

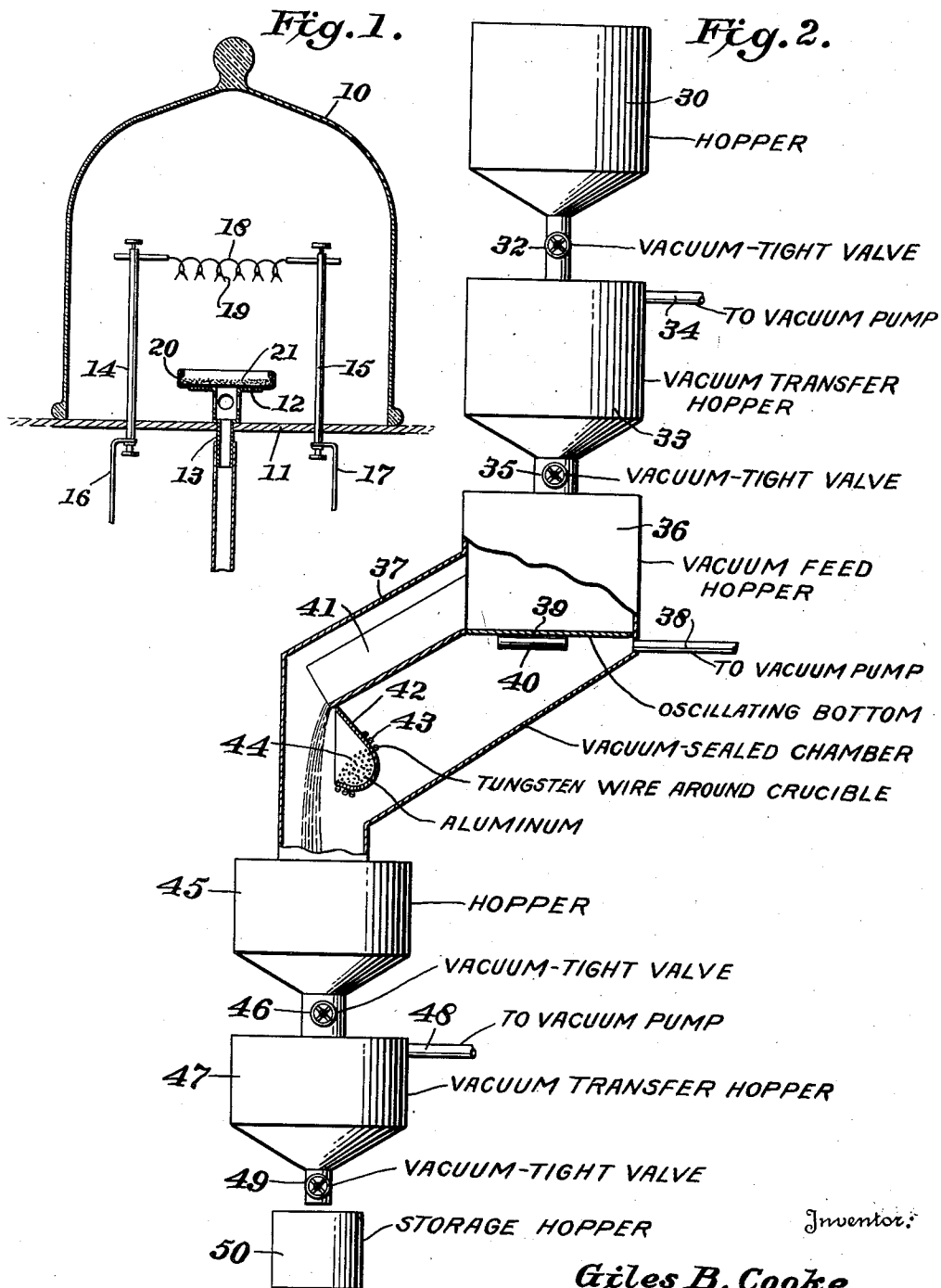
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PROCESS OF ALUMINUM COATING

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PROCESS OF ALUMINUM COATING

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The present invention relates to a process for coating finely divided material and to the product obtained thereby.

It is a principal object of this invention to provide a process for coating and completely covering the exposed surfaces of finely divided material with aluminum.

