

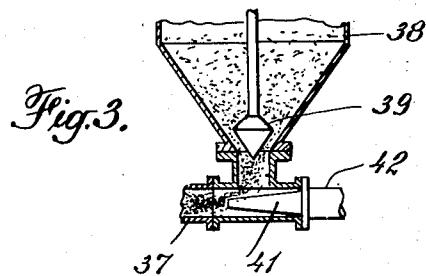
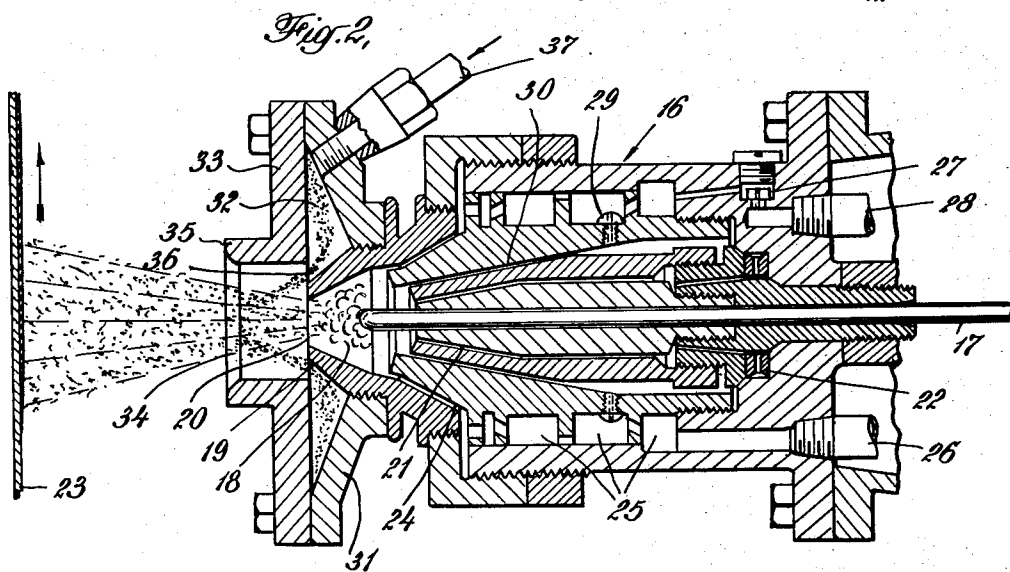
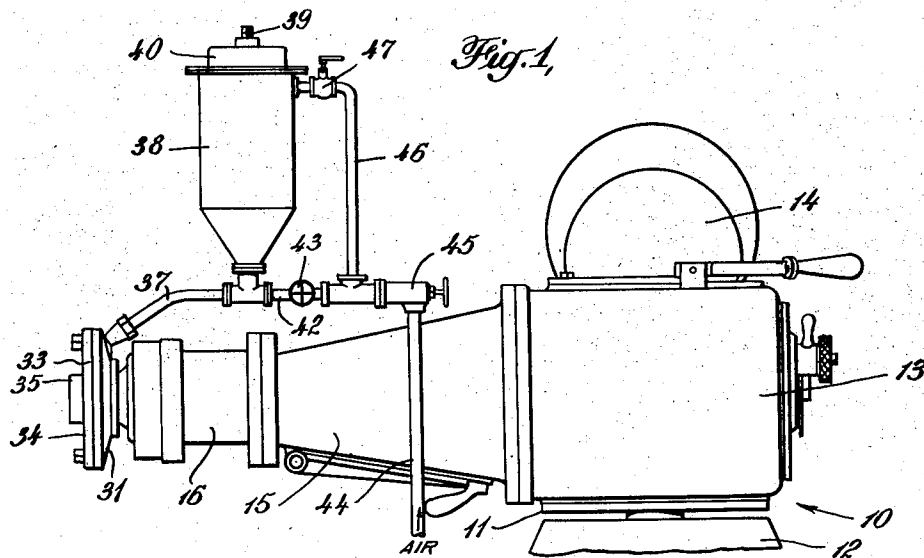
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APPARATUS FOR DEPOSITING FLUENT MATERIALS

