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SHEET HANDLING APPARATUS

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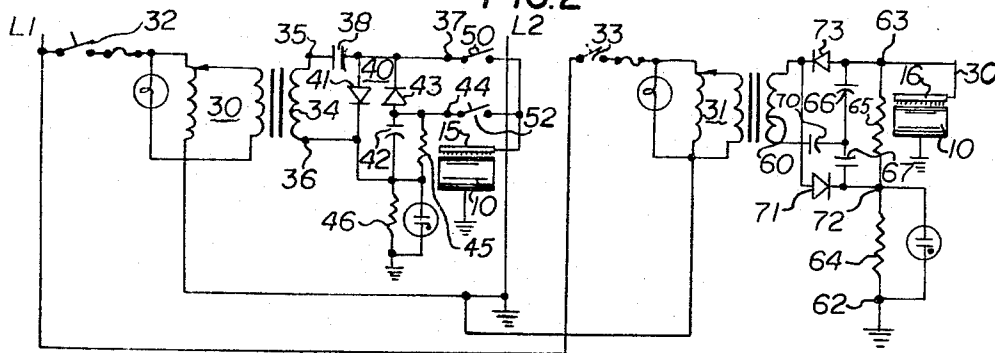
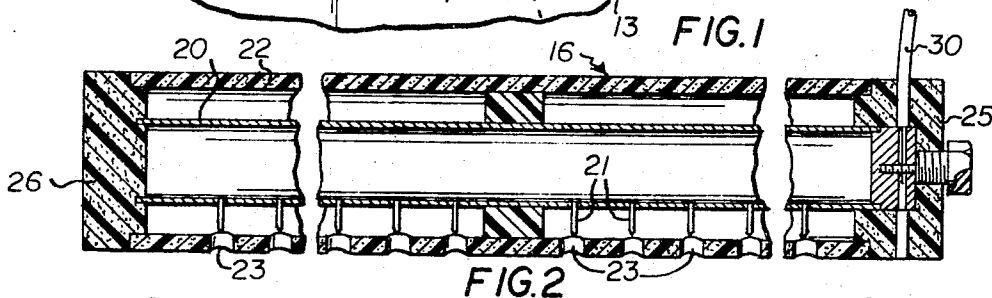
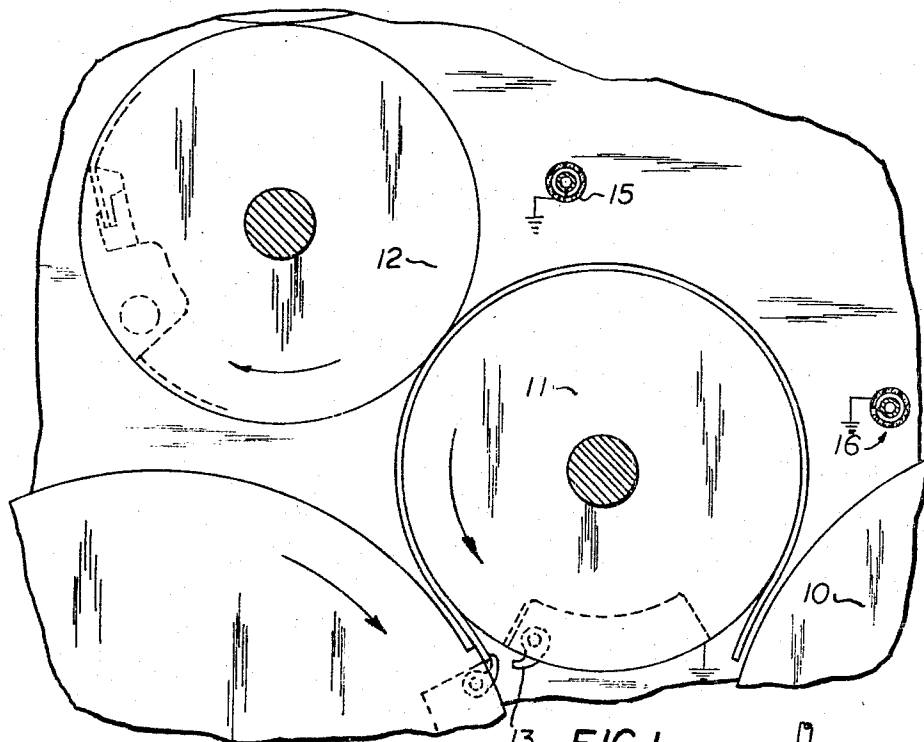


FIG. 3

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The present invention relates to sheet handling apparatus, and, more particularly, to sheet handling apparatus wherein electrostatic devices are utilized to cause a sheet being handled to hug a member moving with the sheet.

