

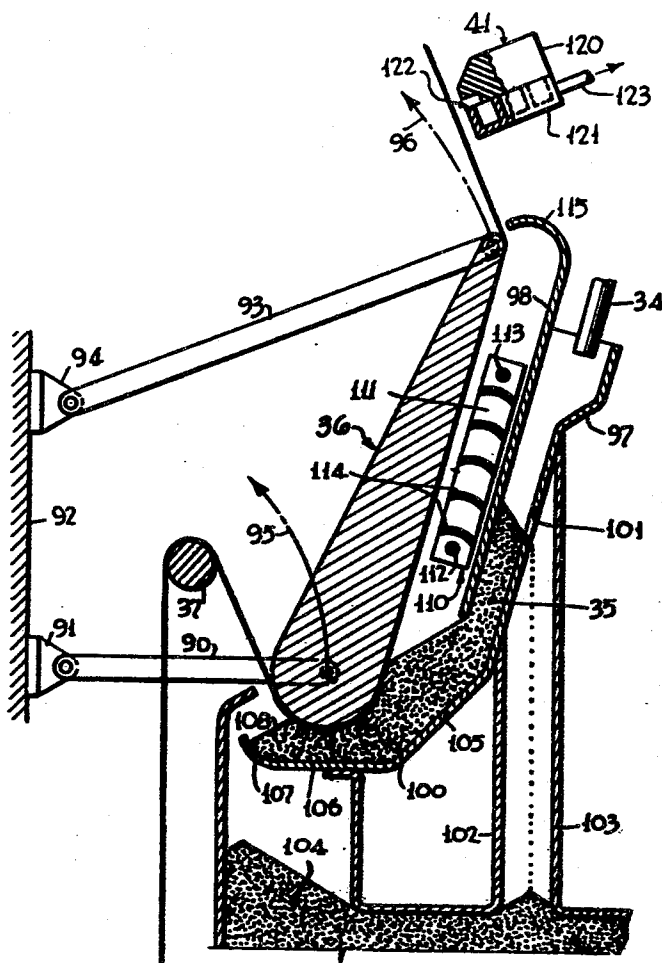
[72]	Inventor	Philip A. Stowell Paoli, Pa.
[21]	Appl. No.	798,218
[22]	Filed	Sept. 16, 1968 Division of Ser. No. 471,176, July 12, 1965, Patent No. 3,439,650.
[45]	Patented	Dec. 29, 1970
[73]	Assignee	Borg-Warner Corporation Chicago, Ill. a corporation of Illinois

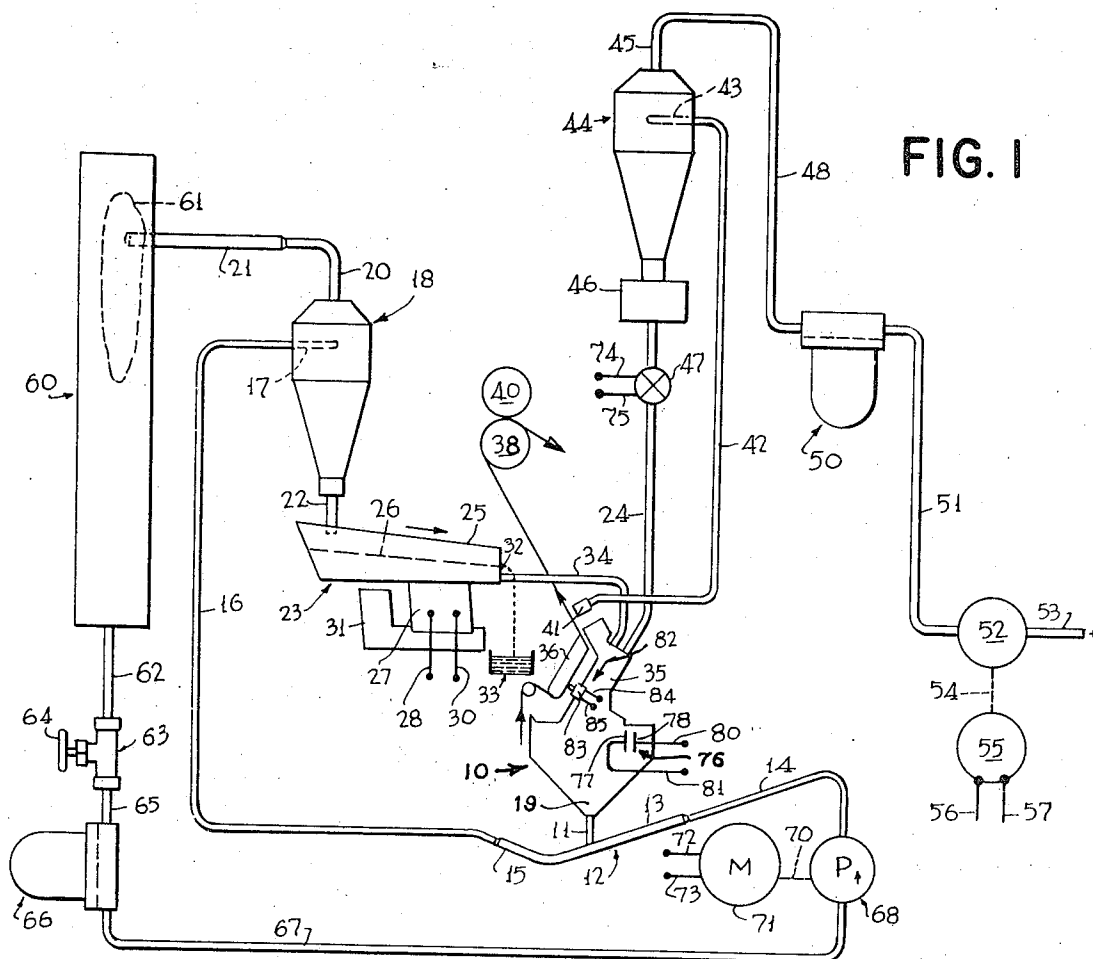
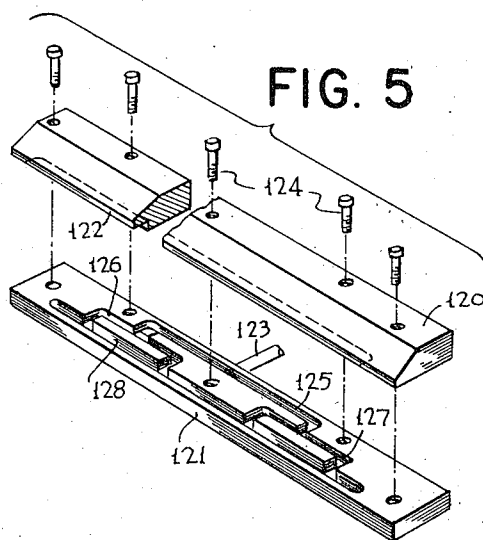
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[54]	INK PARTICLE RESERVOIR		
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[51]	Int. Cl.....	B65g 65/32, B65g 65/76	
[50]	Field of Search.....	214/17.6, 17.62; 222/318, 56; 118/637	
[56]	References Cited		
	UNITED STATES PATENTS		
	932,150	8/1909	Louis..... 222/318X

