Oct. 10, 1967 F. R. PASCHKE 3,346,253

ELECTROSTATIC SHEET CONTROL MEANS

Filed March 31, 1965

FIG. 1

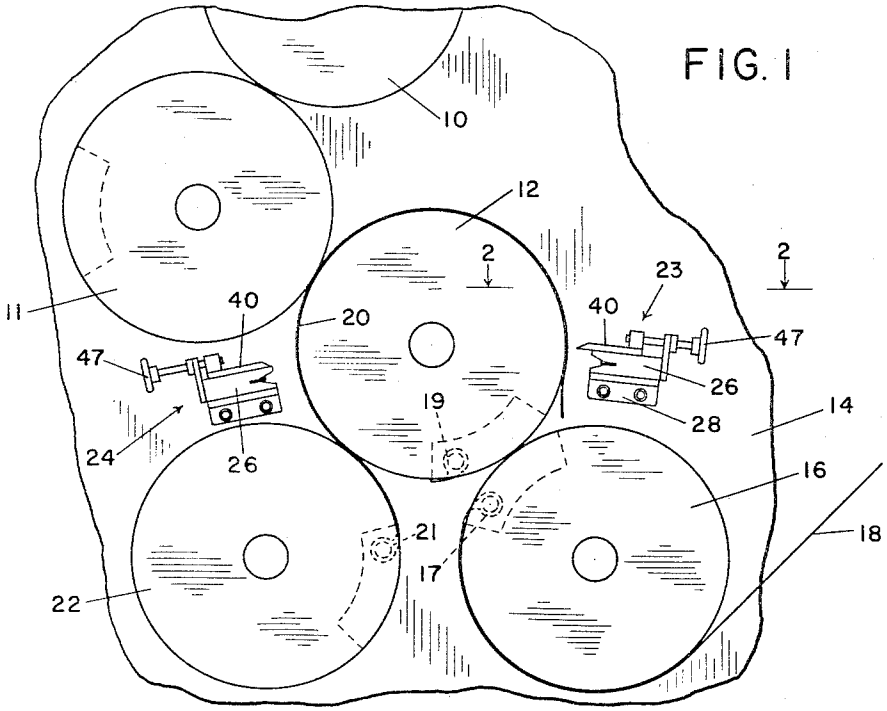


FIG. 2

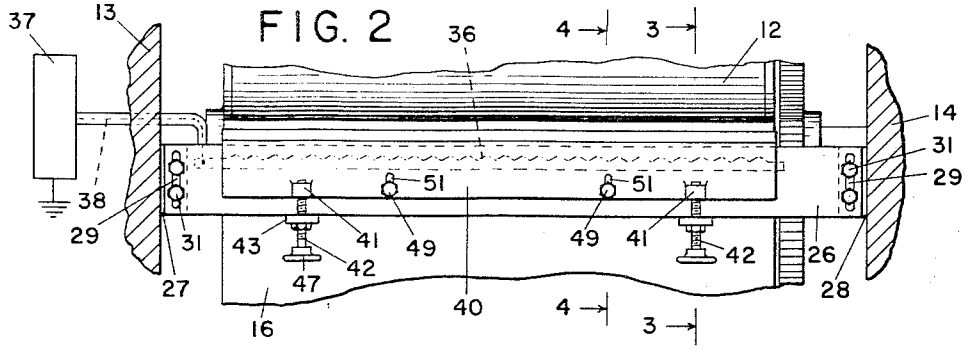


FIG. 3

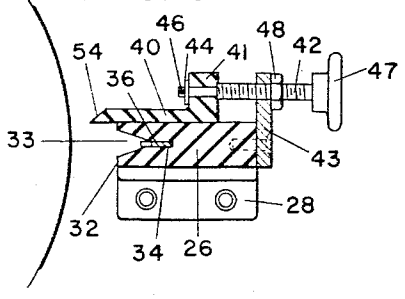
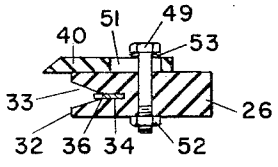


FIG. 4



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3,346,253

Patented Oct. 10, 1967

3,346,253

ELECTROSTATIC SHEET CONTROL MEANS

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Filed Mar. 31, 1965, Ser. No. 444,275
4 Claims. (Cl. 271—36)

The present invention relates to electrostatic means for controlling sheets of material as they travel through a printing press or the like machine. It is directed more specifically to improved means for effectively controlling the density of the change applied to the sheets by a charge unit particularly when two or more of said units are operated from a common power source.