Rotary machines, such as printing presses, have employed electrostatic sheet hold-down devices to cause a moving sheet to hug a surface adjacent to the sheet and moving therewith. In a printing press, electrostatic sheet hold-down devices have been used to cause a sheet to hug the impression cylinder as the sheet is carried into a printing nip formed by the impression cylinder and a printing cylinder in pressure relationship with the impression cylinder. Printing presses are required to handle a wide range of stocks from very light stocks to heavy stocks, such as cardboard. Light stocks present a problem for electrostatic hold-downs, particularly a hold-down which is also capable of handling heavy stocks. It is extremely difficult to adjust an electrostatic unit so that it will clamp a light sheet against the impression cylinder in a manner which does not cause creasing. Moreover, if the electrostatic forces are made light enough to prevent clamping and creasing, the hold-down devices may then not operate satisfactorily with the heavier stocks.

Accordingly, an important object of the present invention is to provide a new and improved sheet hold-down apparatus constructed and arranged in combination with a moving member, such as a rotating sheet-carrying cylinder, in such a manner that electrostatic forces may be used to cause light sheets as well as heavy sheets to hug the cylinder or member without being clamped thereagainst.

Another object of the present invention is to provide for cooperation with a rotating sheet carrying cylinder for carrying a sheet through the nip formed by the rotating cylinder and a cooperating cylinder in pressure relationship therewith, a new and improved electrostatic sheet hold-down arrangement which may be used to cause very light stock to hug a rotating cylinder in a smooth and even manner and pass through the nip formed by the rotating cylinder and a cooperating cylinder without creasing.

Another object of the present invention is to provide a new and improved method and apparatus for electrostatically causing a sheet of material to hug a cylinder with which it is moving as the sheet approaches a nip formed by the cylinder and a cooperating cylinder, the sheet being electrostatically charged at a first station in advance of the nip and the charged sheet moving by a second station at which the electrical attraction at the second station between the sheet and cylinder is periodically released.

A still further object of the present invention is to provide a new and improved method and apparatus for electrostatically causing a sheet of material to hug a rotating cylinder with which it is moving as the sheet approaches a nip formed by the rotating cylinder and a cooperating cylinder in which the sheet is charged at a first station in advance of the nip and wherein the charged sheet is subjected to the action of an alternating field at a second station to periodically cause the electrostatic charges on the sheet at the second station to be repelled away from the cylinder.

A still further object of the present invention is to pro-

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vide a new and improved apparatus for electrostatically attracting a sheet to a rotating cylinder with which the sheet is moving as the sheet approaches a nip formed by the rotating cylinder and a cooperating cylinder in which the sheet is charged electrostatically at a first station in advance of the nip and in which the charged sheet passes a second station at which the charge on the sheet is alternately increased, on one hand, and repelled and neutralized, at least in part, on the other hand.

Further objects and advantages of the present invention will be apparent from the following detailed description of the preferred embodiment thereof made with reference to the accompanying drawings forming a part of the present invention for all matter disclosed therein:

FIG. 1 is a view primarily schematic, of a printing unit embodying the present invention;

FIG. 2 is a cross sectional view through an electrostatic device used in the printing press of FIG. 1; and

FIG. 3 is a schematic circuit diagram for use with the apparatus of FIG. 1.

While the present invention is susceptible of use in various types of sheet handling apparatuses, it is particularly useful in a printing press and has been embodied in a printing press for the purposes of description.

Referring to FIG. 1, a transfer cylinder 10 is adapted to receive a sheet from a first printing unit, not shown, and carry the sheet to an impression cylinder 11 of a second printing unit which includes a printing cylinder or blanket cylinder 12 which forms a printing nip with the impression cylinder 11 and has a pressure relationship therewith during the printing operation. The sheet to be printed in the nip is carried to the impression cylinder 11 by the transfer cylinder 10 and the impression cylinder 11 has grippers 13 thereon for gripping the leading edge of the sheet to take it from the transfer cylinder and carry it into and through the printing nip formed by the cylinders 11 and 12.