ABSTRACT: An inker station for developing a previously charged dielectric web includes a housing for retaining the particles and discharging them into one input connection of a Venturi-type fitting as an airstream is passed into the other input connection of the fitting. From the fitting the entrained material is discharged into a cyclone separator where undesired small particles are removed, and then into a vibrator separator which excludes unduly large particles and passes only particles within the desired size range back into the housing to contact, and adhere to, the previously charged dielectric web as it is pulled through a portion of the housing. A sniffer disposed at the web exit removes excess background ink particles from the developed web.





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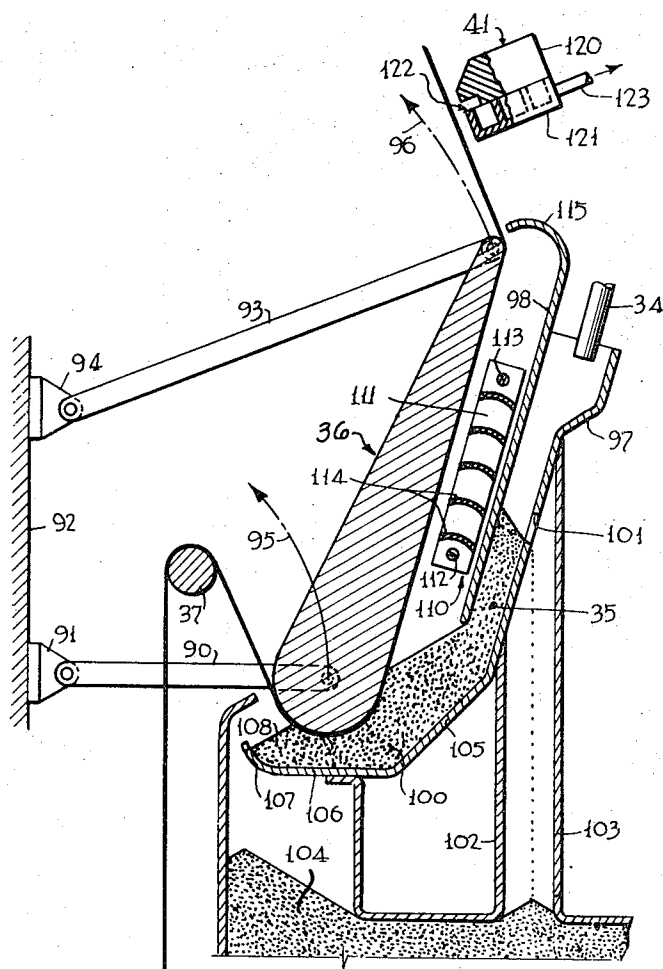