The use of electrostatic charging means to control sheets as they travel through a printing press has long been known. Such means have been employed at various locations in a press such as, for example, immediately prior to the sheet entering the impression nip between an impression cylinder and a coacting printing cylinder to prevent fluttering and premature contact of the sheet with the printing cylinder which causes "ghosting" and/or smudging of the impression. It is also known to use electrostatic charging means to "pin" the sheet to the impression cylinder immediately following the impression nip. This is particularly useful in lithographic presses to assist in stripping the sheet off the blanket cylinder after it receives an impression. Due to the ironing effect of the blanket and the tackiness of the ink used in the lithographic printing process, the sheet tends to adhere tenaciously to the blanket cylinder as it leaves the impression nip and unless it is effectively stripped away this condition can result in smudging of the sheets.

Electrostatic charge means have also been used in other locations on printing presses and it has been found that for optimum results, the density of the charge required at one location is seldom the same as that required at a different location. It is highly desirable, therefore, that means be provided for conveniently adjusting or controlling the density of the charge in accordance with the requirements at the respective locations. It is also desirable, for economic reasons, to be able to operate a plurality of charging units from a single, common power source.

This has been virtually impossible, however, because the charging means are operated by direct current and suitable voltage divider means are not available. The required high resistance is not available in potentiometer form and series arranged, fixed resistors are impractical not only for economic reasons but also because they require separate taps which can only be changed when the power is off.

Consequently, it has been necessary heretofore to use a separate power pack for each unit in order to obtain the desirable and convenient charge density control and it will be evident that in a large multicolor press wherein ten or more charging units are employed, the multiplicity of power packs required adds substantially to the cost.

It is an object of this invention, therefore, to provide charge density control means which will function independently of the power source.

Another object is to provide effective charge density control means which are located on the respective charge units and which permit a plurality of said units to be operated from a common power source.

A further object is to provide charge density control means which can be adjusted conveniently and safely while the charge unit is in operation.

Other objects and advantages will become apparent from the following description and accompanying drawings wherein:

FIGURE 1 is a fragmentary elevation illustrating the

invention as embodied in a conventional lithographic press;

FIGURE 2 is a plan view taken substantially along line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged sectional view taken along line 3—3 of FIGURE 2; and

FIGURE 4 is an enlarged sectional view taken along line 4—4 of FIGURE 2.

The drawings illustrate only those elements of a printing press which are necessary for an understanding of the purpose and function of the electrostatic sheet control means to which this invention pertains and in FIGURE 1 it will be seen that the printing unit consists of a plate cylinder **10**, a blanket cylinder **11** and an impression cylinder **12** all of which are suitably journalled for rotation in the side frames **13** and **14**.

The sheets to be printed are conveyed to the impression cylinder by any conventional means such as by the transfer cylinder **16** which has grippers **17** that grip the leading edge of a sheet such as **18** and transfer it to the grippers **19** on the impression cylinder as both said grippers pass through the transfer zone. After a sheet such as indicated at **20** passes through the impression nip between the blanket cylinder **11** and impression cylinder **12** to receive an impression from the blanket cylinder, its leading edge is transferred to the grippers **21** of the transfer cylinder **22** which conveys it to the next printing unit or to a delivery mechanism all as well understood in the art.

In order to control the trailing portion of each sheet and prevent it from fluttering excessively as it leaves the nip between the impression cylinder **12** and the transfer cylinder **16** an electrostatic charge is applied thereto by a charging unit **23**. After the sheet leaves the impression nip between the blanket and impression cylinders a second charge is applied thereto by the charge unit **24** to assist in stripping the sheet off the blanket cylinder and under normal circumstances the charge applied by unit **24** is necessarily of substantially greater density than that applied by unit **23**.