It is a further object of this invention to provide a vaporlitic process suitable for coating finely divided material with aluminum and affording a substantial saving in the use of the coating metal.

It is also an object of this invention to provide a vaporlitic process whereby finely divided material may be continuously coated with aluminum.

Since the process of my invention is particularly well adapted to coating finely divided mica with aluminum, the following description will refer specifically to the coating of mica although it is to be understood that finely divided material other than mica may be coated by this process.

It is a further object of this invention to provide a product of aluminum coated mica as produced by a vaporlitic process which will have a thin coating of aluminum on its surfaces that is exceedingly smooth and brilliant.

Further objects and advantages of my invention not mentioned above will be apparent by reference to the following specification and drawing in which:

Figure 1 illustrates one form of apparatus suitable for carrying out the vaporlitic process of my invention for coating finely divided mica with aluminum, and

Figure 2 is a diagrammatic illustration of another form of apparatus in which finely divided mica is continuously coated with aluminum by the vaporlitic process of my invention.

Referring to Figure 1 of the drawing, number 10 designates a Bell jar. The Bell jar 10 may be placed on any suitable support or base plate 11 on which is mounted a pump plate 12. The pump plate 12 is provided with a pipe 13 which extends through the base 11 and is connected to a vacuum pump or other source of vacuum. Also supported upon the base 11 are the electrodes 14 and 15 which may be connected to a source of electric current at the binding posts 16 and 17. Connected between the electrodes 14 and 15 and above the base 11 is a tungsten resistance heater wire 18 which will conduct the electricity supplied to the electrodes 14 and 15. Small pieces of aluminum ribbon or wire 19 are suspended from the coils of the tungsten resistance wire 18

in such relation that the aluminum will be vaporized when the tungsten resistance element is heated by the passage of an electric current. Supported upon the pump plate 12 is an open petri dish 20 in which the finely divided mica 21 or other material to be coated is placed.

In carrying out the process of my invention with the apparatus shown in Figure 1 of the drawing and described above, I first place the open petri dish 20 containing the finely divided mica 21 upon the pump plate 12. The Bell jar 10 is then placed on the base plate 11 and surrounding the tungsten resistance wire 18 and the pump plate 12. The interior of the Bell jar 10 is then evacuated and the pressure on the interior is reduced to about one micron. A suitable current of approximately 6 volts at 35 amperes is then passed through the tungsten resistance wire 18 for a period of time approximating 5 seconds. The scrap aluminum 19 is thereby vaporized and deposited on the exposed surface of the mica 21. The vacuum is then broken and the Bell jar 10 removed while the finely divided mica within the petri dish is gently stirred. After stirring, the Bell jar is replaced and the process repeated.

I have found it desirable to remove the Bell jar and gently stir the mica at least four times so that four applications of aluminum to different exposed surfaces of mica will be made. This results in a smooth and uniform coating of aluminum on the finely divided mica particles.

The amount of electricity and the length of time during which the electricity is supplied to the tungsten resistance element may be varied from the values given above and will give varying results. I have found by experimentation, however, that the values given above result in a process which is economical and which produces a smooth and uniform coating of aluminum on mica.

Instead of breaking the vacuum and removing the Bell jar to stir the mica contained in the open petri dish 20 so as to expose different surfaces of the mica to the aluminum vapor, the pump plate 12 may be provided with any suitable motor or vibrator mechanism to periodically or continuously vibrate the petri dish and thus agitate or stir the mica. If a vibrator mechanism is provided to vibrate the petri dish 20 it will not be necessary to break the vacuum in the Bell jar and stir the mica. Also a traveling and vibrating belt might be provided to conduct the mica through the evacuated chamber containing the vaporized aluminum.

I have described above in connection with Figure 1 of the drawing one form of the process of my invention for coating finely divided material such as mica with aluminum. Figure 2 of the drawing diagrammatically shows another form in which finely divided mica is continuously coated by the vaporlitic process of my invention.

