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ELECTROSTATIC DEVICE

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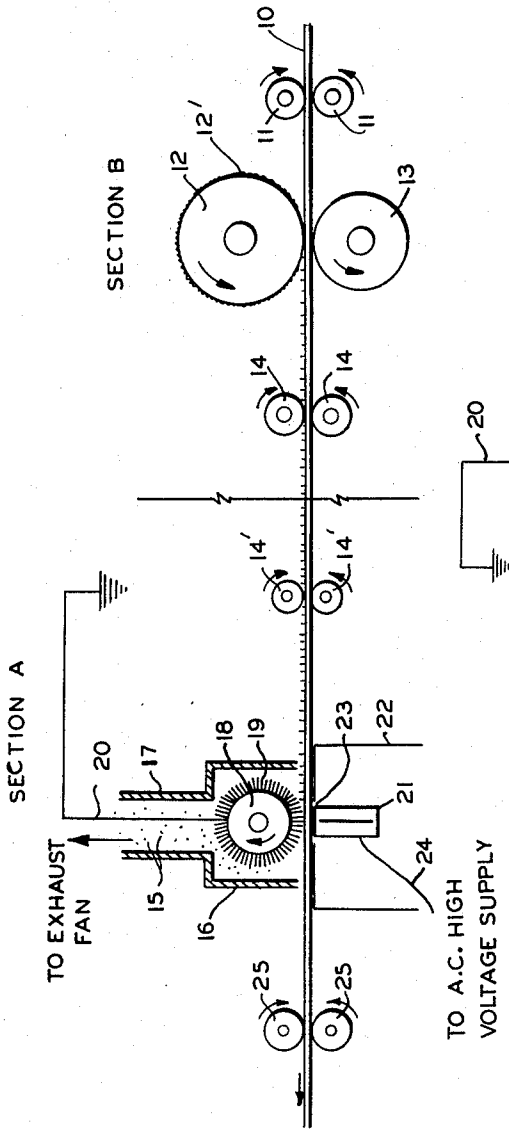



FIG. 1

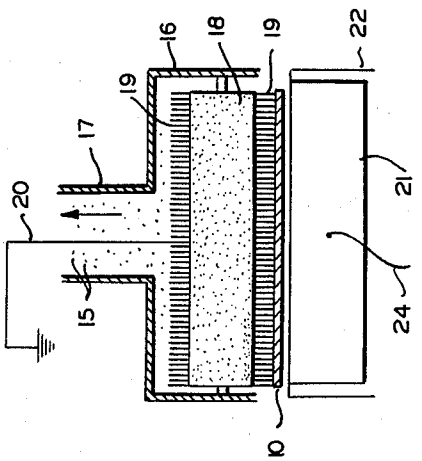



FIG. 2

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# ELECTROSTATIC DEVICE

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1 Claim. (Cl. 134—1)

The present invention relates generally to a device and method for removing particles from the surface of a workpiece and more particularly to an improved electrostatic cleaner and/or static eliminator, especially adapted to remove statically charged particles from the surface of a poorly conductive material.

Any material which is either a non-conductor or a poor conductor of electrical charges presents a serious problem of static electricity removal after passing through rolls or in frictional contact with other surfaces. The frictional passage generates on the surface of the non-conductor a charge of static electricity which, due to the nature of the non-conductor, is not dissipated but builds up and is discharged only when the material is handled or otherwise brought into contact with a grounded conductor. This problem is particularly acute when the non-conductive material is passed through a series of rolls in frictional contact therewith as may happen in a variety of processing operations. The static charge is frequently so high as to constitute an explosion hazard due to the magnitude of the spark which occurs when the charge is discharged.

One of the most common situations in which the above problem arises is in the abrasive grinding or polishing of nonconductive material, as for example, rubber, vinyl tile, leather, paper, etc. The frictional contact of the abrasive belt or wheel plus the frictional contact of the various feeding and pressure rollers builds up a high static charge on the surface of the material being ground. An added problem which is present in such a grinding or polishing operation is that the small particles which have been ground off, as well as any loose abrasive particles, tend to adhere to the surface of the material, bound there by the static charge so tightly that conventional brushes or cleaning means will not remove them.

The present invention has for its object the provision of a means for overcoming the disadvantages listed above.

A principal object of the invention is to provide a means for eliminating a static charge from the surface of poorly conductive material.

A further object is to provide a means for cleaning adherent particles from the surface of a workpiece.

An additional object is the provision of a method for cleaning surfaces and eliminating any static charge present thereon.

Another object is to provide a means for removing adherent particles from the surface of a statically charged, poorly conductive workpiece.

Other objects, if not specifically set forth herein, will be readily apparent from the following detailed description of the invention.

