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SHEET HANDLING APPARATUS

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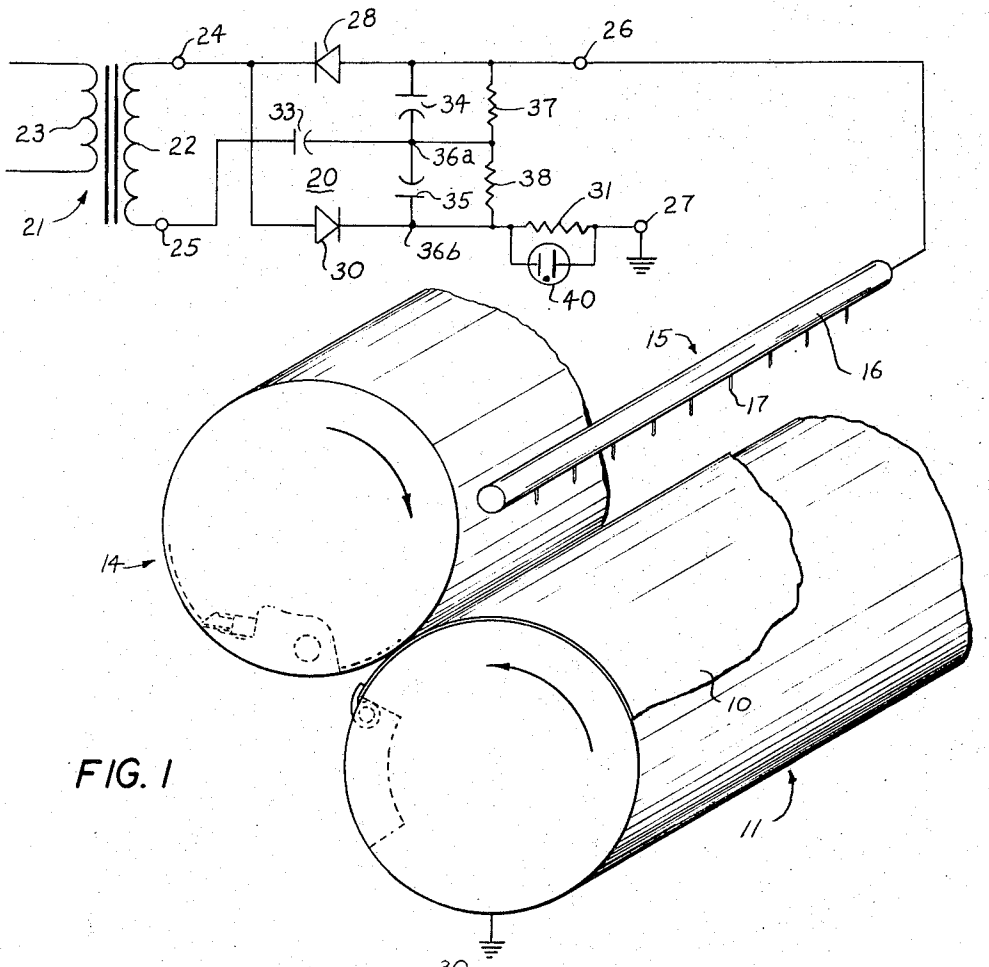


FIG. 1

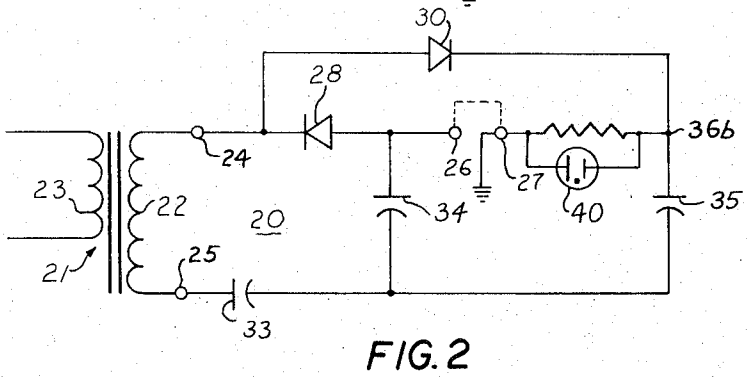


FIG. 2

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SHEET HANDLING APPARATUS

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ABSTRACT OF THE DISCLOSURE

A voltage doubling circuit where sides of two condensers are connected to a common junction which is connected to one side of an A.C. source while the other sides of the condensers are connected to the other side of the A.C. source and have rectifiers therein so that the condensers are charged on alternate half-cycles. Members which are to have a high voltage thereacross are connected across the two condensers. The connection between the common junction and the A.C. source includes an impedance which limits the current to a safe value on a short circuit between the conductive members and the connections which connect the conductive members across the condenser also includes a resistor.

