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SHEET SEPARATING DEVICE

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FIG. 1

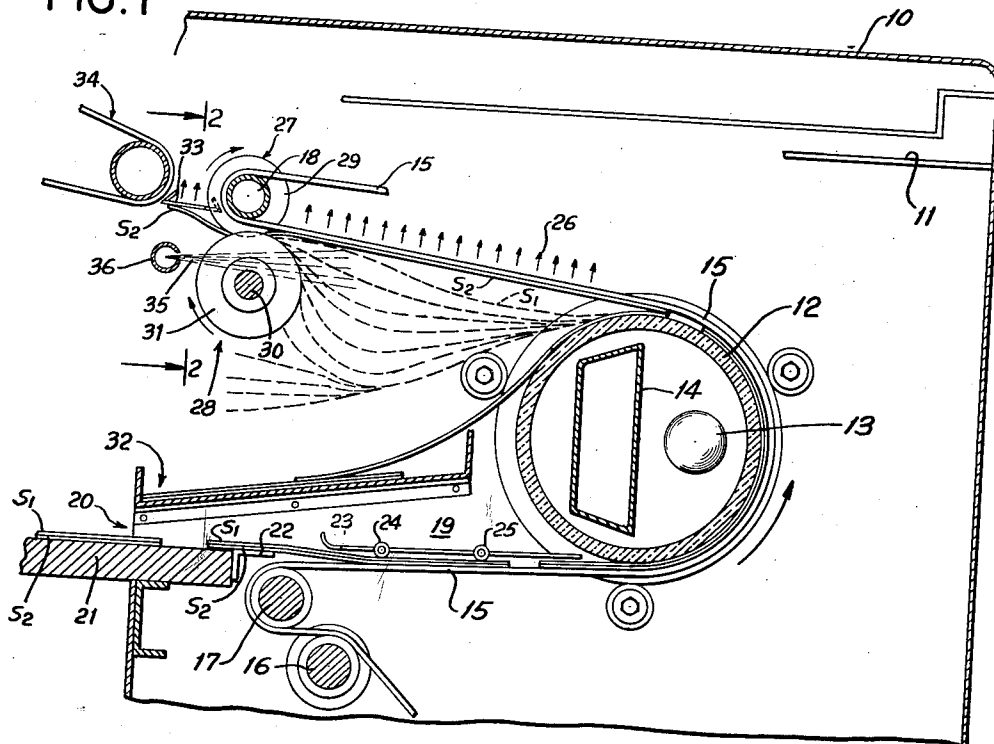
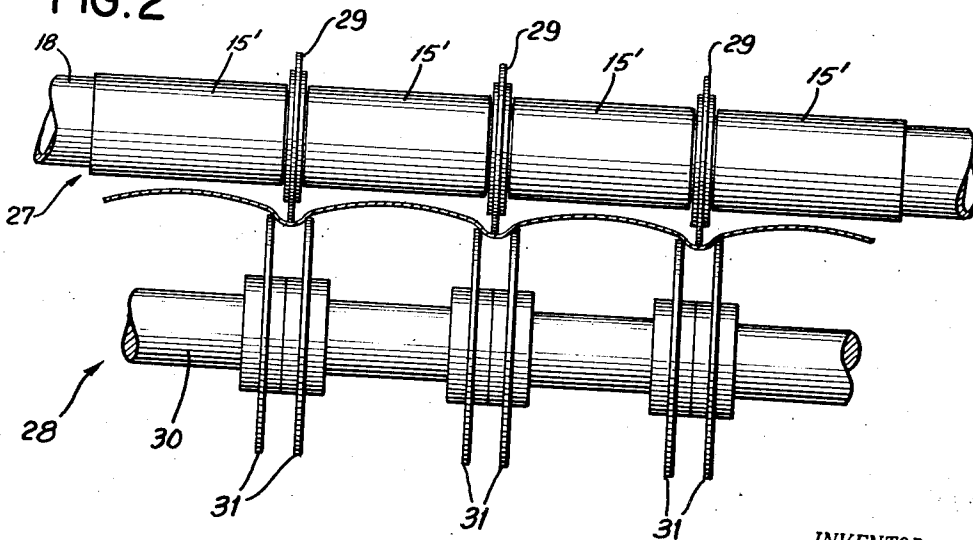


FIG. 2



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2,766,044

SHEET SEPARATING DEVICE

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10 Claims. (Cl. 271-18)

This invention relates to sheet separating devices and more particularly to apparatus for separating superimposed sheets of materials such as paper, which are passed in face-to-face relation through machines such for example as printing or duplicating machines.

