manually to the upper run of the conveyor leaving the roller 13, for delivery into the processing zone 22. When the print sheet reaches the roller 14, it is engaged by the deflector 23, which delivers it upwardly between the rollers 24, 25, and one run of the belt 26. Ultimately the processed sheet is discharged from the machine over the tray 27.

The present improvement avoids manual separation of the print and tracing sheets as described above, and automatically returns the print sheet to the processing zone. In general, my improvement employs pneumatic suction means in conjunction with the conveyor loop that engages roller 13, whereby the print and tracing sheets are automatically separated. In addition, I employ guide or directing means which engages the print sheet, and automatically delivers it to the upper run of the conveyor leaving the roller 13.

More specifically, the pneumatic means preferably consists of a suction chamber 31 which extends between the upper and lower runs of the conveyor adjacent the roller 13, and functions to effect a separation pneumatically. The guide or directing means consists in this instance of the members 32 and 33, which engage the separated print sheet and return it into operative engagement with the upper run of the conveyor.

The suction chamber 31 can be constructed as shown in FIGURE 2. It has a length corresponding generally to the over-all width of the conveyor. It has an arcuate wall 36 which is in relatively close space relationship with the periphery of roller 13. Its lower side wall 37 is provided with a plurality of perforations 38, 39, and 41, and is in contact with the conveyor 11.

As shown in FIGURES 2 and 3, one or both ends of the chamber 31 are in communication with suction ducts. Thus at each side of the machine, and at each end of the roller 13, there is a header 42. In this particular instance each header consists of end walls 43 and 44 which have aligned openings to accommodate the corresponding end of the roller 13. Suitable sealing means 46 and 47, as for example, of the resilient O-ring type, can be provided to prevent undue air leakage about the roller. The space 48 within each header is in communication with the corresponding end of the chamber 31, and is also in communication with pneumatic suction means (e.g. a suction pump or blower not shown), through a pipe connection 49.

FIGURES 2 and 3 show a header 42 at one end of the roller 13. A similar header can be provided at the other end of the roller, with or without a connection to a source of suction.

FIGURES 3 and 4 illustrate the character of the conveyer 11. It consists of a plurality of individual endless belts 11a, which are maintained separated by flanges 51 on the roller 14. FIGURE 4 also shows how the openings 38, 39, and 41 are aligned with the spaces 52, between adjacent belts.

Each header 42 is rigidly secured to the adjacent end wall 53 of the machine housing, by attaching tab 54 or other suitable means.

The guide member 32 can be formed of sheet metal bent to conform to the segment of a cylinder. In general, it is disposed in embracing relationship with the outer periphery of the roller 13, whereby it is coincident with a cylinder formed on a radius having the axis of the roller 13 at its center.

At its ends the member 32 can be provided with the flanges 56, which can be adjustably secured by bolts 57 to the tabs 58, that are rigidly attached to the housings of the headers 42.

Guide members 33 are in the form of bent metal strips or fingers, which generally overlie the roller 13 and the upper run of the conveyer. Thus as shown in FIGURES 2 and 3, the members 33 are in the form of metal finger-like strips, having their corresponding ends attached to a common mounting rod 59. This rod is shown carried by the brackets 61, which in turn are secured to the upper edge of the guide member 32. The rear free end portions 33a of the guide members 33 terminate in spaced relationship with the adjacent upper run of the conveyer 11. The positioning of member 61 together with rod 59 and members 33 can be adjusted by adjusting the attachment of flanges 56 to the tabs 58.

Operation of my improved printing machine can be described as follows: A tracing and a sheet of printing paper are first manually superposed upon the work table 18, and then moved into engagement with the upper run of the conveyer leaving the roller 12, whereby the superposed sheets are engaged and caused to progress between the conveyer and the drum 10. As the superposed sheets progress about the axis of the drum 10, they are exposed to light from the lamp 19, to provide a proper exposure period. As the leading edges of the superposed sheets are delivered from the upper side of the drum 10, they are no longer pressed together. Suction applied to the openings 38, 39, and 41 now acts upon the adjacent printing sheet, whereby this sheet is held in contact with the conveyer, while the tracing leaves its contact with the print sheet and is delivered upon the tray 21. The advancing edge of the print sheet progresses forwardly, being held pneumatically into contact with the lower run of the conveyer as it approaches the roller 13, until the forward edge of the print sheet is within the space 63 between the guide member 32 and the periphery of the roller 13. The print sheet is now directed about the roller 13 through the space 63, and is thereafter guided by the members 33 to cause it to bend about the roller 13 and to be re-presented to the upper run of the conveyer in the region of the ends 33a of the members 33. Here the print sheet is frictionally engaged by the conveyer and directed between the upper end of the conveyer and the feed roller 64, thereafter to pass upwardly through the processing zone 22 as previously described.