The present invention relates to electrostatic sheet hold down apparatus and particularly to such apparatus for use in printing presses.

In printing presses, electrostatic sheet hold downs are used to cause a sheet to hug a rotating cylinder as the sheet is carried by the cylinder. The hold downs generally comprise an electrostatic device for establishing a field between the device and the cylinder and for producing charged particles which are propelled toward the cylinder to charge the sheet moving therewith and cause the latter to be electrically attracted to the cylinder.

One requirement of electrostatic sheet hold downs is that a high voltage be used to provide ionization and an electric field to propel the ions. The high voltage presents problems when accidental short circuits occur between the electrostatic device and the cylinder.

Accordingly, an important object of the present invention is to provide a new and improved electrostatic unit for establishing a high voltage electric field between an electrostatic device and a member moving with a sheet to cause the latter to be attracted to the member, which unit has a circuit arrangement such that it is inherently protected should a short circuit occur between the electrostatic device and the member.

Another object of the present invention is to provide an electrostatic unit of the type described where the voltage at the output terminals immediately reduces in the event of an arc-over.

A further object of the present invention is to provide a new and improved electrostatic hold down unit as in the preceding object which utilizes a voltage doubling circuit to provide the high voltage electric field.

Further objects and advantages of the present invention will be apparent from the following description of the preferred embodiment made with reference to the accompanying drawing in which:

FIG. 1 shows an electrostatic device and a power supply therefor in accordance with the present invention; and

FIG. 2 shows the circuit of FIG. 1 when a short circuit occurs.

As illustrated in the drawing, a sheet **10** is to be caused to hug a rotating cylinder **11** which has grippers thereon for gripping the leading edge of the sheet. The cylinder **11** is illustrated as the impression cylinder of a lithographic printing press and cooperates with a blanket cylinder **14** to form a printing nip for printing the sheet **10**.

An electrostatic hold down device **15** is disposed adjacent the cylinder and comprises an elongated conductive bar **16** extending parallel to the length of the cylinder. The conductive bar **16** has a plurality of ionizing needles **17** arranged in a row along the length of the member and pointing toward the impression cylinder. The impression cylinder is a metallic cylinder and a high voltage is applied to the conductive bar **16** to cause an ionization of the air adjacent the bar to provide electric charges in the form of ions which are propelled toward the cylinder by the high voltage field between the electrostatic bar and the cylinder. The electric charge collects on the sheet to charge the sheet and cause it to be electrically attracted to the cylinder.

In accordance with the present invention the high voltage direct current field is provided by a power unit **20**. The power unit **20** comprises a step-up transformer **21** having a secondary **22** and a primary **23** connected to a 120-volt 60-cycle alternating current source. The secondary coil **22** has terminals **24**, **25** which are connected by a rectifying and voltage doubling circuit to power output terminals **26**, **27**, the output terminal **26** being connected to the electrostatic bar **16** and the output terminal **27** being connected to ground. The secondary terminal **24** of the transformer is connected to the output terminal **26** through a rectifying diode **28** poled to conduct current flowing toward the secondary terminal **24**. The secondary terminal **24** is also connected to the output terminal **27** through a rectifying diode **30** which is poled to conduct current flowing from the transformer terminal **24**, and a resistance **31**.

The secondary terminal **25** of the transformer **21** is connected to the output terminal **26** through a capacitor **33** and through a capacitor **34** connected in series in the order named between the transformer and the output terminal **26**. A condenser **34** has one side connected to a junction **36***a* between the condensers **33**, **34** and its other side to a junction **36***b* between the diode **30** and the resistance **31**. Resistances **37**, **38** are respectively connected across the condensers **34**, **35**.