FIG. 2

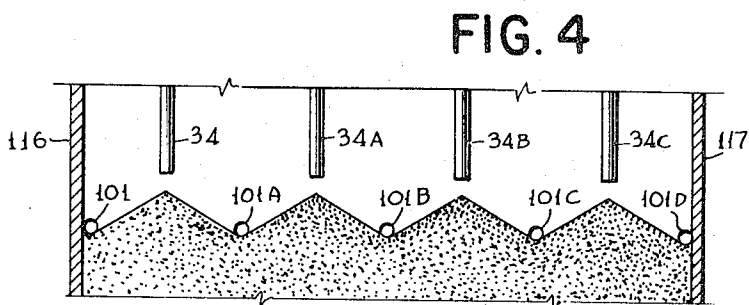


FIG. 4

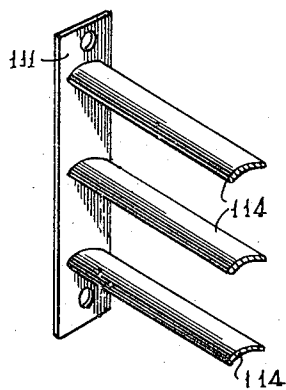


FIG. 3

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FIG. 8

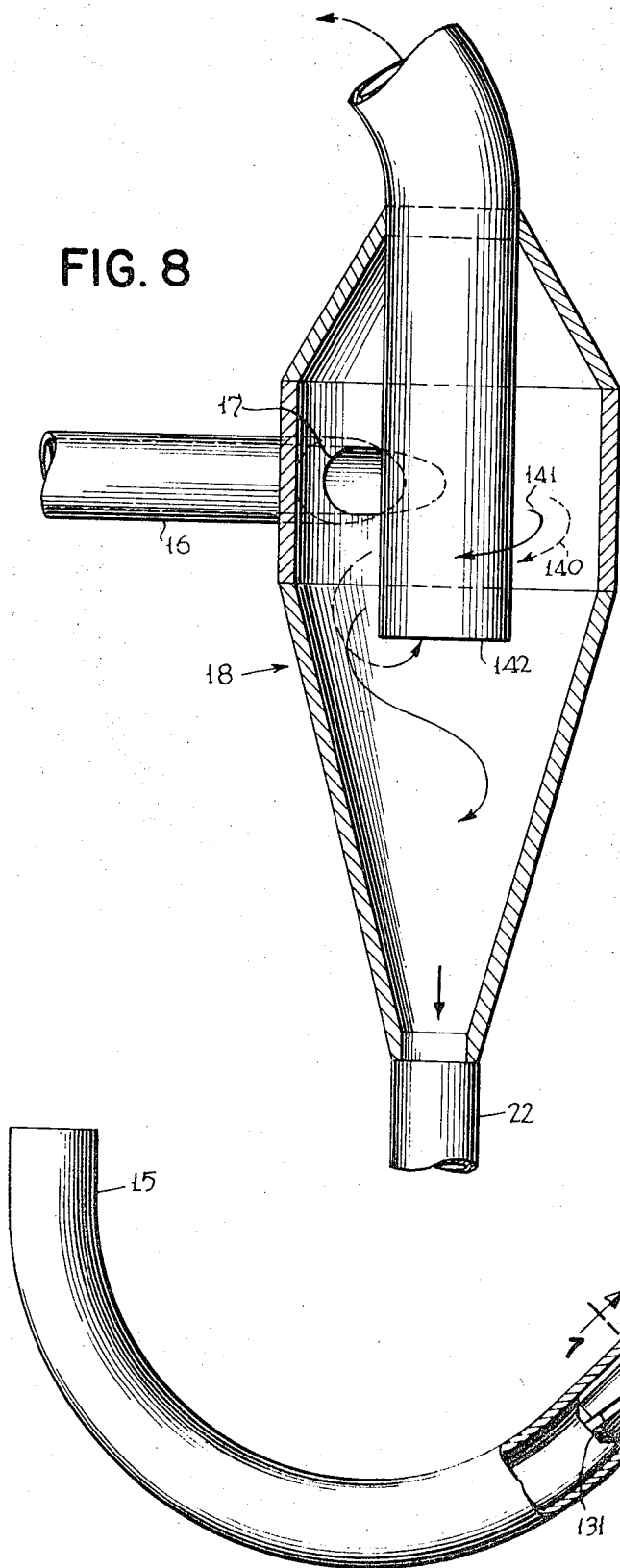


FIG. 7

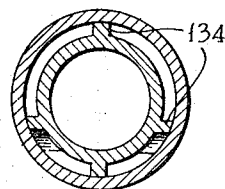
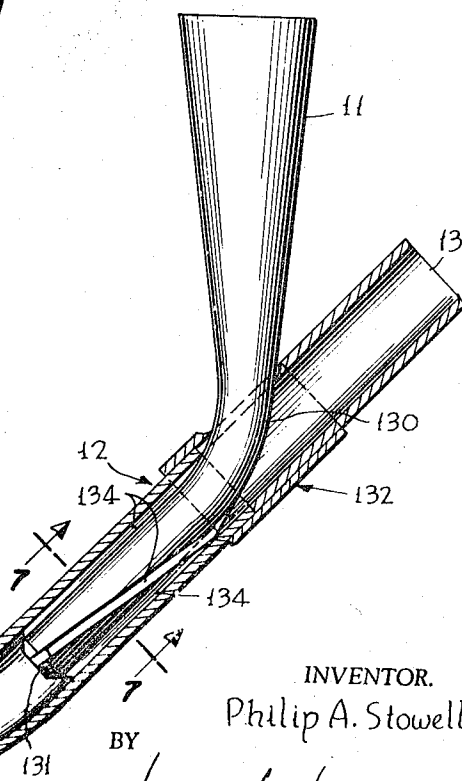


FIG. 6



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INK PARTICLE RESERVOIR

The present application is a divisional application of Ser. No. 471,176, filed July 12, 1965, now U.S. Pat. No. 3,439,650, and entitled INFORMATION TRANSFER SYSTEM. The present invention is directed to an inker station for an electrostatic printer, and more particularly to such a station which is effective to provide the ink particles free of debris and which refines the ink particles to insure that the particles used fall within an acceptable range of particle sizes.