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APPARATUS FOR DEPOSITING FLUENT MATERIALS

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3 Claims. (Cl. 91—12.2)

This invention relates to a molten metal spray apparatus, and has particular reference to a means for introducing into the pencil of finely divided molten metal which issues from the metal spray apparatus a fluent material, preferably in the form of a powder for impregnation of the deposited metal when it hardens, for coaction with the molten metal either mechanically or chemically while it is still in the molten state, for acting upon the surface upon which the molten metal is to be deposited in such a way as to effect a thermal bond between the deposited metal and the surface, and for other purposes.

Attempts have been made heretofore to impregnate or mix solid metallic or non-metallic particles with molten metal for various purposes. For example, in the manufacture of anti-friction bearings of the graphite-impregnated type, it has been attempted to blow by means of a current of air or the like, powdered graphite into a stream of molten metal in such a way that when the metal hardens it forms a matrix for the graphite. These attempts have not been successful, largely because the metal is not sufficiently finely-divided or atomized before the graphite is introduced therein, with the result that while the hardened metal contains a small proportion of graphite, the graphite is not uniformly distributed throughout the metal but occurs in relatively large irregular patches, so that the graphite is not adequately available for uniform lubrication of the bearing during operation. Attempts have also been made to mix powdered metals or the like with a flame or pencil of molten metal for the purpose of melting the powdered metal or causing it to combine chemically or mechanically with the molten metal, but these attempts have not been successful, largely because the powdered metal has not been introduced at the proper point in the flame or in the pencil of molten metal, and in the latter case, because the molten metal has not been sufficiently finely divided for intimate mixture with the powdered metal or other material.

In accordance with the present invention, a molten metal spray apparatus is provided, preferably of the general type disclosed in copending application Serial No. 756,076, filed December 5, 1934, whereby the fluent material, whether liquid or powdered metal, non-metal, or mixtures of metal and non-metal, is introduced into the flame and pencil of either molten metal or other material melted in the metal spray apparatus at a point beyond the melting chamber.

More specifically, in the apparatus of the aforesaid copending application, on which the fluent material distributor is preferably an attachment, the material to be initially molten is fed into a substantially closed melting chamber having a restricted orifice and containing a melting zone in which the material is melted and from which it is conveyed and divided into minute particles by means of a tubular envelope of a gas, which preferably contains a component rendering the gas inert or deoxidizing it where it initially contains oxygen, or which contains a fluid material specifically reacting or combining chemically with the molten material. The attachment for connecting the metal spray apparatus of the form described into the apparatus of this invention is mounted over the restricted discharge orifice for introducing into the pencil of molten material within the gaseous envelope the fluent material under pressure from a reservoir, which is either placed under pressure to force the fluent material therefrom and through the gaseous envelope into the pencil, or is so arranged that the fluent material is abstracted therefrom with an aspirating action by means of a current of gas under pressure for forcing the fluent material through the gaseous envelope into the pencil of molten material for intimate commingling therewith.

It will be seen that with the apparatus of the present invention, fluent extraneous material, either liquid or powder, may be effectively and intimately mixed with the finely-divided molten material in such a way that when the material hardens, the initially fluent material is either uniformly distributed throughout the hardened material, or is intimately mixed therewith if it is of the nature producing a chemical action or a solution with the molten material.

For a more complete understanding of the invention, reference may be had to the accompanying drawing, in which:

Figure 1 is a side elevation of the apparatus of this invention;

Fig. 2 is an enlarged axial section through the spray head of the apparatus, showing the arrangement of the fluent material distribution; and

Fig. 3 is an enlarged fragmentary section of the lower portion of the fluent material reservoir, showing the fluent material injector.