It will be evident from the foregoing that the present improved machine makes possible automatic separation of the print and tracing sheets, and also automatic introduction of the print sheet into the processing zone. The previous operations of manually separating the sheets as previously described, and also manually introducing the print sheet after exposure, are eliminated.

FIGURES 5 and 6 illustrate another embodiment of 75

the invention in which the headers 42 are omitted. In this instance the ends of the pneumatic chamber 31 are directly secured to the end walls 53 of the machine housing, by the tabs 66 and bolts 67. Also the ends of the chambers directly connect with a source of suction through the tubes or pipes 68. The guide members 32 and 33 in this instance are independently mounted.

What is claimed is:

1. A separator for a pair of superimposed sheets, comprising:

a pair of engaged but divergently circulating upper and lower members for pinching at least the trailing ends of said sheets together and for moving said sheets endwise in a generally horizontal plane to a position in which the leading ends of said sheets are overhanging an empty space, said upper member being an openwork member;

a pneumatic suction means positioned in a predetermined zone above said upper openwork member and above said empty space and spaced substantially from said lower member, so as to cause a local portion of the uppermost of said sheets to adhere to said upper member in passage through said predetermined zone, while the lowermost sheet drops into said space;

means for causing circulation of said upper member upwardly and in a reverse direction immediately beyond said pneumatic means;

means for guiding the leading edge of said uppermost sheet upward and reversely above said reversely circulating upper member;

the span between said last-named means and the point of divergence of said upper and lower members being substantially less than the length of said uppermost sheet; and

means for causing frictional engagement of said uppermost sheet and upper member during movement in said reversely circulating direction;

whereby said uppermost sheet is permanently prevented from falling with said lowermost sheet into said empty space.

2. A separator for a pair of superimposed sheets, comprising:

a pair of engaged but divergently circulating upper and lower members for pinching at least the trailing ends of said sheets together and for moving said sheets endwise in a generally horizontal plane to a position in which the leading ends of said sheets are overhanging an empty space, said upper member being an openwork member;

a pneumatic suction means positioned in a predetermined zone above said upper openwork member and above said empty space and spaced substantially from said lower member, so as to cause a local portion of the uppermost of said sheets to adhere to said upper member in passage through said predetermined zone, while the lowermost sheet drops into said space;

means for causing circulation of said member upwardly and in a reverse direction immediately beyond said pneumatic means; and

at least one spring guide finger curved upwardly and reversely around at least a portion of said last-named means and terminating in closely-spaced relation to said reversely circulating upper member for guiding the leading edge of said uppermost sheet upwardly and reversely above said reversely circulating upper member and for causing frictional engagement of said uppermost sheet and upper member during movement in said reversely circulating direction;

the span between said fingers and the point of divergence of said upper and lower members being substantially less than the length of said uppermost sheet; whereby said uppermost sheet is permanently prevented from falling with said lowermost sheet into said empty space.

3. A separator for a pair of superimposed sheets, comprising:

- a pair of engaged but divergently circulating upper and lower members for pinching at least the trailing ends of said sheets together and for moving said sheets endwise in a generally horizontal plane to a position in which the leading ends of said sheets are overhanging an empty space, said upper member being an openwork member;
- a pneumatic suction means positioned in a predetermined zone above said upper openwork member and above said empty space and spaced substantially from said lower member, so as to cause a local portion of the uppermost of said sheets to adhere to said upper member in passage through said predetermined zone, while the lowermost sheet drops into said space;
- means for causing circulation of said upper member upwardly and in a reverse direction immediately beyond said pneumatic means;
- at least one spring guide finger curved upwardly and reversely around at least a portion of said last-named means and terminating in closely-spaced relation to said reversely circulating upper member for guiding the leading edge of said uppermost sheet upwardly and reversely above said reversely circulating upper member and for causing frictional engagement of said uppermost sheet and upper member during movement in said reversely circulating direction; and
- a pressure roller mounted for engaging said reversely circulating uppermost sheet and upper member immediately beyond said spring guide fingers;
- the span between said fingers and the point of divergence of said upper and lower members being substantially less than the length of said uppermost sheet;
- whereby said uppermost sheet is permanently prevented from falling with said lowermost sheet into said empty space.