The design and production of a suitable inker station for an electrostatic printer in which a page format is the end product, rather than a narrow strip of dielectric tape on which the information has been imprinted, presents considerable problems. In strip printers where the width of the paper web is of the order of an inch, seals are generally used at least at the input portion of the inker station so that the minute ink particles will not be displaced out of the inker reservoir or hopper when the tape is run through the inker at high speeds. Even with the best of seal arrangements there is some wear, and likewise some smear or lack of clarity of definition in the image as the tape with the particles adhering thereto leaves the inker. It would be desirable, in the development of an inker for a page printer for effectively and rapidly handling the developing of a wide web of paper rather than a narrow strip, to provide such an inker station without any seals whatever. Of course such an inker station would also find utility with strip printers, those using narrow paper tapes.

It has become apparent in the long term operation of strip printers that a considerable amount of debris such as dust particles, slitter dust, etc. is pulled into the inker reservoir on the dielectric web and much of this debris is left in the ink reservoir. It is thus a primary consideration of the present invention to provide an inker station in which the debris is not accumulated but is continually removed from the inker. This is in contradistinction to previously known arrangements in which the dust and dirt usually "floats" to the top of the ink reservoir and inhibits the proper inking of the electrostatically charged web.

Another major disadvantage found in some previous inker arrangements is that a good definition of the image cannot be provided because the technology for providing ink of uniform particle size is not yet perfected. Not only is there aberration in the particle sizes but there is "satelliting" in which several smaller particles may adhere to a larger particle in the production process and retain this arrangement when dumped into the ink reservoir. Other particles of approximately the same size adhere to each other to build undesirable total particle size. In inks such as this which are made of carbon particles and resin, in the finished product the carbon particles are sometimes coated with a very thin resin film which completely surrounds the carbon and thus militates against good inking action. It is accordingly another important consideration of the present invention to provide an ink handling system in connection with the ink reservoir which not only obviates these difficulties encountered with known systems, but actually refines and improves the ink during the particle transfer operation.

SUMMARY OF THE INVENTION

The foregoing and other considerations are realized, in a preferred embodiment of the invention, by providing an inker station which includes a housing having an upper chamber for retaining the ink particles to contact the previously charged dielectric web and a lower reservoir chamber for collecting the particles which fall from the upper chamber. The station includes a Venturi-type fitting with an output connection and two input connections. One of the input connections is coupled to the reservoir chamber so that as air under pressure is passed into the other input connection, a stream of air with conductive particles entrained therein is discharged from the output connection. First separation or refining means, which may be a cyclone separator, is provided with an input connection which is coupled to the output connection of the Venturi-

type fitting for receiving the entrained particles of desired size together with fine and coarse impurities. "Impurities" refers not only to foreign matter but also to particles smaller than, and particles larger than, the ink particles falling within the predetermined or desired range of particle sizes. The first separation means also includes a first output connection for discharging the fine impurities and a second output connection for discharging both the desired particles and the coarse impurities. A filter is coupled to the first output connection of the first separation means to trap the fine impurities. A second separation means is disposed so that its input portion receives both the desired and coarse impurities from the first separation means. The second separation means includes means for separating the coarse particles from the particles of desired size and for discharging the coarse particles for receipt in a collection receptacle as the desired size particles are discharged through an output port for receipt in the upper chamber of the inker housing. Pressure unbalance means, such as a pump, is coupled between the first output connection of the first separation means and the other input connection of the Venturi-type fitting, for both removing the fine impurities from the first separation means and for providing the air under pressure to the Venturi-type fitting. Thus, upon energization of the pump, the opaque inking particles are pneumatically recirculated throughout a closed system and continually refined as the particles of undesired size are removed in each cycle of movement.

The invention may also comprise a "sniffer" or suction means disposed against adjacent the location at which the inked web emerges from the inker station. Upon application of suction pressure to the inker the background ink particles are drawn from the tape as it emerges from the inker station, thus providing better contrast and a more satisfactory printed record.

To enable those skilled in the art to practice the invention, the best mode contemplated for making and using the invention will now be described in connection with the accompanying drawings, in the several figures of which like references numerals identify like elements, and in which:

FIG. 1 is a schematic diagram indicating generally the pneumatic transfer of the inker particles around the system and the particle size classification;

FIG. 2 is a partial sectional showing, taken on a scale enlarged with respect to that of FIG. 1, showing the normal position of the ink particles in the upper chamber of the inker housing as the web passes in contact with the ink particles;

FIG. 3 is a perspective illustration of air deflecting means within the upper chamber of the inker housing;

FIG. 4 is a partial sectional view showing the means for feeding the ink particles across the width of the inker chamber;

FIG. 5 is an exploded view, partly broken away, indicating the components of the sniffer which are positioned adjacent the inked web;

FIG. 6 is a side view, partly in section, of the Venturi-type fitting utilized in the system;

FIG. 7 is a sectional view, taken along the line 7-7 of FIG. 6, particularly illustrating a portion of the Venturi fitting construction; and

FIG. 8 is a front view, partly in section, illustrating a cyclone apparatus of the type utilized in the inventive system.

