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ROTARY PRINTER WITH SHEET SEPARATING DEVICE

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FIG. 1.

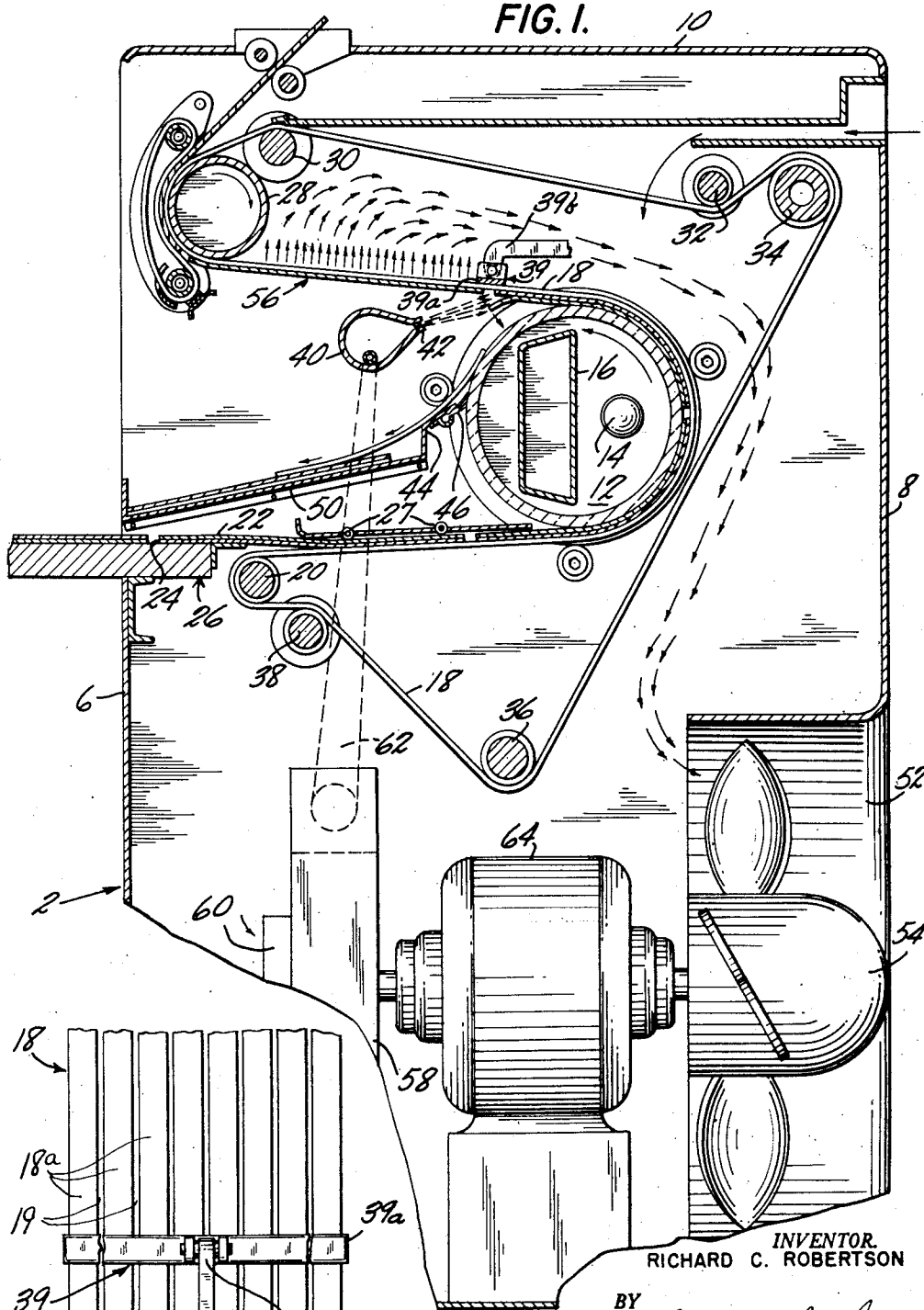


FIG. 2.