During normal operation, when the transformer terminal **24** is positive with respect to the terminal **25**, current will flow from the terminal **24** through the diode **30** to charge the condenser **35** and the condenser **33**. On the alternate half cycle, current will flow from the terminal **25** to reverse the charge on the condenser **33** and to charge the condenser **34**, the charging current flowing through the diode **28** to the terminal **24**. The resistors **37**, **38** are high resistance bleed resistors which also stabilize the voltage across the condensers. On the half cycle when condenser **34** is being charged, the diode **30** blocks current and prevents the discharging of the condenser **35** and its charging in the opposite direction by the voltage on the secondary of the transformer. Similarly, when the condenser **35** is being charged, the diode **28** prevents the condenser **34** from being charged in the opposite direction by the voltage of the secondary coil **22**. The condensers **34**, **35** are in a voltage doubling arrangement and the voltage appearing across the resistors **37**, **38** will be the sum of the voltages to which the condensers **34**, **35** are charged.

While the condensers **34**, **35** are connected in a voltage doubling arrangement, the voltage to which each of the condensers **34**, **35** is charged will not be the voltage across the secondary coil **22** since in any half cycle, the condenser **33** is also charged and the sum of the voltages on the condensers **33**, **34** on one half-cycle and the voltages on condensers **33**, **35** on the other half-cycle approximate the output voltage across the secondary coil.

If a short circuit appears across the output terminals **26**, **27**, as is shown in FIG. 2, the condenser **35** and the

resistance **31** is effectively connected in parallel with the condenser **34** for one half-cycle and the condenser **34** and the resistance **31** are connected in parallel with the condensers **35** on the other half-cycle. With this circuit arrangement, both the condensers **34, 35** are charged on each half cycle and since the condensers are now connected in parallel with each other, the reactive impedance in series with the condenser **33** is considerably less than it was without the short circuit and the major portion of the voltage drop appearing across the secondary coil now appears across the condenser **33** and a much smaller portion appears across the condensers **34, 35**. Consequently, the voltage at the output terminals **26, 27** drops since only a very small portion of the voltage across the secondary **22** appears across the parallel circuit including condensers **34, 35**. Because of the parallel circuit arrangement, this is also true for short circuits which present appreciable impedance.

While a short circuit between the terminals **26, 27** effectively connects the condensers **34, 35** in parallel with each other to reduce the effective impedance in series with the secondary coil **22**, the reactive impedance of the condenser **33** will act to limit the current in the circuit. Moreover, as pointed out above, the resistance **31** is always in the branch of the parallel circuit including the output terminals **26, 27** and is used in the preferred embodiment to develop a voltage for an indicating light **40** of the glow tube type. The resistance **31** will also, on both half-cycles, limit the current flow through the short circuit and will aid in reducing the voltage at the output terminals **26, 27** when a short occurs. This is particularly helpful when the short circuit is due to an arc-over since the dropping of the voltage may extinguish the arc. The indicating light **40** is normally out but will light to indicate short-circuit conditions when the current through the resistance **31** reaches a predetermined magnitude.

It can now be seen that the present invention provides a new and improved apparatus for electrostatically holding a sheet to a rotating cylinder in which the problems caused by a short circuit across the field are minimized.

While a preferred embodiment of the present invention has been described in detail, it is hereby intended to

cover all modifications, constructions and arrangements which fall within the ability of those skilled in the art and within the spirit and scope of the present invention.

Having described my invention, I claim:

1. An apparatus of the character described comprising first and second conductive members which are to have a high voltage therebetween, and means for applying a direct current potential between said members comprising a source of alternating current having a pair of A.C. terminals, first and second condensers, first circuit means connecting one side of said first condenser to one of said A.C. terminals, second circuit means connecting one side of said second condenser and said one of said A.C. terminals, each of said circuit means comprising a rectifier with said rectifiers poled to conduct on different half-cycles of the voltage across said A.C. terminals, the other sides of said first and second condensers being connected to a common junction, a connection from the other of said A.C. terminals to said junction, and additional circuit means connecting said condensers in series across said first and second conductive members, said common connection having impedance means therein effectively limiting current to a safe value on a short-circuit between said members.

2. An apparatus as defined in claim **1** wherein said impedance comprises a capacitive means.

3. An apparatus as defined in claim **2** wherein said additional circuit means includes a resistor independent of said first and second circuit means connected between one of said condensers and one of said members.

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