

Feb. 19, 1963

R. S. COOK

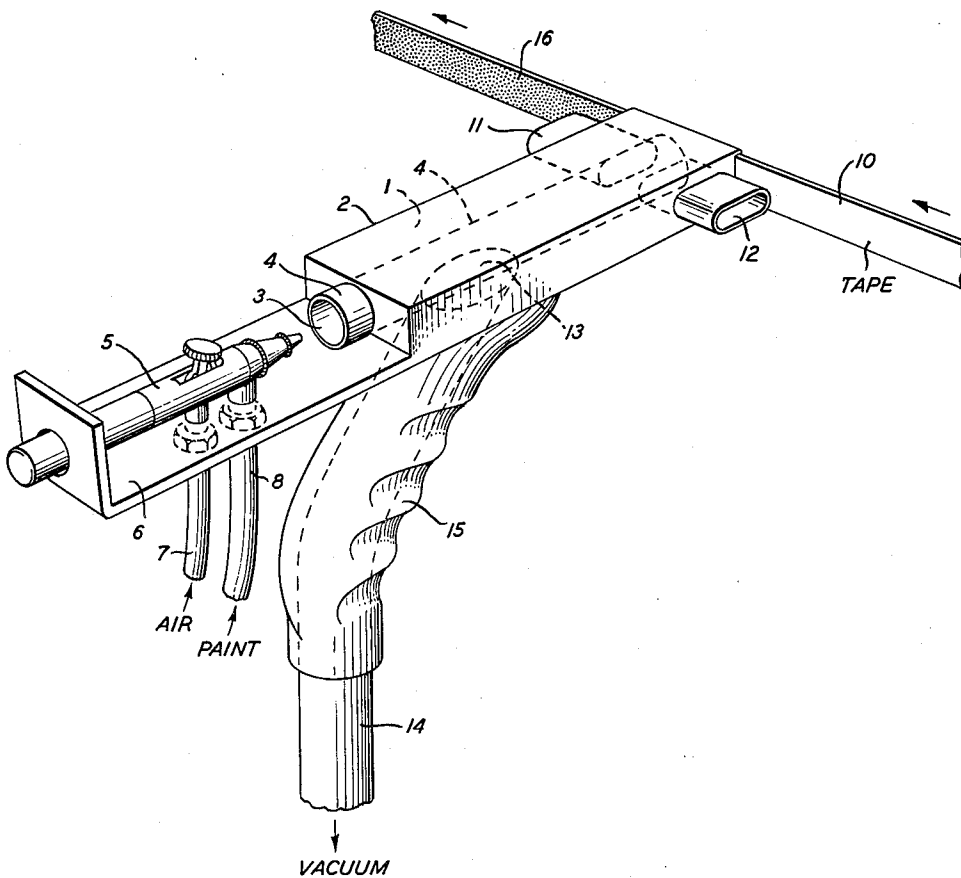
3,077,859

APPARATUS FOR APPLYING A DISPERSION COATING  
TO A SURFACE, SUCH AS A TAPE

Filed Nov. 4, 1958

2 Sheets-Sheet 1

FIG. 1



INVENTOR  
R. S. COOK  
BY *B. S. Stoddard*  
ATTORNEY

Feb. 19, 1963

R. S. COOK  
APPARATUS FOR APPLYING A DISPERSION COATING  
TO A SURFACE, SUCH AS A TAPE

3,077,859

Filed Nov. 4, 1958

2 Sheets-Sheet 2

FIG. 2

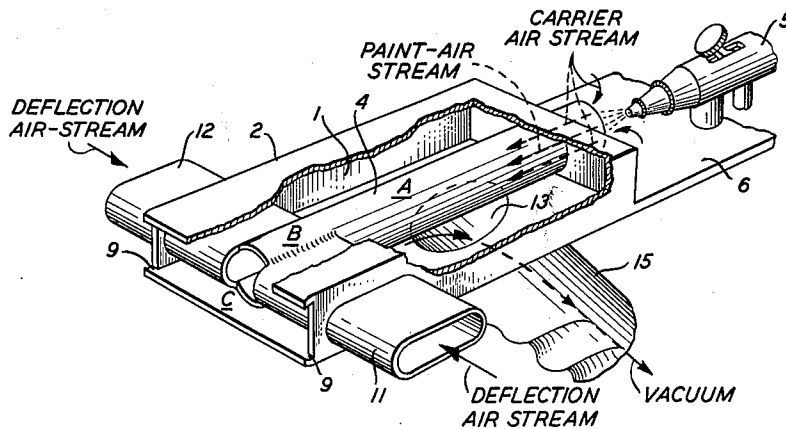


FIG. 3A

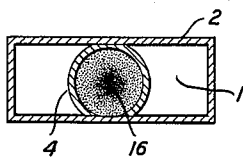


FIG. 3B

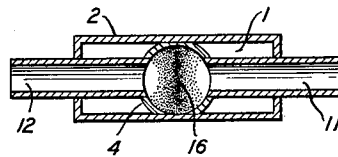
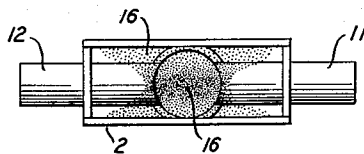


FIG. 3C



INVENTOR  
R. S. COOK  
BY *B. Stoddard*  
ATTORNEY

1

3,077,859

## APPARATUS FOR APPLYING A DISPERSION COATING TO A SURFACE, SUCH AS A TAPE

Robert S. Cook, Morristown, N.J., assignor to Bell Telephone Laboratories, Incorporated, New York, N.Y., a corporation of New York

Filed Nov. 4, 1958, Ser. No. 771,922

3 Claims. (Cl. 118-326)

This invention relates to a method of, and apparatus for, forming dispersion coatings and, more particularly, to a self-enclosed spray system for forming dispersion coatings of uniform thickness and density.

The formation of dispersion coatings on various objects is of interest in many different processes and types of equipment. One important field of interest is the fabrication of magnetic recording drums each having a multiplicity of recording tracks which have their external surfaces formed by magnetic dispersion coatings. It is desirable that these recording tracks should be made in such a manner that they will have high recording sensitivity and will provide good signal reproduction with satisfactory signal-to-noise ratio. These characteristics are determined by such factors as the thickness of the recording tracks and the degree of uniformity of the distribution and density of the metallic particles which form the magnetic coatings on the tracks since the inherent magnetic noise amplitude is somewhat proportional to these conditions in different unit areas of the tracks.