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ROTARY PRINTER WITH SHEET SEPARATING DEVICE

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5 Claims. (Cl. 95—77.5)

This invention relates to improvements in machines through which a pair of superimposed sheets of material, such as paper, pass in face-to-face relation and wherein it is necessary or desirable that the sheets be automatically separated from one another at any given point or location in their passage through such machines.

This application is a continuation-in-part of the co-pending application Serial No. 287,465, filed May 13, 1952, which was abandoned after the filing of this application.

In photoprinting machines and the like, such as machines for developing and printing papers having light-sensitive emulsions, the subject to be copied, for example a tracing, is placed on the light-sensitive side of the paper and the two sheets are then passed over a transparent cylinder within which a source of light is provided in order that the design on the tracing may be exposed to and printed upon the light-sensitive paper. As the two sheets issue from the printing stage, they must be separated so that the light-sensitive paper can be developed.

In machines of this type, difficulty has been experienced in providing means for separating the tracings from the exposed paper. During the exposure to intense light, the tracings and the paper are pressed together closely to eliminate relative motion between the two so as to insure sharp and exact reproductions of the tracings. The effect of this pressure, possibly in combination with the effect of the heat from the light source and the mutual attraction induced by static electricity, makes difficult the separation of the tracings from the exposed paper.

Accordingly, one object of the present invention is to provide an apparatus for separating tracings from exposed printing paper by the utilization of pneumatic effects.

A further object of the invention is to provide an apparatus for separating tracings from printing paper in which the necessity of stripping the laminated tracing and printing paper from the transparent printing cylinder, before separation of the sheets, is eliminated and in which the flutter of the sheets is also eliminated.

The invention, as well as other features and objects thereof will be further illustrated by reference to the accompanying drawings in which:

Figure 1 is a view in transverse vertical section of a printing apparatus embodying the present invention; and

Figure 2 is a fragmentary view of the endless belt means in the apparatus of Figure 1 as viewed at the zone of separation of the sheets.

Referring to the drawings, the printing machine comprises apparatus within a casing 2, having a bottom 4, a front wall 6, a rear wall 8 and a top wall 10. Mounted transversely of the casing 2 and in the upper part thereof is light-transmitting means in the form of a cylinder 12 of heat-resisting material such as "Pyrex." The cylinder 12 is usually mounted for rotation but may be fixedly mounted. If fixed, the light transmitting means can be

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non-cylindrical and have a flat or convex light-transmitting surface. A suitable light source, such as a mercury vapor lamp 14, is mounted within the cylinder 12, the heat from which can be carried off by a duct 16 which also can serve as a light shield for part of the cylinder. The duct 16 can furthermore be provided with a reflecting surface to increase the intensity of the light transmitted through the non-shielded portion of the cylinder 12.

Endless conveyor belt means 18 is provided in the form of a series of laterally spaced, flexible, endless bands 18a which pass around the light transmitting means 12. As best seen in Figure 2, the bands 18a are laterally spaced to provide air passage spaces 19 therebetween for purposes presently to be described. In the printing machine illustrated in the drawing, belt means 18 approaches the lower edge of the cylinder 12 in a horizontal leg providing a receiving surface for tracings 22 and sensitized printing paper 24 in face-to-face relationship, as introduced into the apparatus at an infeed station 26. A series of auxiliary presser rollers 27, or other suitable means, can be used to prevent relative movement between the laminated paper 24 and tracings 22.

At the top edge of the cylinder 12, the belt means moves forward horizontally to the left, as viewed in Figure 1, to the lower edge of a roller 28, around the roller 28, over a roller 30, under a roller 32, over a roller 34, downwardly and forward to pass under a roller 36 and then upwardly and forward to pass over a roller 38, and back to a roller 20 at the infeed station.

