POWDER SPRAY APPARATUS

FIELD OF THE INVENTION

This invention relates to recovery of sprayed powder entrained in air and, more particularly, to recovery of overspray paint powder from an electrostatic paint booth.

BACKGROUND OF THE INVENTION

As disclosed in U.S. Pat. No. 5,107,756 an electrostatic paint system consists of a paint booth or enclosure in which a coating such as paint powder is applied to parts, a conveyor for carrying parts into and out of the booth, and an electrostatic paint applying system. The paint applying system includes a powder spraying device which imparts a velocity to the paint powder particles which directs its, them toward the device to be painted, places an electrical charge on the powder particles, creates an electrical field between the device being painted and ground, and meters the powder. Electrostatically-charged powder particles are attracted to and have an affinity for the grounded object to be painted since the grounded object assumes a polarity opposite that of the powder-spraying device. The charged powder particle, acted upon by the electrical field, can be deflected from its original trajectory in the direction of the grounded object.

In an automatic electrostatic system, the spraying device may be mounted in a fixed position, attached to a gun mover device that provides reciprocating motion, attached to a robot that imparts a predetermined complex motion, or manipulated manually. An electrostatic adhesion system greatly increases powder transfer efficiency from the gun to the surface to be coated as compared to a non-electrostatic device.

The paint powder that does not adhere to the part is generally referred to as overspray. Overspray comprises powder that misses the part, rebounds from the part surface, and powder electrostatically deflected to other grounded surfaces such as spray booth metal components and article conveyors. Most overspray is entrained in the spray booth exhaust air.

Electrostatic powder spray users generally use either a cyclone type powder recovery system or a cartridge filter type powder recovery system. Cartridge systems are very efficient, recovering nearly all powder overspray for reuse. In comparison, conventional cyclones alone normally recover only approximately 80% to 90% of oversprayed powder. A scrap collector is employed to trap the remainder of the powder. Powder from the scrap collector is speckled and therefore must be disposed of. Thus, cyclones are not as efficient as cartridges. In long runs, this difference in efficiency can result in a substantial difference in powder usage and, accordingly, cost of operation. However, cyclones are advantageous in that, unlike cartridges, cyclones can be completely cleaned between successive runs of differing colors in a relatively short time. Thus, since one cyclone can be easily cleaned after a color run, it is not necessary to employ separate cyclones for each color to be run. Accordingly, short runs of specialized colors can be performed much more economically than with cartridge systems, which require separate cartridges for each specialized color to be run.

As shown in the '756 patent a system was developed which allowed a diverted door or the like to select an exhaust path either directly into a scrap cartridge filter assembly employing a plurality of filter cartridges **42** or first through an inlet duct **70** to a cyclone **73** where most of the particulate are removed and air including only very fine particulate are expelled from an outlet duct **94** back to the cartridge filter cartridge **42** following which air is exhausted through a final filter **84** via a fan **82**. In particular the system shown in FIG. **8** includes a manifold assembly having a relatively large inlet for receiving air from the air including powder and train therein from the spray booth passing it to the cyclone and then back to the cartridge filter or in the alternative directly to the cartridge filter. The patent also teaches the use of adjustable baffles in combination with a cartridge filter **42** to control the flow of air within the spray booth for efficient transfer of powder to the workpiece **12** within the booth.

The existing system, however, could be improved as to its ease of clean out and as to the control of air flow therethrough. Typically when a color change is to be made the bottom of the spray booth must be cleaned by hand. This involves someone actually going in and manually removing powder spray particles which have settled on the floor of the booth during multiple spraying operations of multiple workpieces. Typically the powder has to be scooped out of the booth and disposed of. This may take 45 minutes or more, a substantial down time particularly when color changes are frequent when runs are short.

In addition, a portion of the powder resting on the booth floor would ultimately reach the cyclone or the cartridge filters for automatic recycling via the feed line **54** back to the powder reservoir **56**. Because of the extensive manual labor involved in the color change within the booth this leads to substantial down time of the booth which might otherwise be used in a productive capacity.

What is needed is a method and apparatus for rapidly color changes by enabling efficient clean out of the spray booth as well as recycling of the powder left on the booth floor after a run of a particular has been completed.

SUMMARY OF THE INVENTION

An electrostatic, adhesion powder spray paint apparatus is provided which provides minimal overspray with rapid cleanout of the spray booth during color changeover.

In running high volume or commonly used colors, the cyclone module is isolated from the spray booth apparatus, and the overspray from the spray booth is drawn directly into a conventional cartridge cabinet in a conventional manner. That is, the overspray powder-air mixture is drawn into a conventional, dedicated cartridge cabinet and drawn radially through the cartridge filters in the cartridge cabinet which separate the powder from the air. Overspray powder accumulated on the exterior of the cartridge filters is pulsed off the filters by short pulses of reverse flowing air, into a hopper located at the bottom of the cartridge module where the powder mixes with the replenished virgin powder and is pumped back to the spray guns. As stated above, since the cartridge cabinet is dedicated to that particular color, the recovered powder pulsed off the filters is untainted by other colors and therefore reusable. Such an arrangement allows recycling of virtually all overspray.

In changing to a secondary color, the air path from the spray booth is diverted such that overspray powder is drawn from the spray booth directly into the cyclone, initially bypassing the cartridge module. The centrifugal force within the cyclone throws the particulate against the cyclone wall which separates the majority of the powder from the air-powder mixture. The fine particulate not separated in the cyclone is drawn out of the cyclone through its upper end into a scrap collector, which may be a cartridge booth dedicated to collection of scrap.

The powder recovery apparatus constructed in accordance with the present invention provides the particular advantage