In photoprinting machines and the like, such as machines for developing and printing papers having light-sensitive emulsions on one surface, the subject to be printed, usually a tracing, is placed on the emulsion side of the sensitive paper and the two sheets passed over a strong light source to expose the emulsion to the light through the tracing. As the sheets emerge from the printing area they must be separated in order that the tracing may be discharged at one point in the machine and the exposed paper passed on to a suitable developing stage in another part of the machine. In machines of this type difficulty has been experienced in separating the tracing from the printing paper due to the facts that the sheets are pressed very tightly together during the printing, and that air pressure differentials of a continuous nature are used to hold the sheets in close contact with moving feed belts which convey the sheets through the machine.

One object of the present invention therefore, is to provide improved apparatus for separating superimposed sheets.

Another object of the invention is to provide improved apparatus for separating tracings from sensitized sheets in photoprinting machines in an efficient and essentially fool-proof manner.

In accordance with the invention the superimposed sheets to be separated may be advanced by means of a feed belt against a counterflowing air jet directed at the advancing leading edges of the mated sheets, the air jet thus affording a first sheet separating stage. Disposed between the source of the air jet and the place at which sheet separation by the jet would be expected to occur, are a pair of companion parallel rotor assemblies which straddle the feed belt and which carry sheet-engaging discs, preferably formed of a relatively high friction material such as rubber. The discs of one of the rotor assemblies are arranged to project through the spaces between adjacent sections of the feed belt, which is preferably comprised of a series of relatively narrow belts disposed side by side, and the discs of the companion rotor assembly are preferably arranged in a series of closely spaced pairs to receive in intermeshing relationship the projecting discs of the first assembly. The rotor assemblies are both rotated in the same direction so that the peripheries of the opposed discs will be moving in opposite directions where they intermesh. Both rotor assemblies being driven, one may also be used as a drive roller for the feed belt.

In operation, assuming the air jet to have been ineffective to separate the advancing sheets, the sheets will be carried into the rotor assemblies where they will first be forced as one away from the belt by the discs which project therethrough, and then subjected to forces by

the discs which will push one sheet in the direction of its movement through the machine and the other in the opposite direction. One sheet will, therefore, be allowed to pass through the rotor assemblies and the other will be rejected. The sheet passing through will be formed by the intermeshing discs into a series of ridges, which will impart stiffness against bending so that the leading edge of the sheet may be cantilevered outwardly for a sufficient distance to be picked up by the sheet conveying means of the next stage of the machine. Meantime the rejected sheet will be bellying away from the non-rejected sheet, while the air jet blows through the discs against its under surface, and will ultimately become fully separated from the non-rejected sheet.

The invention may be better understood by reference to the accompanying drawing illustrating a preferred arrangement thereof, in which:

Figure 1 is a view in vertical section of a portion of a printing machine; and

Figure 2 is a front view of a portion of the sheet printing machine as viewed looking into the machine in the direction of the arrows 2-2.

The invention may be embodied in a printing machine (partly shown) having a casing 10 formed with an air vent 11 and housing a transparent printing roller 12 inside of which are located a printing light 13 and a ventilating air duct 14. Passing about the printing roller 12 is a continuous or endless feed belt 15 which is preferably made up of a series of narrow strips 15' (Figure 2) disposed side by side with a small space between each pair. The belt, only part of which is shown in the drawing, passes over rollers 16, 17, the printing cylinder 12 and a roller 18, and in its passage between the roller 17 and the printing cylinder 12 traverses a chamber 19, which may be regarded as part of the infeed station 20 of the printing machine. This station may include a stationary platform 21, the inner end of which carries a lip 22 which overhangs the feed belt 15 onto which the superimposed sheets S₁ and S₂, which may comprise the tracing paper and printing paper respectively, are placed. A suitable guide 23 including rollers 24 and 25 may be disposed within the chamber 19 to press the sheets downwardly against the feed belt to facilitate the feeding action.

The feed belt passes the superimposed sheets about the printing cylinder 12, permitting light to pass through the tracing to the printing paper, and discharges them from the upper edge of the printing cylinder, at which point they are disposed on the under side feed belt and held in place by an air pressure differential across the belt. This air pressure differential may be set up by means of an air flow in the direction of the arrows 25 through the machine, by means for example of a blower (not shown).