Heretofore, in order to maintain these differentially charged fields it has been necessary to employ separate adjustable power packs for each charge unit. However, by means of the present invention, both units can be operated from a common power pack and the differential fields can be obtained by an adjustable element on the charge unit as will now be explained.

With more particular reference to FIGURES 2, 3 and 4 it will be seen that each charging unit comprises a relatively long rectangular supporting bar **26** which is formed of any suitable insulating material such as for example acetate or polyethylene terephthalate comprising a trademarked material known as Mylar. This bar is arranged parallel to but spaced from the periphery of the impression cylinder and it is supported at each end on a bracket **27** and **28**, respectively, which are secured to the respective side frames **13** and **14**. Preferably each end of the bar **26** is provided with a transverse slot **29** to permit initial adjustment of the bar with respect to the periphery of the impression cylinder **12** and it is secured in position by the bolts **31** which project through the slots and are threaded into the respective brackets **27** and **28**. The spacing between the edge **32** of the bar **26** and the periphery of the impression cylinder is not particularly critical and it may be varied under differing circumstances. However, very satisfactory results have been obtained by spacing the bar about two inches away from the impression cylinder.

The edge **32** of the bar **26** is provided with a V shaped groove **33** which extends substantially the entire length of the bar and aslot **34** is formed at the apex of the groove to receive a conductor **36**. The conductor may be of any conventional type which, when a high voltage is applied

thereto, will establish an electrical field between the conductor and the impression cylinder and which will effectively ionize the air and cause an electrical charge to be induced on the sheets as they pass between the conductor and the impression cylinder. A flat metal conductor having a saw tooth configuration along one edge thereof is preferred, however, because of its ability to establish the desired field at a relatively low operating temperature.

The conductor extends across the full width of the impression cylinder and one end thereof is connected to a power pack **37** or source of high voltage direct current by means of the wire **38**. Although the potential applied to the conductor may either be negative or positive with respect ot ground, a positive potential has proved to be far more efficient. Accordingly the impression cylinder is suitably grounded so as to establish the desired electrical field between said cylinder and the conductor and when the press is in operation and a positive potential is applied to the conductor **36**, a positive charge will be induced on the sheet as it passes the conductor and this charge will draw the sheet toward and effectively pin it against the periphery of he grounded impression cylinder.

It has been discovered that the intensity of the charge induced upon the sheets can be effectively varied, independently of the potential applied to the conductor, by providing an adjustable control element **40** on the supporting bar **26**. The control element is formed of insulating material which may be the same as that used for the supporting bar and it is substantially coextensive with the conductor **36**. The control element is substantially rectangular in cross section and it is formed with a projection or boss **41** adjacent each end thereof. An adjusting screw **42** is supported in a bracket **43** secured to the support bar in alignment with each boss **41** and the end of the screw is reduced in diameter so as to slidably fit into an opening in the boss. A washer **44** which is secured to the end of the screw by means of a pin **46** secures the control element to the adjusting screw and thus when the screw is rotated by means of the handle **47** it will be seen that the control element will be advanced and retracted relative to the edge **32** of the support bar. A locking nut **48** is provided to lock the screw in its adjusted position.

The control element is secured to the support bar for transverse adjustment relative thereto by means of the spaced bolts **49** each of which is inserted through a transverse slot **51** in the control element and secured to the support bar by means of the nut **52**. A spring washer **53** under the head of each bolt serves to retain the control element in position against the support bar but permits it to slide relative thereto when the adjusting screws are rotated.

The control element accomplishes its function by attracting the charges emitted by the conductor and its effect is directly proportional to its position relative to the support bar. When fully projected into the space between the support bar and the impression cylinder substantially all of the charged particles are attracted to the control element and little if any charge is induced on the sheets. On the other hand when fully retracted the control element is ineffective and a maximum charge is induced on the sheet.