GENERAL SYSTEM ARRANGEMENT

As shown in FIG. 1 the inker housing 10 includes a reservoir 19 coupled to a first input connection 11 of a Venturi-type fitting 12. The other input connection 13 of the Venturi-type fitting is coupled to a conduit 14 for receiving air under pressure as will be described hereinafter.

The output connection 15 of the Venturi fitting is coupled through another conduit to a tangential input connection 17 of a first separation means 18, shown as a cyclone separator unit. The refining unit 18 includes an upper outlet 20 or first

connection which is coupled to a conduit 21, and a second output connection or lower outlet 22 for discharging particulate material by gravity. The cyclone separator operates in a well-known manner in the inventive system so that, when a pressure less than atmospheric pressure is supplied from conduit 21 to the upper output connection 20, particles of material fed inwardly through tube 17 and less than a predetermined mass are drawn upwardly through fitting 20 and out of the cyclone separator. The remaining particles of a greater mass are thrown outward against the wall by centrifugal forces and drop downwardly under the force of gravity to be discharged through output port 22 into the second separation means 23.

The second refining means includes a receptacle portion 25 with a screen mesh 26 effectively dividing the receptacle into upper and lower portions. Within actuator portion 27 a vibrator motor (not shown) is positioned and coupled to receptacle 25 so that, responsive to energization over input conductors 28 and 30, the receptacle 25 is rapidly vibrated in the horizontal plane. This vibrating arrangement is supported on a base 31. The screen is inclined slightly downwardly to the right, and the effect of the vibrating action is twofold. Particles greater than a given size will not pass through the apertures in screen 26 but will be carried downwardly to the right and fall over lip 32 downwardly for receipt within a collection box 33. The remaining inking particles, less than the predetermined size as determined by screen 26, pass through the apertures in mesh 26 and are likewise displaced to the right by the vibrating action to emerge through conduit 34 and drop downwardly into the upper chamber 35 of the ink reservoir 10. Additional ink particles are discharged from conduit 24 into chamber 35 each time the system is energized, as will be explained hereinafter. The ink also includes an anvil 36 or reference plate for guiding the dielectric web as it passes through the ink housing to attract conductive particles to the previously charged web areas. The dielectric web passes around a guide roller 37 and thereafter around the lower portion of anvil 36, being pulled upwardly and deflected around the upper edge portion of the anvil to emerge from the ink housing and pass between pressure fixing rolls 38, 40. Thus the only impetus for dielectric web displacement through the ink station is providing by the positive driving engagement of pressure fixing rolls 38 and 40.

As the web emerges from the ink station it passes adjacent a suction head 41 or "sniffer." The sniffer is coupled over a conduit 42 to the central or tangential input connection 43 of another cyclone separator 44, which likewise includes an upper output port 45 and a lower output connection coupled between collection box 46 and conduit 24, to dump collected particles through conduit 22 into chamber 35 each time valve 47 is actuated by a control signal over conductors 74, 75.

The upper output connection 45 of cyclone separator 44 is coupled over a conduit 48 to one side of a filter 50, the other side of which is coupled through a conduit 51 to a pump 52 which has its output side discharging through a conduit 53 to the atmosphere. Pump 52 is mechanically coupled as represented by the broken line 54 to a motor 55 which can be energized over its input conductors 56, 57.

Considering again the first separator means or cyclone separator 18, the conduit 21 coupled with the upper output portion of this separator is also coupled to the input of a filter box 60, in the interior of which is disposed a collection receptacle 61 constructed of a suitable fine mesh material (analogous to placement of a disposable bag within a vacuum cleaner). Conduit 21 is coupled to the interior of the disposable receptacle 61 so that fine particles can be entrapped within the receptacle 61 and air can still pass through receptacle 61, the remainder of filter box 60 and downwardly through conduit 62 to a metering cock 63, which includes an adjustable screw or element 64 for adjusting the pressure balance of the system. The other side of the metering cock 63 is coupled through another conduit 65, an intake filter 66, and conduit 67 to one side of pressure unbalance means 68. The other side of pump 68 is coupled to conduit 14, and the pump is coupled, as in-

indicated by the broken line 70, to a motor 71 which can be energized over its input conductors 72, 73 to drive the pump 68 and draw air from conduit 67 through the pump and displace the air under pressure through conduit 14 to the input connection 13 of Venturi fitting 12.