In the drawings:

Figure 1 is a schematic plan drawing showing the present invention employed in a conventional grinding operation.

Figure 2 is an end view of section A of Figure 1.

Referring now to Figure 1, section B illustrates a conventional grinding operation wherein a sheet of poorly



conductive material **10** is fed through feed rolls **11** to a grinding cylinder **12**. Pressure roll **13** maintains a close frictional contact between the sheet **10** and the abrasive surface **12'** of cylinder **12**. Additional guide rolls **14** and **14'** are arranged to conduct the sheet **10** from the grinding operation into the area designated as section A which illustrates the present invention. After passing through the grinding operation, numerous small particles of the abraded material and abrasive grit remain bonded to the surface of the sheet **10** as illustrated at **15**. These particles are tightly adhered to sheet **10** because of the static charge built up thereon due to passage through the grinding and feed rolls. The illustrated modification of the present invention, designed to both relieve the dangerous static charge and to remove the adhered particles from the sheet comprises a suction head **16** having the end adjacent the sheet **10** open and a pipe **17** leading from the other end to a conventional exhaust fan (not shown). Mounted within the suction head and in contact with or closely adjacent to the sheet **10** is a rotating cylinder **18**, preferably having a plurality of small raised projections **19** thereon. As shown, these projections **19** are formed by a wrapping of fancy wire cloth around the steel cylinder. Obviously, the cylinder could be formed with a plurality of projections itself, or other types of wrappings having projecting wires or fins could be used. Cylinder **18** is grounded as illustrated by a wire **20**. Immediately below the grounded cylinder is an electrode **21** of any suitable design, positioned as close as possible to the surface of the sheet **10** opposite the surface with which the projections **19** of cylinder **18** are in contact. Any suitable means may be utilized to obtain the positioning, but as illustrated, a table **22** having a slot **23** is adapted to receive the electrode **21** therein. Electrode **21** is connected as by wire **24** with a conventional source of high voltage alternating current. Suitable guide rolls **25** are provided beyond suction head **16** to guide sheet **10** out of the device.

In operation, the sheet **10**, carrying a high charge of static electricity and a plurality of statically bound particles **15** on the upper surface thereof, passes into the electrostatic field set up between electrode **21** and the grounded cylinder **18**. This field, due to the alternating current high voltage source to which electrode **21** is connected, rapidly and continuously reverses itself, damping out the static charge to practically zero. The multipoint contacts afforded by the projections **19** on cylinder **18** are very effective in this respect. Additionally, due both to the electrostatic effect and to the physical contact of projections **19** with the surface of sheet **10**, the particles **15** are freed from the surface of sheet **10**. As these particles are projected upwardly from the sheet **10** due to the action of the alternating current electrostatic field, the suction induced in the head **16** by the action of the exhaust fan connected to the opposite end of head **16**, picks up and carries away the loosened particles. Sheet **10**, as it passes from the head **16**, is essentially free from both any static charge and from any adhered particles.

The voltages used in establishing the electrostatic field may vary from several thousand volts up to about one hundred thousand volts. The optimum voltage, as is well known in the electrostatic art, will be dependent upon the material being passed between the electrodes, its thickness, dielectric properties, etc. Generally, voltages in the range of from about 20,000 to 50,000 volts are satisfactory.

Many modifications can be made in the apparatus within the scope of the present invention, both in the grounded cylinder construction as stated above and also in the arrangement of the components. For example, one or more electrodes may be positioned on the same

side of the sheet as the grounded cylinder and either grounded or connected to a high voltage source. Also, for some purposes the cylinder might be replaced by flat electrodes with or without projections, or the mouth of the suction head itself might act as the electrode. Obviously, the device may be reversed and the bottom electrode grounded while the cylinder is connected to the high voltage alternating current source. Many other modifications and variations not specifically set forth herein will be readily apparent to one skilled in the art, and no limitation on the scope of the invention is intended by the modifications described herein other than as may appear in the appended claims.

The invention, while particularly adapted for use with non-conductive or poorly conductive sheet material, is also of value in connection with the processing of strips, rods, and the like. The invention combines both the functions of cleaning and static eliminating and is of value wherever a problem of this type exists. Obviously, the invention may be used to clean workpieces even where the problem of static charges does not exist or is very minimal.



We claim:

A method of eliminating static electrical charges from the surface of a workpiece and removing particles adhered to such surface by the electrical charge thereon which comprises: passing a workpiece having particles adhered to the surface thereof by a static electrical charge through a constantly reversing electrostatic field to damp out the static charge on the surface of said workpiece and to cause said particles to be attracted upwardly from said surface; and at the same time subjecting said surface to the action of a reduced pressure zone to cause said particles to be removed permanently from said surface.

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