It is not precisely understood how the control element functions to control the charge emitted by the conductor but it has definitely been established by tests under actual operating conditions that when a given potential is applied to the conductor, the density of the charge induced upon the paper can be effectively varied over a wide range by shifting the control element relative to the support bar. It is believed that when the control element is projected beyond the edge of the support bar, the charge emitted by the conductor is attracted to the control element which rapidly assumes a charge of like polarity. The resultant field produced by the charge on the control element, which is proportional to the exposed area thereof, then functions to inhibit or repel the emission of the conductor and thereby reduces the charge which is induced upon the exposed surface of the paper.

Accordingly it is entirely practical to operate any number of charge units from a common power source and by means of the control element each unit can be adjusted independently to produce upon the sheet an electrostatic charge of the density required for its particular location thereby providing optimum control.

The thickness and overall size of the control element are not critical and are determined primarily by the physical requirements of a specific installation. Moreover, the control element may be simply rectangular in cross section as mentioned above but it has been found that by tapering the leading edge as indicated at **54** somewhat finer and more critical control effects can be obtained.

Although the control element has been illustrated as being adjustable manually by means of the screws **42**, this is merely by way of example. It will be obvious that by using suitable gearing and a reversible electric motor, adjustments can be effected from a remote location which, in many applications, would be preferred because of the relative inaccessibility of a particular charge unit.

The invention is not to be limited to or by details of construction of the particular embodiment thereof illustrated by the drawings, as various other forms of the device will, of course, be apparent to those skilled in the art without departing from the spirit of the invention or the scope of the claims.

What is claimed is:

1. In a machine for processing webs or sheets of paper or other dielectric material, the combination comprising, a support for said material, a conductor arranged parallel with but spaced from said support whereby a gap exists between the elements, means for establishing a high potential between the conductor and the support whereby a force field is created and an electrostatic charge is induced on said material as it passes through the gap between the conductor and the support to attract the material to the support, and charge control means including an element mounted adjacent said conductor for adjustment relative thereto toward and away from said support in a direction substantially parallel to the longitudinal axis of said force field for varying the intensity of the charge induced on said material.

2. In a sheet processing machine, a sheet carrying cylinder, a conductor arranged parallel to but spaced from the periphery of said cylinder whereby a gap exists between the elements, means for establishing a high voltage between said conductor and the cylinder whereby an electrostatic force field is created for inducing an electrostatic charge on a sheet passing through the gap between the cylinder and the conductor to cause the sheet to be attracted to said cylinder, and means capable of adjustment across said gap toward and away from the cylinder in a direction substantially parallel to the longitudinal axis of said force field for controlling the intensity of the charge induced on said sheets.

3. In a sheet handling machine, a sheet carrying member having gripper elements for engaging a sheet at its leading edge and conveying it in a predetermined path, a support bar of insulating material arranged parallel to but spaced from said member whereby a gap exists between the elements, a conductor mounted in said bar in a manner that one edge thereof is exposed adjacent said member, means for establishing a high voltage between said conductor and said member whereby an electrostatic force field is created between said conductor and said member and an electrostatic charge is induced on each sheet passing through the gap between the conductor and the member to cause the sheet to be attracted to said member, a bar of insulating material mounted on said support bar, said bar being arranged parallel to and substantially co-extensive with said conductor, and means for adjusting said bar to varying extents transversely of said support bar across said gap in a direction substan-

tially parallel to the longitudinal axis of said force field whereby to control the intensity of the charge induced on the sheets.

4. In a machine for processing webs or sheets of paper or other dielectric material, the combination of a support for said material, a conductor arranged parallel to but spaced from said support whereby a gap exists between the elements, means for applying a high voltage to said conductor to establish an electrical force field between the conductor and said support, said field being adapted to induce an electrical charge on the material as it passes through the gap between the conductor and the support whereby said material is attracted to said support, a charge control element mounted adjacent said conductor for adjustment relative thereto in a direction substantially parallel to the longitudinal axis of said electrical force field, said control element having an influence on said electrical field which is directly proportional to its position relative to said conductor, and means for adjusting the position of said control element to thereby vary the intensity of the charge induced on said material.

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