GENERAL SYSTEM OPERATION

When the general system of FIG. 1 is energized, electrical energy is supplied over conductors 72, 73 to energize motor 71 and drive pump 68; electrical energy is supplied over input conductors 56, 57 to drive motor 55 and in turn drive pump 52; and electrical energy is also supplied over conductors 28, 30 to actuate the vibrating means of the second separator 23. In a preferred embodiment of the invention, valve 47 is of the solenoid type so that, upon initial energization of the system, energy is temporarily supplied over conductors 74, 75 to actuate this valve and dump particles previously collected in box 46 downwardly through the valve and through conduit 24 into the upper chamber of housing 10. This energization is removed and the valve closed during subsequent operation of the system.

Air is displaced from pump 68 upwardly around the bend of conduit 14 into the second input connection 13 of the Venturi unit 12. As is well known, the reduced pressure (due to the flow of air) provided interiorly of the Venturi tube draws conductive ink particles downwardly from the reservoir 19 through the other input connection 11 of the Venturi fitting, and an airstream with the conductive particles entrained is displaced out of the Venturi output connection 15, through conduit 16, and into the tangential input connection 17 of the cyclone separator 18. The pressure supplied at output port 20 is less than that at output port 22. Thus particles passed in through input port 17 initially tend to circulate around the central portion of the separator in a path defined by the circular inside wall. The heavier particles then descend downwardly to drop through output port 22 into the input portion of the second separator means 23. The particles which are lighter than the predetermined mass (as determined by the setting of the pressures in the system) pass upwardly from cyclone separator 18 through output connection 20 and conduit 21 into the meshlike receptacle 61 within elutriation box 60. These lighter particles are the "fines" or minute particles such as paper debris, slitter dust, fragmented ink particles, etc., which accumulate in a system where a large amount of paper is displaced in the printing operation. The fines are entrapped within bag 61 and the cleaned air is then displaced downwardly through conduit 62, metering cock 63 and conduit 65 to intake filter 66, where any stray particles which may pass through receptacle 61 within the elutriation box are trapped. The cleaned air is passed from filter 66 through conduit 67 to the input side of pump 68.

As the ink particles fall downwardly from the end of conduit 22 into the end of the vibrator arrangement 23, the lateral vibration of this unit gradually displaces both the larger particles, retained above the mesh 26, and the properly sized conductive particles which fall through this mesh, to the right as shown in the drawing. The remaining conductive particles, all within the acceptable size range, pass onwardly through conduit 34 down into the upper chamber 35 of the ink housing 10. The larger-than desired particles, which in effect are coarse impurities, pass to the right over sieve 26, thence outwardly over lip 32 and fall under the impetus of gravity for receipt in collection box 33.

The paper web, which has minute, discrete areas specifically charged to represent a latent information denoting pattern, is passed upwardly over roller 37 and downwardly to the right around the lower curved portion of anvil or reference plate 36. As the charged portions of the web pass upwardly they touch the mass of conductive ink particles and some of the particles are attracted by electrostatic force to the charged web areas. These particles are retained on the web as it is pulled upwardly and to the left, over the upper lip portion of

anvil 36 to emerge from the ink housing. Some ink particles may adhere to the uncharged areas of the tape to provide a slight background coloration which reduces the clarity and contrast of the desired image after fixing. Accordingly the sniffer head 41 is positioned to draw off the conductive particles from the background areas where a high-level charge has not been applied. The temporarily inked, background-cleaned web then passes upwardly and between pressure-fixing rolls 38, 40, between which the particles are firmly pressed into the surface of the dielectric web to provide a permanent record of the information originally denoted by the selective charges on the web.

The background particles removed through sniffer head 41 are pulled upwardly through tube 42 into the central or tangential input connection 43 of cyclone separator 44. The heavier particles entering port 43 fall downwardly into collection box 46, and inasmuch as these particles fall within the appropriate range for ink use, they are retained in box 46 until valve 47 is again opened. The lighter particles, representing fines or undesired portions of the material, are drawn upwardly through port 45, conduit 48, and are trapped in filter 50. Air from this filter is pulled through conduit 51, pump 52, and tube 53 for discharge into the atmosphere.

INKER HOUSING

Salient portions of the ink housing, including upper chamber 35 which retains the conductive, opaque particles for engaging the charged portions of the web, are depicted in FIG. 2. As there shown the reference plate 36 is pivoted at its lower end portion over a pivot arm 90 secured to a support 91 affixed to support wall 92, and the upper portion of anvil 26 is likewise pivotally connected to another arm 93 secured at its opposite end to a support 94 on the wall 92. With this arrangement the anvil 36 can be displaced upwardly and to the left as indicated generally by the arrows 95, 96 to enable the operator of a page printer system embodying the novel inking system described herein to readily thread the web into the ink station when the system is initially conditioned for operation. Particles dropped downwardly from tube 34 strike the curved portion of plate 97 which, together with plate 98 at the opposite side of the input channel, deflects the particles downwardly into the main powder supply 100 within chamber 35 to provide a supply of the powder particles for contacting the charged dielectric web. Side plate 97 is apertured to define an overflow opening 101 in the sidewall through which particles can drop downwardly between walls 102, 103 and into the main ink reservoir 19 and accumulate in a mass designated 104. Aperture 101 is in effect an overflow vent through which any excess accumulation of the particles are discharged into the mass 104. Accordingly the level of the powder particles within the ink is always kept at a predetermined level.