Accordingly, it is an object of this invention to provide an improved method and means for forming dispersion coatings.

Another object of the invention is to provide an improved self-enclosed spray system for forming dispersion coatings of uniform thickness and density.

It is also an object of this invention to provide an improved self-enclosed spray system having a controlled environment for forming an evenly dispersed coating on a selected portion of the surface of an object without the necessity for masking other portions of this surface.

These and other objects of the invention are accomplished by employing an air brush for directing a cone-shaped spray of fine particles into one end of a small chamber having its other end provided with an output opening adapted to be placed adjacent to an object which is to be coated. The chamber is provided with air ducts or deflection tubes on opposite sides thereof near the output opening. Air supplied through these ducts serves to reshape the spray by spreading its center so as to provide more even dispersion of the particles. The chamber is further equipped with a vacuum source for controlling the rate of entry of air coming into the chamber from the deflection tubes. The vacuum source also functions to draw out or remove any particles of the spray material which do not stick to the object to be coated.

These and other features of the invention are more fully discussed in connection with the following detailed description of the drawing in which:

FIG. 1 is a perspective view of one embodiment of an improved self-enclosed spray system in accordance with this invention and illustrating the manner in which it is positioned against a recording track;

FIG. 2 is a three-dimensional view partly in section of the spray system and showing its internal construction; and

FIGS. 3A, 3B, and 3C are schematic diagrams representing the distribution and concentration of the coating material in the air stream at those points in the spray system that are indicated by the reference characters A, B, and C in FIG. 2.