Referring to the drawing, numeral 10 generally designates the metal spray apparatus disclosed in the aforementioned application and includes a base 11, preferably pivoted or otherwise

mounted on a suitable support 12, for movement relatively to the surface being sprayed, and carrying the wire feed mechanism-housing 13 and the wire feed motor 14. Secured to the housing 13 is a hollow bracket 15 through which the wire is advanced to the spray head 16, supported by the bracket 15 and shown in enlarged section in Fig. 2.

The wire 17 of metal or other material to be molten is advanced by the wire feed mechanism through the spray head 16 into the melting chamber 18 having the nozzle 19 forming the restricted discharge orifice 20. The combustible gas for heating the melting chamber 18, such as a mixture of acetylene and oxygen, is supplied thereto through passages 21 from a suitable mixing device 22 to which the individual gases are supplied by means not shown. The molten metal or other material is finely-divided and conveyed out of the melting chamber 18 to the surface 23 of deposit by a tubular envelope of compressed gas supplied through passages 24 from connected annular chambers 25 to which the gas is supplied by pipe 26.

As described in the aforementioned application, the tubular envelope gas may be air, which is preferably rendered inert by having mixed therewith an auxiliary gas, such as hydrogen, acetylene, or the like, for deoxidizing it. Alternatively, the auxiliary gas may be an active gas for reducing or reacting with the molten material, as described in said application. This auxiliary gas is supplied to annular chambers 25 through metering port 27 from pipe 28. A portion of the envelope air is bled through metering port 29 into passages 30, which lead it into the melting chamber 18, where the air serves as secondary combustion-supporting air. While the arrangement described is preferred, it may be modified to suit requirements.

Threaded on nozzle 19 as shown in Fig. 2, or otherwise mounted at the discharge orifice 20 is a dished disc 31 which forms with the inclined outer surface of nozzle 19 an annular depression. Screwed or otherwise secured to the disc 31 and forming therewith the annular chamber 32 is a nozzle plate or ring 33 having central opening 34 encircled by the flange 35 and aligned with discharge orifice 20 of nozzle 19. Opening 34 is larger in diameter than the end of nozzle 19, so that an annular passage 36 leading from chamber 32 is formed.

Discharging into chamber 32 near the periphery thereof is a pipe 37 supplied with fluent material from reservoir 38 in quantity regulatable by needle valve 39 adjustably threaded through the cover 40. The fluent material in reservoir 38 is preferably aspirated therefrom into pipe 37 by an air blast through injector 41, supplied by pipe 42 controlled by valve 43 from source pipe 44, in turn controlled by shut-off valve 45. Preferably connected to pipe 42 between valves 43 and 45 is a branch pipe 46 leading to the upper portion of the reservoir 38 above the fluent material therein and controlled by valve 47, so that, if required, pressure may be applied to the material from above.

In operation, assuming that it is desired to mix a fluent dry material, such as powdered graphite, with a metal, such as babbitt, for the purpose of depositing a self-lubricating bearing material on the surface 23, the wire 17 is of babbitt and the graphite is charged into reservoir 38. The metal spray apparatus 10 is then placed in operation to spray a pencil of finely-divided

molten babbitt through orifice 20 by means of the tubular gaseous conveying envelope. The air valves 43 and 45 are opened and the resulting action of injector 41 causes the graphite to be blown under pressure through pipe 37 into annular chamber 32, from which it is uniformly distributed through annular passage 36 into the molten metal pencil, the pressure of the graphite blast being sufficient to penetrate the tubular gaseous envelope, so that the graphite intimately and uniformly commingles with the finely-divided molten material. The mixture of graphite and babbitt is deposited on surface 23 and when the babbitt hardens, it forms a matrix for the uniformly dispersed graphite therein.

The supply of fluent material is preferably regulated jointly by the air blast and by needle valve 39. Where pressure on the fluent material is desired instead of or in addition to the aspirating action, the valve 47 is opened and properly manipulated. Where only aspiration is employed the reservoir cover 40 is provided with an air leak. The inlet from pipe 37 may be arranged tangentially in chamber 32 to impart a whirl to the graphite.