That portion of the powder mass which passes downwardly past aperture 101 is constrained within the channel formed by portions 97, 98 and the lower portion of plate 97 is bent to define a first angled portion 105 and a substantially horizontal portion 106 which is terminated in an arcuate lip 107. The extremity of lip 107 is positioned, with respect to the lowermost portion of guide plate 98, so that the powder particles falling downwardly are aligned at an angle which causes the particles to assume a position indicated by slanted line 108, terminating below the lip 107. This angle is termed the "angle of dynamic repose" in the art, and is determined by the position at which the freely flowing particles comes to rest when dropped downwardly from a central point. Thus, even with the anvil 95 rotated upwardly out of the way and not engaging the powder mass 100, when the system is initially loaded with powder particles there is not an overflow over the lip 107 down into the mass 104. Because the diameter of the particles used in the inking operation is very small, for example of the order of 50 microns, in the mass 100 the particles behave much as a fluid so that after the anvil is displaced away from the body of the ink and the paper web is placed adjacent the ink structure,

return of anvil 36 to the position indicated in FIG. 2 displaces the web into the operating position and the powder mass 100 assumes the configuration shown.

A wind or air deflection assembly 110 is shown affixed in the space between deflection plate 98 and the dielectric web as it passes over the rear of anvil 36. More specifically, deflector assembly 110 comprises a base plate 111 affixed by a pair of screws 112, 113 to a support base (not visible) of the ink structure. The plurality of chevrons or air deflector vanes 114 extend from the base 111 at substantially right angles as also shown in FIG. 3. As the web is displaced rapidly upward, air is pulled along by friction to create a movement which entrains a few of the powder particles in mass 100. The positioning and curvature of the vanes 114 sets up semicircular air currents, deflecting most of the air around the chevrons to drop the entrained particles back into the mass 100. It is also noted that, as the web emerges from the ink between the top of anvil 36 and lip 115 of deflector plate 98, the web is turned while the particles entrained in the air tend to continue along a straight line to strike lip 115 and drop downwardly into the mass 100 of the powder particles.

FIG. 4 shows in more detail the discharge of the opaque conductive particles from the conduit which receives the appropriately sized particles from the second separating means 23. As there shown, the particles are actually distributed through four separate input conduits 34, 34A, 34B and 34C across the width of the ink between sidewalls 116 and 117. Likewise in addition to a single overflow aperture 101, as visible in FIG. 2, FIG. 3 shows there are actually five such apertures 101, 101A, 101B, 101C and 101D spaced across the width of the ink housing.

A "low ink" signal arrangement is provided within ink reservoir 19. The indicator may comprise a pair of electrodes 77, 78 coupled to a pair of conductors 80, 81 for attachment to a conventional resistance-measuring unit such as an ohmmeter. When the mass of conductive particles falls beneath the level required to maintain contact between plates 77, 78 the value of the effective resistance between these plates is changed to provide a signal to associated equipment that the ink has fallen below a predetermined level within the reservoir. Another signal unit 82 is also provided within the ink housing and includes a microswitch unit 83 which engages a portion of anvil 36 when the anvil is in closed or operating position. A pair of output conductors 84, 85 are coupled to switch 83 to pass a signal to associated equipment as to the position of anvil or reference plate 36 of the ink.

SNIFFER ASSEMBLY

The Sniffer assembly shown in FIG. 2 includes an upper member 120 which is affixed to lower member 121 to define a plurality of channels for pulling air through input port 122, as air is pulled outwardly through conduit 123 under the impetus of pump 52. Although the input area 122 appears as a port in FIG. 2, FIG. 5 shows the general expanse of the input area 122 which is actually a channel defined in the upper chamber 120 of the slitter assembly 41. A plurality of fastening screws 124 are passed through the apertured portions of upper member 120 for receipt in the correspondingly tapped portions of lower plate 121. The conduit 123 is connected interiorly to a first lateral channel 125, in its turn coupled through a pair of connecting lateral channels 126 and 127 to the lateral channel 128 near the front of lower member 121. This channel 128 cooperates with the indented portion 122 of upper plate 120 to define an input slot for drawing air from across the entire width of the inked web, to draw off the background ink before the pressure-fixing step. This arrangement has proved very effective with the arrangement indicated in FIG. 1, in that the web portions which should be inked are selectively charged to voltage levels of 500 to 600 volts while the value of the random charges detected in the background area is of the order of 10 to 20 volts. Accordingly there is a variation of at least an order of magnitude between the voltage level in the areas

which should be inked and the random aberrations of transient voltages found in the background areas which should not be inked.

VENTURI FITTING

As illustrated in FIG. 6 the first input connection 11 of the Venturi fitting includes a conical input section for connection to the lower reservoir chamber 19 of the inker housing. Conductive particles within the conical section 11 are pulled downwardly through the arcuate portion 130 and discharged through the nozzle portion 131 of this input section, as air under pressure is provided through the other input connection 13 of the Venturi-type fitting. A joint 132 is provided to unite the input connections and define a suitable aperture for the first input section 11. Accordingly the air under pressure passes around the portion of the first input connection in a manner better shown in FIG. 7, which depicts separating ribs or supports 134 for both positioning the arcuate tapered portion of the first input connection and directing the passage of air under pressure from the other input connection. The conductive particles entrained in the air stream are then passed around curved portion 15 of the Venturi-type fitting for displacement through conduit 16 to the first separation means 18.