In FIGS. 1 and 2, the spray system is shown to include a chamber 1 formed by a rectangular housing 2.

2

The chamber 1 is provided at one end with an input opening 3 constituted by the projecting end of a hollow cylindrical tube 4 which extends longitudinally through the chamber 1. Adjacent to this input opening 3 is a conventional air brush 5 which is mounted in any convenient manner, such as upon a bracket 6 which may be an extension of the bottom of the housing 2. The air brush 5 is equipped with an input 7 for supplying pressurized air and another input 8 for supplying the material which is to form the dispersion coating.

The chamber 1 is provided at its opposite end with a relatively large output opening 9 which, if desired, may be shaped in the manner indicated in the drawing so as to fit snugly against the particular object that is to be coated. This object may, for example, be a magnetic recording tape 10 in which case the output opening 9 may be so shaped as to enclose a portion of the surface of the tape 10. By thus enclosing the surface to which the dispersion coating is to be applied, the escape of fumes or off-spray particles is prevented. In addition, this construction avoids the necessity for masking or covering any adjacent surface area which is not to be coated.

As is indicated in the drawing, the tube 4 extends through the chamber 1 almost to the output opening 9 but terminates a short distance therefrom. This end portion of the tube 4 is intersected on opposite sides thereof by two air ducts 11 and 12 which function as deflection tubes in a manner that is explained hereinafter. These air ducts 11 and 12 project through opposite sides of the housing 2 in the manner illustrated in the drawing.

An opening 13 is cut in the bottom of the chamber 1 for admitting one end of a pipe or hose 14 which is connected to a conventional adjustable vacuum source. As was stated above, the vacuum thus supplied serves to control the rate of entry of air coming into the chamber 1 through the air ducts 11 and 12. It is to be noted that the opening 13 is so located that it is nearer to the input end of the chamber 1 than it is to the output end of the chamber 1. By thus separating the vacuum opening 13 from the output opening 9 of the chamber 1, undesirable turbulence of the air stream is avoided.

This spray system may be mounted in a stationary manner in which case the object to be coated would be placed against the output opening 9. When this object is in the form of a magnetic recording tape, such as the tape 10, it can be moved at a uniform rate of speed across the opening 9, such as in the direction of the arrows shown in FIG. 1, while it is receiving the dispersion coating.

If it should be desirable for the object to remain stationary, then the spray system can be moved over it at a constant rate of speed by means of a handle 15 which may be attached to the bottom of the housing 2. When the spray system is to be used in this manner, it should be placed closely against the surface that is to be coated. This handle 15 may be in the shape of a pistol grip, as is represented in FIG. 1, and may be fabricated of any suitable material, such as molded plastic material. As a matter of convenience, the handle 15 may be formed in a hollow manner so that the vacuum hose 14 can extend therethrough as is shown in FIG. 1.

It is to be understood that the spray system of this invention may be employed for forming evenly dispersed coatings of fine particles of various substances on different kinds of objects. As was stated above, one important field of use is the production of magnetic coatings on magnetic recording drums or tapes. When the invention is used for this purpose, the input 8 of the air brush 5 is connected through a conventional circulation system to a receptacle containing appropriate material for forming the magnetic dispersion coating. This material may be a paint-like compound of very fine particles of magnetic

material, such as a suitable magnetic oxide, thoroughly mixed with a binder, such as lacquer, and a solvent or thinner for keeping the components in a stable solution. As this magnetic paint enters the air brush 5, it is atomized by pressurized air supplied through the input 7 with the result that the air brush 5 produces a narrow cone-shaped spray of extremely small droplets of paint.

At the time when this cone-shaped spray of paint droplets enters the input opening 3 of the chamber 1, the vacuum source 13 draws in through the input opening 3 a carrier air stream, as is represented in FIG. 2, which blends with the paint spray output from the air brush 5. The vacuum source 13 causes the resulting paint-air stream to flow through the passage defined by the tube 4 toward the output opening 9 at such a velocity as to control the spreading of the cone-shaped spray so that its full diameter is not reached until it is about to enter the area influenced by the deflection tubes 11 and 12. Before reaching this point, the paint-air stream will have at some earlier point, such as the point indicated by the reference character A in FIG. 2, a high droplet concentration in the center of its frontal area as is illustrated in FIG. 3A. It can be seen in FIG. 3A that the concentration of the droplets diminishes toward the outer edge of the spray.