4. A separator for a pair of superimposed sheets, comprising:

- a roller and an openwork belt means engaging the upper side of said roller and circulating divergently away therefrom for pinching at least the trailing ends of said sheets together and for moving said sheets endwise in a generally horizontal plane to a position in which the leading ends of said sheets are overhanging an empty space;
- a pneumatic suction means positioned in a predetermined zone above said openwork belt means and above said empty space and spaced substantially from said roller, so as to cause a local portion of the uppermost of said sheets to adhere to said belt means in passage through said predetermined zone, while the lowermost sheet drops into said space;
- means for causing circulation of said belt means upwardly and in reverse direction immediately beyond said pneumatic means;
- at least one spring guide finger curved upwardly and reversely around at least a portion of said last-named means and terminating in closely-spaced relation to said reversely circulating belt means for guiding the leading edge of said uppermost sheet upwardly and reversely above said reversely circulating belt means and for causing frictional engagement of said uppermost sheet and belt means during movement in said reversely circulating direction;
- the span between said guide fingers and the point of divergence of said roller and belt means being substantially less than the length of said uppermost sheet; and
- a pressure roller mounted for engaging said reversely circulating uppermost sheet and belt means immediately beyond said spring guide fingers;
- whereby said uppermost sheet is permanently prevented

from falling with said lowermost sheet into said empty space.

5. A separator for a pair of superimposed sheets, comprising:

- a roller and an openwork belt means comprising a plurality of spaced parallel belts engaging the upper side of said roller and circulating divergently away therefrom for pinching at least the trailing ends of said sheets together and for moving said sheets endwise in a generally horizontal plane to a position in which the leading ends of said sheets are overhanging an empty space;
- a pneumatic suction vessel positioned in a predetermined zone above said openwork belt means and above said empty space and spaced substantially from said roller, said vessel having a plurality of suction ports opening downwardly between said belts so as to cause a local portion of the uppermost of said sheets to adhere to said belts in passage through said predetermined zone, while the lowermost sheet drops into said space;
- means for causing circulation of said belt means upwardly and in a reverse direction immediately beyond said pneumatic means;
- at least one spring guide finger curved upwardly and reversely around at least a portion of said last-named means and terminating in closely-spaced relation to said reversely circulating belt means for guiding the leading edge of said uppermost sheet upwardly and reversely above said reversely circulating belt means and for causing frictional engagement of said uppermost sheet and belt means during movement in said reversely circulating direction;
- the span between said guide fingers and the point of divergence of said roller and belt means being substantially less than the length of said uppermost sheet; and
- a pressure roller mounted for engaging said reversely circulating uppermost sheet and belt means immediately beyond said spring guide fingers;
- whereby said uppermost sheet is permanently prevented from falling with said lowermost sheet into said empty space.

6. A separator for a pair of superimposed sheets, comprising:

- a roller and an openwork belt means comprising a plurality of spaced parallel belts engaging the upper side of said roller and circulating divergently away therefrom for pinching at least the trailing ends of said sheets together and for moving said sheets endwise in a generally horizontal plane to a position in which the leading ends of said sheets are overhanging an empty space;
- a pneumatic suction vessel positioned in a predetermined zone above said openwork belt means and above said empty space and spaced substantially from said roller, said vessel having a plurality of suction ports opening downwardly between said belts so as to cause a local portion of the uppermost of said sheets to adhere to said belts in passage through said predetermined zone, while the lowermost sheet drops into said space;
- means for causing circulation of said belt means upwardly and in a reverse direction immediately beyond said pneumatic means;
- at least one guide member embracing the lower portion of said last-named means and at least one spring guide finger curved upwardly and reversely around at least a portion of said last-named means and terminating in closely-spaced relation to said reversely circulating belt means for guiding the leading edge of said uppermost sheet upwardly and reversely above said reversely circulating belt means and for causing frictional engagement of said uppermost

sheet and belt means during movement in said reversely circulating direction;
 the span between said guide member and the point of divergence of said roller and belt means being substantially less than the length of said uppermost sheet; and
 a pressure roller mounted for engaging said reversely circulating uppermost sheet and belt means immediately beyond said spring guide fingers;
 whereby said uppermost sheet is permanently prevented from falling with said lowermost sheet into said empty space.

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