A cyclone separator, such as used for the first separation means, is also employed as the means for recovering the usable particles from the sniffer arrangement. Such a separator is depicted in FIG. 8. This structure is now well known in the art and includes a tangential input connection 17 where the airstream with the particles entrained therein is passed into the central body portion of separator 18 to receive a generally circular motion around the wall. Lighter particles, or those of less than a predetermined mass, are represented by the broken line 140, and heavier particles, which may include both particles of desired size and those of larger than desired size, are depicted by the solid line 141. In that a pressure lower than atmospheric pressure is provided to the upper input connection 20, the fines, or the lighter impurities and particles of less than the desired mass, are drawn upwardly into aperture 142 and through the first exit 20 for collection in the elutriation box 60 or the input filter 66 (FIG. 1). Heavier particles, including the desired ink particles and those of larger than desired mass, drop downwardly for discharge through the other output connection 22 into the input portion of the vibrator separator. The particular mass of the particles which will be drawn upwardly and those which will be drawn downwardly can of course be adjusted by regulating the pressure in the system, with suitable manipulation of adjustment screw 64 on the metering cock 63 in FIG. 1.

To assist those skilled in the art to practice the invention, the value of parameters measured during operation of a preferred embodiment of the invention will be given. It is understood that these values are given by way of illustration only and in no sense by way of limitation.

In the preferred embodiment, as motor 71 was energized to operate pump 68, about 2.2 cubic feet per minute (c.f.m.) of air was passed through conduit 14 and through the system. There was a pressure drop of approximately 1½ inches of water measured in the Venturi-like fitting 12. Conduits 16 and 22 were both of ½-inch inside diameter by ¾-inch outside diameter. The input connection 17 of the first separation means 18 was positioned 33½ inches above the bottom of Venturi-type fitting 12 and a pressure drop of about one-fourth inch of water was measured in the conduit 16. There was only a minimal pressure drop in the cyclone separator 18. A ¾-inch inside diameter by 1-inch outside diameter conduit 20 was provided to form the connection between the upper output port of the cyclone separator and the larger conduit 21, which was 1-inch inside diameter by 1¼ inches outside diameter. The pressure drop measured in the elutriation box 60 during operation was 2¼ inches of water.

SUMMARY

The inventive system provides a novel particulate material handling system, which may be used as the inking station for an electrostatic printing system. The ink is transported by a completely pneumatic system to the inking position where the charged web picks up ink particles. There is no mechanical handling of the ink throughout the closed system. Not only does the pneumatic displacement of the ink particles avoid damage to the fragile particles, but actually the quality of the ink particles in the inker itself has been determined to be significantly improved over the quality of particles received from the manufacturer. Evidently, this is caused by the continuing recirculation of the ink which breaks up the agglomerates, reduces the satelliting, and continuously refines the ink by removing the fine impurities in the elutriation box 60 and in the input filter 66 while concomitantly eliminating the larger-than-desired impurities through the vibrator separator 23. This pneumatic transfer system for the inked particles has proved so successful in providing particles only of the appropriate size within the inking chamber that it may replace previously considered systems for processing and refining the ink particles to insure there is no resin coating surrounding the carbon and to make certain that only particles of appropriate diameters are utilized in the inking process. The excess or background particles trapped by the sniffer apparatus are returned periodically each time the system is energized, by simply opening a valve and dumping the particles back into the inker chamber.

While only a particular embodiment of the invention has been described and illustrated, it is apparent that various modifications and alterations may be made therein. It is therefore the intention in the appended claims to cover all such modifications and alterations as may fall within the true spirit and scope of the invention.

I claim:

1. For use with an electrostatic printing system, an inker station comprising; means for defining a lower reservoir chamber, input means defining an entrance channel in which ink particles are received and directed downwardly for free flow into an inking area, and means in the inking area providing a lip projecting above the point at which the particles freely halt in assuming the dynamic angle of repose so that ink particles are not dumped over the lip to fall downwardly into the reservoir as ink particles are provided at the input channel, and a portion of said entrance channel being apertured to define at least one overflow opening for allowing excess ink particles to fall downwardly through an overflow channel into the lower reservoir chamber and thereby maintain a constant ink level.

2. For use with an electrostatic printing system, an inker station comprising; means for defining a lower reservoir chamber, input means defining an entrance channel in which ink particles are received and directed downwardly into an inking area, a portion of said entrance channel being apertured to define at least one overflow aperture for allowing excess ink particles to fall downwardly through an overflow channel into the lower reservoir chamber, and means positioned within said lower reservoir chamber for providing a signal related to the level of ink particles in said chamber.

3. For use with an electrostatic printing system, an inker station comprising; means for defining a lower reservoir chamber, input means including a first plate and a second plate spaced from said first plate to define an entrance channel, said first plate including a first portion apertured to define an overflow opening, a second portion angled relative to the first, and a third portion which is substantially horizontal and terminates in an arcuate lip above the point at which the ink particles freely halt in assuming the dynamic angle of repose so that no particles are dumped over the lip to fall downwardly into the lower reservoir chamber as ink particles are provided at the entrance channel.