When the paint-air stream reaches the area of the deflection tubes 11 and 12, such as at the point indicated by the reference character B in FIG. 2, the air injected laterally into the tube 4 through these tubes 11 and 12 will compress the sides of the paint-air stream thereby spreading its center vertically so that some of the droplets that were in the center portion are now dispersed above and below it as is represented in FIG. 3B. At this point, the pressure in the center of the paint-air stream is slightly higher than the pressure in its upper and lower portions.

This pressure differential is considerably increased when the paint-air stream leaves the output end of the tube 4 and approaches the object that is to be coated, such as the magnetic recording tape 10 that is positioned within the output opening 9 of the chamber 1. In order to achieve this increase in the pressure differential, each of the ducts 11 and 12 is so located as to have a side portion extending a short distance outwardly beyond the output end of the tube 4. Because of this construction, a portion of the opening of each of the ducts 11 and 12 projects beyond the end of the tube 4 in the direction of the output opening 9 as is shown in FIG. 2. Air from these projecting portions of the ducts 11 and 12 serves to further increase the above-mentioned pressure differential.

It is to be noted that air in this horizontal center area is prevented from flowing directly to the vacuum opening 13 by the curvilinear sides of the ducts 11 and 12 which function as baffles to direct the flow of air over the top and bottom flat surfaces of the ducts 11 and 12. The vacuum source 13 consequently draws a higher volume of air from the four corner regions of the output area of the chamber 1 than it draws from the horizontal center portion of this area. This action causes the upper and lower portions of the paint-air stream in this output area to be greatly widened or expanded with respect to the horizontal center portion of the paint-air stream.

The resulting effect produced by this controlled environment at a point located near the output opening 9 of the housing 1, such as the point indicated by the reference character C in FIG. 2, is illustrated in FIG. 3C. Here it can be seen that, while the suction created by the vacuum source 13 has spread the horizontal center portion of the paint-air stream so that it is wider than it was at the point shown in FIG. 3B, it also has, at the same time, considerably increased the extent of the upper and lower portions of the paint-air stream.

It can also be seen in FIG. 3C that the concentration of the paint droplets along an imaginary vertical line at the output end of the housing 1 opposite the center of the tube 4 is higher in the middle than at either end. The distribution of the droplets is gradually reversed as the

hypothetical vertical line is moved laterally across the output opening 9 toward either end thereof. For example, if the assumed line is placed opposite the mid-point of either one of the ducts 11 and 12, then the center portion of the line will not contain any droplets as they will be distributed only along the end portions of the line.

The extent of this reversal of the distribution of the droplets in the area of the output opening 9 is determined by controlling or regulating the rate of entry of air coming into the chamber 1 from the deflection tubes 11 and 12. This control is accomplished by adjusting the degree of vacuum supplied through the vacuum opening 13 so that the higher density of the droplets in the shorter horizontal center portion of the spray at the output opening 9 is balanced or compensated by the longer lengths of the less dense upper and lower portions of the spray. In other words, although the density of the droplets in either the upper or lower portions of the spray at this point is less than it is in the horizontal center portion, this lesser density is compensated by the fact that the length of the horizontal center portion is much less than the length of either the upper or lower portions of the spray. The end result obtained from this balanced condition is that, when the above-mentioned hypothetical vertical line, or the tape 10, is moved across the output opening 9 from one end to the other at a constant rate of speed, it will acquire an evenly dispersed coating of uniform thickness and density.

It can be understood from the above explanation that this desirable result is dependent on the reshaping of the paint-air stream as described above. The importance of reshaping the paint-air stream can be appreciated when it is recalled that the paint-air stream from the air brush 5 initially has a high droplet concentration at its center portion as is illustrated in FIG. 3A. If no substantial change should be made in this condition of the paint-air stream before it reaches the tape 10, then the resulting coating which would be formed on the tape 10 would be much thicker along its horizontal middle portion than it would be along either its upper or lower portions. The formation of such uneven coatings can be avoided by employing the spray system of this invention in the controlled environment described above.