It is desirable that the sheet hug the surface of the impression cylinder as it approaches the printing nip so that the sheet does not flap against the blanket cylinder 12. To this end, a pair of electrostatic sheet hold-down devices 15, 16 are supported adjacent the sheet-carrying periphery of the impression cylinder 11 in advance of the printing nip.

The electrostatic devices 15, 16 are adapted to establish electric fields between the respective devices and the cylinder and to provide electric charges to electrostatically charge the portion of the sheet moving from the transfer cylinder 10 to the printing nip. The electrostatic device 16 is disposed adjacent the transfer point between the transfer cylinder 10 and the impression cylinder 11 and is adapted to electrostatically charge the portion of the sheet which has just been transferred to the impression cylinder 11, and the electrostatic device 15 is disposed between the electrostatic device 16 and the printing nip to operate on the portion of the sheet immediately in advance of the printing nip.

The electrostatic devices 15, 16 are the same and the electrostatic device 16 has been shown in cross section in FIG. 2. The electrostatic device 16 comprises a tubular conductive member 20 and a plurality of ionizing needles 21 mounted in the conductive member 20 and arranged in a row extending the length of the conductive member 20. The conductive member 20 is disposed within a tubular insulating housing 22 and the housing 22 has an opening 23 adjacent each of the needles 21 for exposing the needle. The conductive member 20 is supported within the tubular housing 22 with an annular air space separating the conductive member from the interior wall of the housing and is supported by end plugs 25, 26 mounted in the ends of the tubular housing. An elec-

trical connection 30 is led in through the end plug 25 and is electrically connected to the conductive member 20. The connection 30 is used to connect the elongated conductive member to one side of a power supply, the other side of which is grounded. The electrostatic device 16 is mounted in a printing press with the length of the conductive member 20 extending along the length of the cylinder 11 and with the needles 21 pointing directly toward the adjacent periphery of the metal impression cylinder. The impression cylinder is grounded and an electric field is established between the conductive member 20 and the impression cylinder. In the case of the hold-down device 16, the power supply is a high voltage unidirectional power supply and the electric field is, accordingly, a unidirectional field. When the field is turned on, the needles 21 cause an ionization to occur and provide charged particles which are propelled toward the impression cylinder 11 and establish an electrostatic charge on the portion of the sheet opposite the device to cause the sheets to be attracted to the impression cylinder 11.

The electrostatic device 15 is identical in construction to the electrostatic device 16 but either a high voltage alternating potential or a high voltage unidirectional potential may be applied between the electrostatic device 15 and the impression cylinder 11. When a high voltage unidirectional potential is applied, the operation of the device is the same as the operation of the device 16 and the electrostatic charge on the sheet 11 is increased by the operation of the device 15. However, when an alternating potential is applied between the device 15 and the impression cylinder 11, the alternating field will on alternate half cycles, reduce at least in part, the charge applied to the sheet by the electrostatic device 16 and will cause a momentary release of the sheet from the cylinder 11 at the location of the device 15.

In the preferred embodiment the cylinder 11 is positive with respect to the device 16 and the electrostatic charge on the sheet is provided by negative ions. On the half cycle of the alternating current voltage applied between the device 15 and the cylinder 11 during which the cylinder is negative with respect to the device 15, the negative ions on the portion of the sheet passing through the field will be driven away from the cylinder. At least part of the negative ions will be driven off to reduce the charge on the sheet applied by the device 15. Preferably, the total charge is not reduced to zero. The repelling of negative ions at least momentarily releases the force holding this portion of the sheet against the cylinder to in effect release the portion and allow the sheet to smooth out and lie evenly along the surface of the impression cylinder without wrinkling.

Preferably the device 15 is an ionizing device so that during the described half-cycle the negative ions on the sheet will also be neutralized by positive ions being propelled toward the negative cylinder. During the other half cycle the ionizing device 15 will cause negative charges to be added to those charges already established on the sheet by the electrostatic device 16. Consequently portions of the sheet will have the charge thereon increased as the portions pass the electrostatic device 15 and alternating with these portions will be other portions where the device 15 will operate to reduce the charge on the sheet. When the device 15 is an ionizing device, sufficient positive ions might, during the half cycle when the cylinder is negative and repelling the negative ions on the charged sheet, be propelled to the sheet to cause the portion being acted upon to be charged with positive ions before it leaves the influence of the device 15 and this charge will tend to hold the sheet portion against the cylinder 11 as the latter approaches the nip.