Referring to Figure 2 of the drawing, the mica is placed in the top hopper 30 from which it passes through the vacuum-tight valve 32 to the vacuum transfer hopper 33. The vacuum transfer hopper 33 is connected to a vacuum pump or other source of vacuum at the pipe 34. The mica passes from the vacuum transfer hopper 33 through the vacuum-tight valve 35 into the vacuum feed hopper 36. This vacuum feed hopper is positioned within the vacuum chamber 37 which is sealed and connected to a source of vacuum at the pipe 38. The vacuum feed hopper is provided with an oscillating or vibrating bottom 39 which is vibrated in response to any suitable vibrator mechanism 40. An inclined chute 41 also positioned within the vacuum chamber 37 is in communication with the oscillating bottom 39 of the vacuum feed hopper. Suspended from the lower end of the inclined chute 41 is a crucible 42 surrounded with a tungsten wire heater 43. Other means of heating the crucible 42 may be employed such as an induction heater or the like. The crucible 42 is adapted to contain a quantity of coarse granular aluminum 44 which when heated will vaporize to produce an atmosphere of vaporized aluminum within the vacuum sealed chamber 37. If desired, aluminum wire or powdered aluminum, may be used in place of the coarse granular aluminum. The finely divided mica supplied to the oscillating bottom 39 of the vacuum feed hopper flows down the inclined chute 41 and falls through an atmosphere of aluminum vapor into the mica receiving hopper 45. The aluminum coated mica collected in hopper 45 is passed through the vacuum-tight valve 46 into the vacuum transfer hopper 47 which is connected to a source of vacuum at the pipe 48. The aluminum coated mica from the vacuum transfer hopper 47 is passed through the vacuum-tight valve 49 to a storage or collection hopper 50.

In carrying out the continuous process of vaporlitically coating finely divided materials such as mica with aluminum in connection with the above described apparatus, the mica is placed in the hopper 30. The valve 32 is then opened and the mica passes therethrough into the vacuum transfer hopper 33 after which the vacuum-tight valve 32 is again closed. The vacuum transfer hopper 33 is then evacuated to a pressure of approximately one micron by means of the pipe 34 connected to a source of vacuum. After a vacuum has been created in the vacuum transfer hopper, the vacuum-tight valve 35 is opened allowing the mica to pass into the vacuum feed hopper 36 located within the vacuum sealed chamber 37. The vacuum sealed chamber 37 is maintained in an evacuated condition at a reduced pressure of approximately one micron by means of the pipe 38 connected to the source of vacuum. The mica collects upon the oscillating or vibrating bottom 39 of the vacuum feed hopper 36. The vibration of the bottom 39 causes the mica collected thereon to flow down the inclined chute 41 and fall past the source of aluminum vapor, i. e. the mouth of the crucible 42 containing the heated aluminum 44, from which the aluminum vapors are given off.

It is of course understood that with a vacuum maintained in the chamber 37 and the crucible heated by the tungsten wire heater 43 there will be an atmosphere of vaporlitic aluminum maintained in the chamber 37. It is to be noted, however, that the mica falling from the chute 41 directly passes the mouth of the crucible 42 and is thereby subjected to a concentrated vapor of aluminum which is deposited in the form of a thin continuous coating completely covering the exposed surfaces of the falling mica. The aluminum coated mica collects in the hopper 45.

When it is desired to remove the aluminum coated mica collected in the hopper 45, a vacuum is created in the vacuum transfer hopper 47. The vacuum-tight valve 46 is then opened allowing the aluminum coated mica to pass into the vacuum transfer hopper 47. The valve 46 is again closed and the vacuum is broken in the vacuum transfer hopper 47. Thereafter the vacuum-tight valve 49 may be opened and the aluminum coated mica may be collected in the storage hopper 50.

A second vaporizing unit similar to that described above in connection with Figure 2 of the drawing may be used and the mica receiving hopper of such second unit corresponding to the hopper 30 in the first vaporizing unit may be substituted for the storage hopper 50 of the first vaporizing unit. Or, if desired, the aluminum coated mica collecting in the vacuum transfer hopper 47 may be valved directly into a second vacuum sealed chamber containing the aluminum vapor. If the coated mica is passed directly from the hopper 47 to the second vacuum sealed chamber corresponding to the chamber 37 of the first vaporizing unit, it will not be necessary to break the vacuum in the hopper 47. It is of course not possible to examine the coated mica obtained from the first unit when passing the mica directly from hopper 47 to the second vacuum sealed chamber unless a window or other observation means is provided in the wall of the hopper 47. By using two or more of these vaporizing units in succession, any degree of thickness of aluminum coating on the finely divided mica may be continuously applied.