What is claimed is:

1. A spray system for producing a dispersion coating of uniform thickness and density on a surface of an object, said spray system including in combination a housing defining a chamber for forming a controlled environment for said spray system, said housing having at one end means defining an output opening adapted to be positioned against at least a portion of said surface, a hollow tube mounted in said chamber and having an input end protruding externally beyond another end of said housing for receiving both air and coating material in the form of a paint spray, said tube having an output end contained entirely within said chamber and located near said output opening, a source of vacuum connected into said chamber for drawing outside air into the input end of said tube for forming a paint-air stream, and means including a plurality of air ducts for increasing the pressure in the central portion of said paint-air stream while reducing the pressure of its opposite outer portions as it leaves the output end of said tube, said air ducts being disposed in said chamber near said output opening and having output orifices entering into opposite sides of the output end of said tube, each of said ducts having an input orifice at one end thereof protruding externally outside said chamber for admitting outside air to the output end of said tube, and each of said output orifices of said ducts being so constructed and arranged as to have a side portion thereof projecting beyond the output end of said tube in the direction of the output opening of said housing for increasing the difference between said pressures.

2. A spray system for forming a dispersion coating

5

upon only a portion of a surface of an object, said spray system comprising a chamber having at one end means defining an output opening adapted to enclose said portion of said surface, a hollow tube mounted in said chamber and having an output end completely contained within said chamber and positioned near said output opening, said tube having an input end projecting externally beyond another end of said chamber for receiving both air and coating material in the form of a paint spray, a source of vacuum connected into said chamber near the input portion of said tube for drawing outside air into the input end of said tube for forming a paint-air stream, said vacuum source also being adapted for drawing said paint-air stream out of the output end of said tube and in a direction back into said chamber toward the input portion of said tube, and means including a plurality of curvilinear baffles for expanding opposite end portions of the paint-air stream with respect to the center portion thereof when said paint-air stream leaves the output end of said tube, said baffles being attached to opposite sides of the output end of said tube and disposed transversely across the output portion of said chamber with one side edge of each of said baffles protruding beyond the output end of said tube in the direction of the output opening of said chamber, and each of said baffles having an input orifice so constructed and arranged as to protrude outside said chamber for admitting outside air to the output end of said tube for increasing said expansion of said paint-air stream.

3. A spray system for producing a dispersion coating of uniform thickness and density on a surface of an object, said spray system including in combination a housing defining a chamber for forming a controlled environment

6

for said spray system, said housing having at one end means defining an output opening adapted to be positioned against at least a portion of said surface, a hollow tube mounted in said chamber and having an input end protruding externally beyond another end of said housing for receiving both air and coating material in the form of a paint spray, said tube having an output end contained entirely within said chamber and located near said output opening, a source of vacuum connected into said chamber for drawing outside air into said tube, and means including a plurality of air ducts disposed in said chamber near said output opening and having output orifices entering into opposite sides of the output end of said tube, each of said ducts having an input orifice at one end thereof protruding externally outside said chamber for admitting outside air to the output end of said tube, and each of said output orifices of said ducts being so constructed and arranged as to have a side portion thereof projecting beyond the output end of said tube in the direction of the output opening of said housing.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |                   |               |
|-----------|-------------------|---------------|
| 1,661,150 | Birkenmaier       | Feb. 28, 1928 |
| 2,088,542 | Westin            | July 27, 1937 |
| 2,270,579 | Chamberlin et al. | Jan. 20, 1942 |
| 2,514,748 | Di Stefano        | July 11, 1950 |
| 2,646,313 | Peeps             | July 21, 1953 |

##### FOREIGN PATENTS

|         |               |               |
|---------|---------------|---------------|
| 846,841 | France        | Sept. 6, 1939 |
| 614,475 | Great Britain | Dec. 16, 1948 |