It will be recognized that the electric field established by the device 16 is a sine function and that the number of the charges propelled to the portion of sheet passing the device 15 and the resultant charge on the sheet will vary with the magnitude of electric field. In operation,

a unidirectional potential is applied to the devices 15 and 16 for board and paper stocks other than light papers. For light paper stocks, the unidirectional potential is applied to the device 16 and an alternating current potential is applied to the device 15. With the A.C. potential on the device 15, the sheet will have trembling movement as it passes under the device 15 as it is periodically released and attracted to the cylinder 11.

A power supply for providing both the alternating current charge and the unidirectional potential charge is illustrated in FIG. 3. As is shown therein, a 60 cycle alternating current power supply on power lines L1 and L2, L2 being ground, is connected to the primaries of step-up transformers 30, 31 through respective switches 32, 33. The transformer 30 has a secondary 34 with output terminals 35, 36. The output terminal 35 is connected to an A.C. power terminal 37 through a condenser or capacitor 38. A parallel circuit 40 is connected between the transformer terminal 36 and the power terminal 37 and includes a first branch comprising a diode 41 poled to conduct current flowing from the transformer terminal 35 to the terminal 36 and a second branch comprising a condenser 42 connected to the terminal 36 and a diode 43 connecting the condenser to the power terminal 37 and poled to conduct current flowing in a direction from the transformer terminal 36 to the power terminal 37. A D.C. power terminal 44 is connected to a junction between the condenser 42 and the diode 43 and a resistor 45 is connected across the condenser 42. A second resistor 46 is connected between the transformer terminal 36 and ground.

In operation, on one-half cycle, current flows from the terminal 36 to charge the condenser 42 and the condenser 38 and on the next half-cycle, the diode 43 blocks current from the transformer, but the diode 41 conducts current to reverse the charge on condenser 38. Consequently, a unidirectional voltage, the charge on the condenser 42, exists between the D.C. output terminal 44 and ground and an alternating voltage will exist between the power terminal 37 and ground due to the alternating charge on the condenser 38. The ground side of the power supply is connected to the cylinder and the A.C. power terminal 37 may be connected to the electronic device 15 by closing a switch 50 or the high voltage D.C. output may be applied to the electronic device 15 by closing a switch 52 to connect the device 15 to the D.C. power terminal 44.

Preferably, the voltage applied to the electronic device 16 is a higher unidirectional voltage than that applied to the device 15. The power supply for the device 16 is derived from the transformer 31 which has a secondary coil 60 connected to a voltage doubling circuit having output terminals 62, 63. The voltage doubling circuit comprises resistors 64, 65 connected between the output terminals 62, 63 and condensers 66, 67 connected across the resistor 65. The secondary coil 60 of the transformer has one side connected through a capacitor 70 to a junction intermediate the condensers 66, 67 and its other side connected by a diode 71 to a junction 72 between the resistors 64, 65 and by a diode 73 to the output terminal 63. This circuit provides a voltage doubling circuit so that it applies to a higher direct current potential to the device 16.

It can now be seen that the present invention provides a new and improved method and apparatus for electrostatically causing a sheet to hug a rotating cylinder which enables electrostatic hold-downs to be used with light stock being carried into a nip where it is operated upon under pressure.

While the preferred embodiment of the present invention has been described in considerable detail, it will be understood that it is hereby intended to cover various constructions, modifications, and arrangements which fall within the ability of those skilled in the art and within the scope and spirit of the present invention.

Having described my invention, I claim:

1. In a rotary sheet handling machine comprising co-operating first and second cylinders operating in a pressure relationship and forming a nip through which a sheet is to be carried, said first cylinder having gripper means thereon for gripping the leading edge of a sheet and carrying it into and through said nip as said cylinders are rotated, first and second electrostatic hold-down devices adjacent the sheet-carrying periphery of said first cylinder in advance of said nip adapted to provide charged particles and to establish respective electric fields between said devices and said first cylinder, said second hold-down device being disposed between said first hold-down device and said nip, and means for selectively applying a unidirectional potential to said first hold-down device and said cylinder and means for selectively applying either one of a unidirectional potential or an alternating current potential to said second device and cylinder to selectively establish an electric field of one polarity therebetween or a field of alternating polarity therebetween.