In order to prevent pre-cooling of the molten spraying material by the fluent material blast, a combustible, such as acetylene, hydrogen, or the like, may be mixed with the air from pipe 44 so as to ignite as it mixes with the flame issuing from nozzle 19.

Metallic, as well as non-metallic, fluent materials may be supplied in this way to be mixed or otherwise combined with the molten material, or the fluent material may be a liquid, such as a molten material, heavy oils, tars or waxes, and the like, for effecting combinations of dissimilar materials of practically any kinds that will remain in miscible state under the conditions of operation of the apparatus. For example, powdered metals and metallic compounds, such as metallic aluminum, aluminum oxide, ferro-silicon, and the like, may be initially sprayed with or without molten metal to serve as a fluxing agent for preparing the surface to be sprayed in order to secure a good bond between it and the molten material. Thus, after the fluxing materials have been employed to treat the surface to be sprayed, their supply is shut off and the molten material then deposited alone.

Also, alloys of aluminum and steel provided by spraying the former in powdered form or alloys or mixtures of other metals may be effected in the same manner. Molten lead or other material may be supplied from the reservoir for mixture with finely-divided molten copper or other metal in the sprayed pencil for making copper-lead bearings or the like, the pressure and speed of the conveying envelope largely preventing volatilization of the lead or low melting material mixed with a high melting material. Other advantages of the new apparatus are apparent.

It will be seen that with the arrangement of the present invention, each fine particle of the molten or heat-softened material is kept separate from the adjacent molten or heat-softened particles by the high-pressure, high-speed conveying gas, so that agglomeration and coalescing is prevented, and while so supplied, the molten or heat-softened particles are intimately and uniformly mixed with the particles of fluent material which are distributed between them by the blowing action described. Because of the pressure and speed of the conveying gas and the relatively uniform subdivision of the heat-softened and

fluent particles this intimate and uniform mixture is maintained to the place of deposit.

I claim:

1. In apparatus of the class described, the combination of a first nozzle, means forming a passageway for reception of a rod to be melted in said first nozzle, means for directing a gaseous stream therethrough to melt said rod and spray the molten material through said first nozzle, a peripheral chamber around said first nozzle providing an annular passage disposed entirely in the radial plane of the outlet of said first nozzle, a second nozzle extending from the outer periphery of said passage forwardly from said first nozzle and concentric therewith, and means for supplying finely divided solid material to said chamber for introduction into said stream through said passage.

2. In combination with a molten metal spray apparatus having a nozzle provided with a single discharge orifice, a passageway for receiving a metal rod to be melted, at least one passageway for supplying a combustible gas and a chamber wherein the gas is burned to melt said rod in said nozzle and spray the molten metal through said orifice, a chamber surrounding said nozzle for supplying finely divided solid material for mixture with the metal spray issuing therefrom,

and a second nozzle on said chamber concentric with said first nozzle and forming with the latter an annular passage around the orifice of said first nozzle through which said material is admitted into the spray, the inlet end of said second nozzle being positioned substantially in the radial plane of the end of said first nozzle, whereby said passage is positioned substantially in said plane.

3. In combination with a molten metal spray apparatus having a nozzle provided with a single discharge orifice, a passageway for receiving a metal rod to be melted, at least one passageway for supplying a combustible gas and a chamber wherein the gas is burned to melt said rod in said nozzle and spray the molten metal through said orifice, a chamber surrounding said nozzle for supplying finely divided solid material for mixture with the metal spray issuing therefrom, said chamber being formed by the exterior surface of said nozzle and an enclosing wall having an interior surface lying substantially in the plane of the end of the nozzle and an opening surrounding said nozzle and providing with the exterior surface thereof an annular passage lying substantially in the radial plane of the end of the nozzle orifice, and a second nozzle projecting forwardly from said wall concentrically with said first nozzle.

PURLING ALLEN BLEAKLEY.