Spaced from the top of the printing cylinder 12 in the direction of movement of the feed belt 15 is a sheet separating device which may take the form of a pair of rotor assemblies 27 and 28 disposed respectively above and below the feed belt 15 to define a sheet-receiving channel. The rotor assembly 27 which may conveniently be incorporated with the feed roller 18, includes a series of annular sheet-engaging members which may take the form of discs which turn with the roller 18 and which are spaced apart to project through the spaces between adjacent pairs of the belt parts 15'. The rotor assembly 28 includes a shaft 30 rotatably journaled in the frame of the printing machine and to which are attached a series of sheet-engaging members which may take the form of discs arranged in pairs 31 to receive the discs 29 of the rotor assembly 27 in intermeshing relationship. The discs 29 and 31 will preferably be formed of a smooth high-friction material, such as rubber, for example, at their peripheries.

The shafts 18 and 30 are each driven in a clockwise

3 direction as viewed in Figure 1 so that the discs 29 and 31 at their overlapping peripheries will be moving in opposite directions, the peripheries of the lowermost discs 31 moving counter to the direction of movement of the feed belt and the peripheries of the upper discs 29 moving in the same direction as the belt. The roller 18 may either be driven by the belt or itself driven to drive the belt.

The advancing superimposed sheets, assuming they have not been separated when they reach channel defined by the rotor assemblies 27 and 28, will first be disengaged from the under surface of the feed belt 15 by means of the discs 29 and forced against the discs 31. Thus the discs 29 will engage the upper surface of the upper sheet S₂ to apply frictional forces in the direction of feeding movement whereas the discs 31 will engage the lower surface of the lower sheet S₁ to apply frictional forces in the opposite direction. In this fashion the tracing will be rubbed free of the printing paper and will be rejected by the rotor assemblies while the printing paper will be passed through the rotor assemblies due to the pushing force of the feed belt rearwardly of the point of separation and the feeding force of the discs 29. The frictional opposition of the lower discs 31 will be insufficient to overcome these forces.

The rejected sheet S₁ will assume the successive positions shown by dotted lines in Figure 1, and will ultimately drop into a receiving tray 32 from which it may be removed by the operator. The sheet S₂, as best seen in Figure 2, will be corrugated or ribbed by means of the intermeshing discs 29 and 31 so that its leading edge is cantilevered outwardly. A certain rigidity will be imparted thereto which will enable it to hold its substantially horizontal position until such time as the air currents which hold it against the feed belt 15 at an earlier stage, are again able to press it against a stationary plate 33 at the infeed end of a second feed belt 34 which will serve to draw the trailing end of the sheet S₂ through the rotor assemblies and carry the sheet to a developing stage (not shown). The sheet may if desired be discharged from the machine at the output side of the rotor assemblies.

A preliminary or first sheet separating stage may be provided to separate the sheets, when possible, before the sheet separating rotors 27 and 28 come into play. This primary arrangement may take the form of an air jet 35 (Figure 1) issuing from nozzle means 36 and directed at the advancing edges of the superimposed sheets as they emerge from the top of the printing cylinder 12. This jet may be formed generally in accordance with the disclosure of the pending U. S. application Serial No. 287,465, filed May 13, 1952. In accordance with the present invention this jet nozzle means 36 may be located behind the rotor assemblies 27 and 28 in the direction of movement of the feed belt so that the air jets may pass between the shafts 18 and 30, and between the spaced discs 29 and 30 before meeting the advancing sheets. Thus the nozzle means 36 will be out of the way in the event the rotor assemblies 27 and 28 come into play, i. e., it will not interfere with the sheet S₁ dropping into the receiving tray 32. Furthermore, it will blow against the underside of the sheet S₁ as it bellies downwardly as indicated in dotted lines in Figure 1, thereby to assist the discs 31 to separate the sheets.

While the invention has been described above with specific reference to a preferred embodiment, it will be understood that the invention may take other forms and be applied to other environments. The invention should not, therefore, be regarded as limited except as defined by the following claims.

I claim:

1. A sheet separating device for separating a pair of superimposed sheets advancing edgewise, a first series of laterally spaced annular sheet-engaging members mounted to engage one surface of the advancing superimposed sheets, a second series of sheet-engaging members

mounted to engage the other surface of the superimposed sheets, and means to rotate at least one series of sheet-engaging members with components of motion, at their points of engagement with the sheet, which are in alignment with the direction of advancing movement of the sheets, the first and second series of sheet-engaging members overlapping and the members of the first series being laterally offset from those of the second series.