2. In a rotary sheet handling machine comprising co-operating first and second cylinders forming a nip through which a sheet is to be carried, said first cylinder having gripper means thereon for gripping the leading edge of a sheet and carrying it through said nip as said cylinders are rotated, first and second electrostatic hold-down devices adjacent the sheet-carrying periphery of said first cylinder in advance of said nip and adapted to establish respective electric fields between said devices and said first cylinder, said second device being disposed between said first device and said nip, a high voltage unidirectional power supply connected between said first device and said cylinder to establish an electric field therebetween and for providing electrically charged particles for electrostatically charging said sheet to attract the latter to said cylinder, and an alternating current potential connected between said second device and said cylinder for establishing an electric field therebetween and charged particles to modify the electrostatic charge on said sheet in advance of said nip.

3. In a rotary sheet handling machine comprising co-operating first and second cylinders operating in a pressure relationship and forming a nip through which a sheet is to be carried, said first cylinder having gripper means thereon for gripping the leading edge of a sheet and carrying it into and through said nip as said cylinders are rotated, a first electrostatic sheet hold-down device adjacent the sheet-carrying periphery of said cylinder in advance of said nip adapted to provide charged particles and an electric field between said device and said cylinder to charge said sheet with particles of one polarity, and alternating current electrical means outwardly of said first cylinder between said device and said nip for establishing an electric field of alternating polarity through which the charged sheet passes.

4. In a rotary sheet handling machine comprising co-operating first and second cylinders operating in a pressure relationship and forming a nip through which a sheet is to be carried, said first cylinder having gripper means thereon for gripping the leading edge of a sheet and carrying it into and through said nip as said cylinders are rotated, a first electrostatic sheet hold-down device adjacent the sheet-carrying periphery of said cylinder in advance of said nip adapted to provide charged particles and an electric field between said device and said cylinder to charge said sheet with particles of one polar-

ity, and alternating current electrical means between said device and said nip establishing an electric field of alternating polarity between said cylinder and nip and providing positive and negative ions subject to the action of said field of alternating polarity.

5. The method of causing a sheet to hug the surface of a rotating cylinder as the sheet is being carried by the cylinder into and through a nip formed by a second cylinder cooperating with the rotating cylinder to process the sheet, electrostatically charging said sheet as it passes a first station in advance of the nip to electrostatically attract the sheet to the rotating cylinder and at a second station between the first station and the nip periodically eliminating the electrical attraction between a portion of the sheet at the second station and the cylinder as the sheet is moving to the nip.

6. The method of causing a sheet to hug the surface of a rotating cylinder as the sheet is being carried by the cylinder into and through a nip formed by a second cylinder cooperating with the rotating cylinder, electrostatically charging said sheet as it passes a first station in advance of the nip to electrostatically attract the sheet to the rotating cylinder and at a second station between the first station and the nip, periodically eliminating the electrical attraction between a portion of the sheet at the second station and the cylinder by establishing an electric field at the second station which periodically repels the charge on the sheet from the cylinder as the sheet is moving to the nip.

7. The method of causing a sheet to hug the surface of a rotating cylinder as the sheet is being carried by the cylinder into and through a nip formed by a second cylinder cooperating with the rotating cylinder, electrostatically charging said sheet as it passes a first station in advance of the nip to electrostatically attract the sheet to the rotating cylinder and at a second station between the first station and the nip, periodically eliminating the electrical attraction between the portion of the sheet at the second station and the cylinder by establishing an alternating electric field and charged particles in the field whereby the electric field periodically increases the charge on the portion of the sheet passing the first station and periodically repels the charged particles on the sheet from the cylinder and neutralizes at least part of the particles with particles of opposite charges.

8. The method of causing a sheet to hug the surface of a rotating cylinder as the sheet is being carried by the cylinder into and through a nip formed by a second cylinder cooperating with the rotating cylinder, electrostatically charging said sheet with particles of one charge as it passes a first station in advance of the nip to electrostatically attract the sheet to the rotating cylinder and at a second station between the first station and the nip subjecting the charged sheet to the action of an alternating electrical field which propels negative and positive charges to said sheet alternately.

References Cited

UNITED STATES PATENTS

287,957	11/1883	Osborne	226—1
3,039,388	6/1962	Brandt et al.	

M. HENSON WOOD, JR., *Primary Examiner*.

J. N. ERLICH, *Assistant Examiner*.