In connection with the vaporizing unit for continuously coating finely divided mica with aluminum it has been previously pointed out that the falling mica from the inclined chute 41 directly passes the mouth of the crucible 42 in which the aluminum is vaporized. The crucible 42 is of such shape and positioned in such relation to the inclined chute 41, as shown in Figure 2 of the drawing, that the aluminum vapor is directed in a concentrated stream against the falling mica. Other means of concentrating the aluminum vapor against the falling mica may be employed, however, and as an example it may be stated that cathode rays can be used to ionize the aluminum vapor and thus direct a stream of such vapor against the falling mica. For instance, deflecting plates may be positioned at the mouth of the crucible. The source or filament for the cathode rays will then be positioned within the crucible and the deflecting plates at the mouth of the crucible will direct the cathode rays comprising the stream of ionized aluminum vapor at the falling mica.

The vaporlitic process for coating finely divided mica with aluminum which I have described above results in an aluminum coated mica product in which the particles of mica have an extremely smooth and uniform coating of aluminum on

their surfaces. The aluminum coating on the surfaces of the mica can be determined as being produced from the aluminum vapor by a metallographic examination or X-ray defraction studies. The aluminum coating on the mica surfaces is characterized by having a purity greater than that of customary aluminum coatings and in fact the distillation of the aluminum upon the surface of the mica enhances the purity of the coating. I therefore am enabled by my vaporlitic process to obtain an aluminum coated mica product having a thin coating of aluminum of extreme smoothness, brilliance and purity.

While I have disclosed above a vaporlitic process for coating finely divided mica with aluminum, it should be understood that other granular or finely divided materials may be coated with aluminum by this process. It is also possible in using the form of my invention shown in Figure 1 to coat a strip material having a roughened or granular like surface with a coating of aluminum. For example, I have found a strip of material such as "celotex" which has a roughened or granular surface may be coated on its exposed surface with aluminum by the process of my invention. "Celotex" is composed of vegetable or organic material. Mineral or organic strips such as "Transite" which is an asbestos board having a roughened surface may also be coated with aluminum by the process of my invention.

I claim:

1. The process of coating finely divided material with aluminum in a sealed chamber, comprising evacuating said chamber and subjecting the material to an atmosphere of concentrated vaporized aluminum within said evacuated chamber while the particles are freely suspended and passing the vapor source whereby the material is coated with aluminum.

2. The process of coating finely divided mica with aluminum in a sealed chamber, comprising evacuating said chamber and subjecting the mica to an atmosphere of concentrated vaporized aluminum within said evacuated chamber while the

particles are freely suspended and passing the vapor source whereby the mica is coated with aluminum.

3. The process of continuously coating finely divided material with aluminum comprising the steps of placing the material in a receiving hopper, conducting the material from said hopper to a vacuum transfer hopper, creating a vacuum in said transfer hopper, conducting the material from said transfer hopper to a vacuum feed hopper positioned within a sealed vacuum chamber, evacuating said vacuum chamber and maintaining an atmosphere of vaporized aluminum within the evacuated chamber, passing the material from said vacuum feed hopper through the atmosphere of vaporized aluminum and as freely suspended particles through a concentrated atmosphere of aluminum vapor at the vapor source whereby the material is coated with aluminum and thereafter conducting the coated material into a second vacuum transfer hopper from which the coated material may be collected at atmospheric pressure.

4. The process of continuously coating finely divided mica with aluminum comprising the steps of placing the mica in a receiving hopper, conducting the mica from said hopper to a vacuum transfer hopper, creating a vacuum in said transfer hopper, conducting the mica from said transfer hopper to a vacuum feed hopper positioned within a sealed vacuum chamber, evacuating said vacuum chamber and maintaining an atmosphere of vaporized aluminum within the evacuated chamber, passing the mica from said vacuum feed hopper through the atmosphere of vaporized aluminum and as freely suspended particles through a concentrated atmosphere of aluminum vapor at the vapor source whereby the mica is coated with aluminum and thereafter conducting the coated mica into a second vacuum transfer hopper from which the coated mica may be collected at atmospheric pressure.

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