Mounted above the belt means just to the left of the cylinder 12, as viewed in Figure 1, is a stationary, air-intercepting plate assembly 39 including at least one sole plate section 39a. The plate section extends over the entire width of the belt means, bridging the air passage spaces 19 between adjacent bands 18a. The width of the plate assembly 39, measured in the direction of travel of the belt means, can be made adjustable by the addition of one or more plate sections 39a or by substituting a larger single section. A holding frame 39b is provided for the plate section which is movably mounted so that the entire assembly can be swung between an operative position, with the plate sections lightly resting on or slightly above the belt means, and an inoperative position away from the belt means. It will be seen that the plate 39 or the air jet from the nozzle 42, or both, in effect divide the advancing belt means 18 into a first zone between the plate 39 and the point of tangency of the belt 18 with the drum 12 and a second zone on the far side of the jet or plate in the direction of movement of the belt means. As described below, the two superimposed sheets are held against the belt means in the first zone as they emerge from the drum, and a single or remaining sheet is held against the belt means in the second zone.

In operation, the laminated tracings and sensitized paper are conveyed from the input station upwardly around the light source 14, being tightly held between the cylinder 12 and the belt means 18. Upon leaving the cylinder 12 on the underside of the belt means, the advancing ends of the laminated sheets are met with an air jet issuing from an elongated duct 40 via nozzles 42. The frictional force of the air jet and the low pressure area caused by the velocity of the air stream cause the leading edge of the tracing to be pulled away from the sensitized paper. Thus separated from the paper 24, the tracing 22 follows the cylinder 12 around until it engages a shoe 44 having a brush 46 positioned therebeneath. The brush 46 serves to raise the leading edge of the tracing from the cylinder 12 so that it passes above the leading edge of the shoe 44 and into a tray or output station 50. The sheets of exposed paper 24 are held in

engagement with the endless belt means 18, after the original or tracings are separated therefrom, as a result of a pressure differential existing across the belt means established by means presently to be described.

The printing machine is ventilated and maintained under sub-atmospheric pressure by providing an exhaust outlet 52, in the rear wall 8 of the casing, and an exhaust fan 54 to force air outwardly through said outlet thereby to draw in cool air between the endless belt means, as shown at 56, as well as through any other openings such as those provided for ventilation of the cylinder (not shown). Aside from the cooling and ventilating accomplished by these means, the fan 54 maintains a sub-atmospheric pressure behind the roller 28 and above the endless belt means as it passes from the top of the cylinder 12 to the bottom of the roller 28.

In certain cases, the superimposed tracing and sensitized paper will be slightly out of register, with the tracing (which is the lowermost sheet at the point of emergence from the cylinder 12) slightly in advance of the exposed sensitized paper. In such cases, the air pressure differential across the belt means 18 will have an opportunity to act directly on the leading edge of the tracing, which edge can be pulled into direct engagement with the underside of the belt means 18. In such cases there is direct opposition between the separating jet issuing from the nozzles 42 and the pressure differential established across the belt means, and separation of the tracing from the exposed sensitized paper is made more difficult. The interposed plate means 39, however, creates a dead spot which breaks the pressure differential across the belt means so that the jet issuing from the nozzles 42 is able to cause the leading edge of the tracing to be stripped downwardly.

The width of the plate means 39 measured in the direction of travel of the belt means is made sufficiently narrow, however, so that the sensitized paper will not fall by the action of gravity or the jet from the nozzles 42. It will be understood, however, that the leading edge of the paper might be caused to separate slightly from the belt means as it passes the plate means 39, but the edge is again lifted into contact with the belt means once it is beyond the plate means.

The plate means 39 has been found to help greatly in breaking away the tracing from the paper even when the leading edges of the tracing and paper are in exact register. There may, for example, be some air motions that slightly interfere with good separation at a critical point. In such cases, the dead air space created by the plate means 39 has been found to break up this condition and lead to more effective separation. It has been found by experiment, however, that the leading edges of the tracing and the paper can be out of register up to one-quarter of an inch with effective separation resulting. In all cases, once separation is initiated, the complementary force of gravity assists in stripping the tracing from the exposed sensitized paper.