2. A sheet separating device for separating a pair of superimposed sheets advancing edgewise, a first series of laterally spaced annular sheet-engaging members mounted to engage one surface of the advancing superimposed sheets, a second series of sheet-engaging members mounted to engage the other surface of the superimposed sheets, means to rotate at least one series of sheet-engaging members with components of motion, at their points of engagement with the sheet, which are in alignment with the direction of advancing movement of the sheets, roller means carrying the first series of sheet-engaging members and having an axis of rotation parallel to the advancing sheet, and moving belt means to advance the sheets edgewise into the sheet-separating members, said belt means comprising a series of relatively narrow belt portions passing over the roller between the sheet-engaging members carried thereby.

3. A sheet separating device for separating a pair of superimposed sheets advancing edgewise, a first series of laterally spaced annular sheet-engaging members mounted to engage one surface of the advancing superimposed sheets, a second series of sheet-engaging members mounted to engage the other surface of the superimposed sheets, means to rotate at least one series of sheet-engaging members with components of motion, at their points of engagement with the sheet, which are in alignment with the direction of advancing movement of the sheets, and air jet means disposed behind the sheet-engaging members in the direction of sheet advancement to direct air jets backwardly through the sheet-engaging members at the advancing edge of the superimposed sheets.

4. A sheet separating device for separating a pair of superimposed sheets advancing edgewise, a first series of laterally spaced annular sheet-engaging members mounted to engage one surface of the advancing superimposed sheets, a second series of sheet-engaging members mounted to engage the other surface of the superimposed sheets, and means to rotate at least one series of sheet-engaging members with components of motion, at their points of engagement with the sheet, which are in alignment with the direction of advancing movement of the sheets, said first and second series of sheet engaging members comprising parallel, laterally offset discs having peripheral portions formed of high-friction material.

5. A sheet separating device according to claim 1 including means to rotate the sheet engaging members of the first and second series in the same angular direction, the second series of members being disposed in pairs each pair being spaced apart laterally to receive the peripheral portion of one sheet engaging member of the first series.

6. In a printing machine, sheet feeding means to carry a sheet of sensitized paper and a sheet to be copied through the machine in superimposed, face to face relationship, the machine in superimposed, face to face relationship, a said feeding means including belt means made up of a plurality of relatively narrow belt portions disposed side by side with a space between each pair, a roller over which the belt means move, means to establish an air pressure differential across the belt means to hold the sheets against the belt means, a first series of annular sheet-engaging members carried by the roller and extending radially outwardly therefrom to pass through the said spaces between belt portions, and a second series of sheet engaging members disposed next to the roller and movable relatively thereto to counter the motion of the adjacent belt means and first series of annular sheet-engaging members to define, in conjunction with the sheet engaging

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members of the roller, a sheet-receiving channel, whereby the superimposed sheets are advanced edgewise into the channel to cause the first series of members to engage that surface of the sheet which faces the belt means and to urge that sheet through the channel and to cause the second series of members to engage the outer surface of the other sheet to arrest its advancing motion, thereby to separate the sheets.

7. In a printing machine, sheet feeding means to carry a sheet of sensitized paper and a sheet to be copied through the machine in superimposed, face to face relationship, said feeding means including belt means made up of a plurality of relatively narrow belt portions disposed side by side with a space between each pair, a roller over which the belt means move, a first series of annular sheet-engaging members carried by the roller and extending radially outwardly therefrom to pass through the said spaces between belt portions, a rotor assembly disposed adjacent said roller and including a second series of annular sheet-engaging members the peripheries of which overlap the peripheries of the first series members, the first and second series of members defining a sheet-receiving channel, and means to rotate the rotor assembly in the same angular direction as the said roller, whereby the first and second series of sheet-engaging members engage the outermost surfaces respectively of the superimposed sheets to cause one sheet to be forced through the sheet receive-

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ing channel and to cause the other to be rejected, the overlapping first and second series of members causing the sheet passing therebetween to assume a corrugative shape to impart stiffness thereto.

8. A printing machine in accordance with claim 7 including means to establish an air pressure differential across the belt means adjacent the sheet-receiving channel to hold the sheets thereagainst.

9. A printing machine in accordance with claim 7 including air jet means disposed behind the roller and rotor assembly in the direction of sheet movement to direct air jets between the sheet-engaging members toward the advancing edge of the superimposed sheets.

10. A printing machine in accordance with claim 1, the second series of sheet engaging members being arranged in laterally spaced pairs in the said rotor assembly, the members of each pair being laterally spaced to receive one sheet-engaging member of said roller.

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