The printing machine is also provided with a blower 58 which may take in air either directly from the outside or, as shown in Figure 1 of the drawing, through an opening 60 from the interior of the machine to supply air at super-atmospheric pressure to the duct 40 through a conduit 62. The exhaust fan 54 and blower 58 may be driven individually by any suitable means or together, as shown in Figure 1, by any suitable means such as an electric motor 64.

Instead of providing the casing 2 with an exhaust outlet 52 and an exhaust fan 54, it is also within the scope of this invention to cool and ventilate the casing and to maintain the interior thereof under sub-atmospheric pressure entirely by exhausting air therefrom through the opening 60 of the blower 58, and supplying this air under super-atmospheric pressure to the separating device by way of the duct 62.

It will be appreciated by those skilled in the art that

modifications may be made within the scope of the present invention without departing from the spirit thereof and the invention is to be restricted only in accordance with the following claims.

I claim:

1. In a device for separating a pair of superimposed sheets in face-to-face relation, belt means to advance the sheets edgewise in superimposed face-to-face relation, said belt means having permeable portions for the passage of air therethrough, means to maintain an air pressure differential across the belt means to establish a first holding zone in which the superimposed sheets are both adapted to be held against one side thereof and a second holding zone in which a single sheet is adapted to be held thereagainst, plate means disposed between said first holding zone and said second holding zone and extending across said belt means to define an intermediate zone in which intermediate zone the pressure differential on opposite sides of said belt means is interrupted, and means for directing an air stream toward the advancing edges of said sheets adjacent the intermediate zone, whereby the inner sheet of said pair is maintained against the belt means by the air pressure differential and while so held passes through the second zone and the outer sheet is stripped from said inner sheet by said directed air stream.

2. Apparatus as set forth in claim 1, in which said plate means is a narrow plate disposed against said belt means on the opposite side thereof from the superimposed sheets to break the air pressure differential across said belt means, the width of said plate being such that the inner sheet is held against said belt means by the air pressure differential across said belt means upon passage of said inner sheet into said second holding zone, and means to direct the outer sheet away from said inner sheet.

3. Apparatus as set forth in claim 2, including roller means about which the belt means passes, the belt means passing from the upper edge of the roller means in a horizontal run, said superimposed sheets being disposed between the belt means and the surface of the roller means to emerge from the latter on the underside of the belt means, said air stream being directed upwardly toward the advancing edges of the superimposed sheets.

4. Apparatus as set forth in claim 2, including means to swing the said plate between an operative position closely adjacent the belt means and an inoperative position away from the belt means.

5. In a printing machine, the combination of a casing, a light transmitting surface and a source of light within the casing, means to feed a sheet of sensitized material and a sheet of material to be copied into the casing in superimposed face-to-face relation, belt means to advance said sheets through said casing and having portions through which air may pass, said belt means passing over the light transmitting surface with the sheet of sensitized material and tracing disposed therebetween, means to maintain an air pressure differential across a section of said belt means adjacent the light transmitting surface to hold the sheets in superimposed relation thereagainst upon leaving the transparent surface, means to direct an air stream toward the advancing edges of the sheets whereby the sheet closest to the belt means is held thereagainst by said air pressure differential and the other sheet is separated therefrom by said air stream, said belt means passing horizontally away from the casing at the top edge thereof, a plate member overlying the belt means adjacent the upper edge of the casing to preclude momentarily the action of the air pressure differential to hold the sheets against the belt means, said means to direct the air stream being disposed to direct said stream at the advancing edges of the sheets as they pass under said plate member, whereby the separation of the sheets is effected by the cooperative action of gravity, the air pressure differential and the air stream, and the width of the plate member permitting the sheet

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closest to the belt means to be re-engaged with the belt
means beyond the plate member.

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