Nov. 14, 1933. D. D. TAYLOR 1,934,891

METAL SPRAYING APPARATUS

Filed May 25, 1932 2 Sheets-Sheet 1

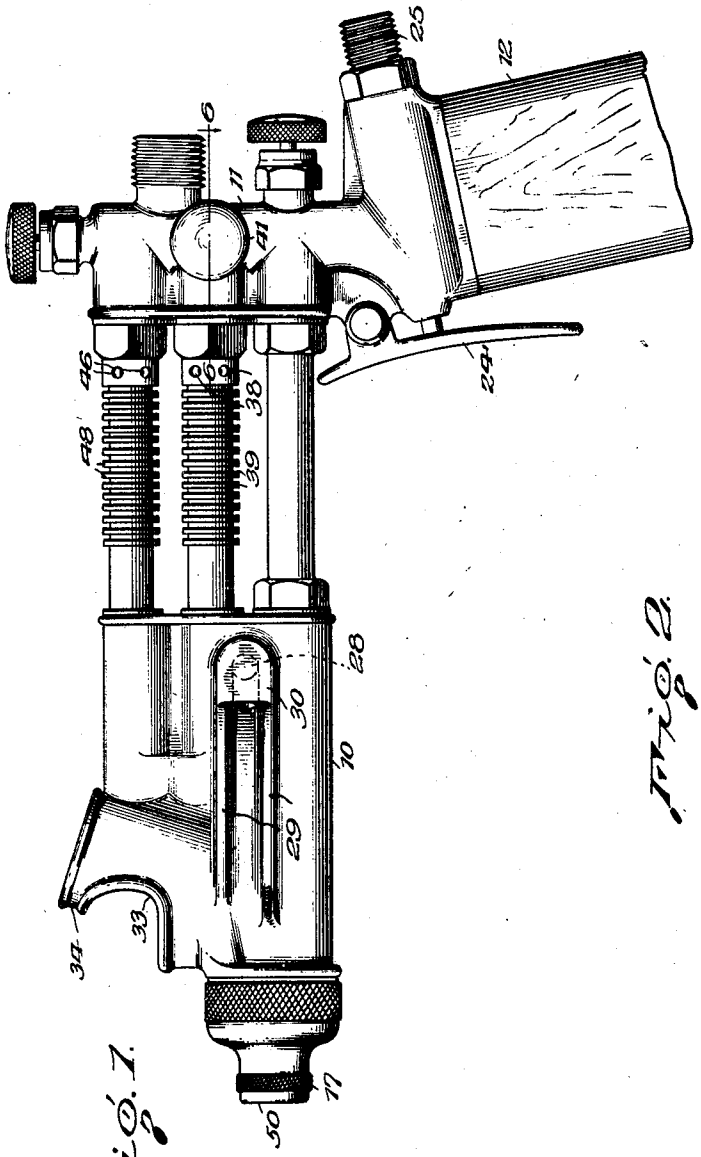


Fig. 1.

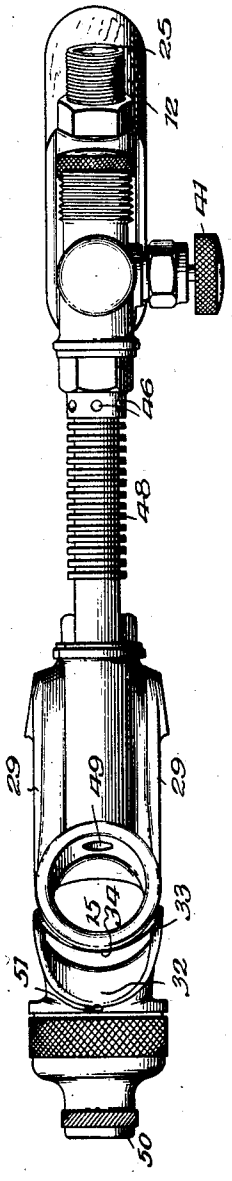


Fig. 2.

Inventor
D. D. Taylor
By Church & Church
His Attorneys

Nov. 14, 1933. D. D. TAYLOR 1,934,891

METAL SPRAYING APPARATUS

Filed May 25, 1932 2 Sheets-Sheet 2

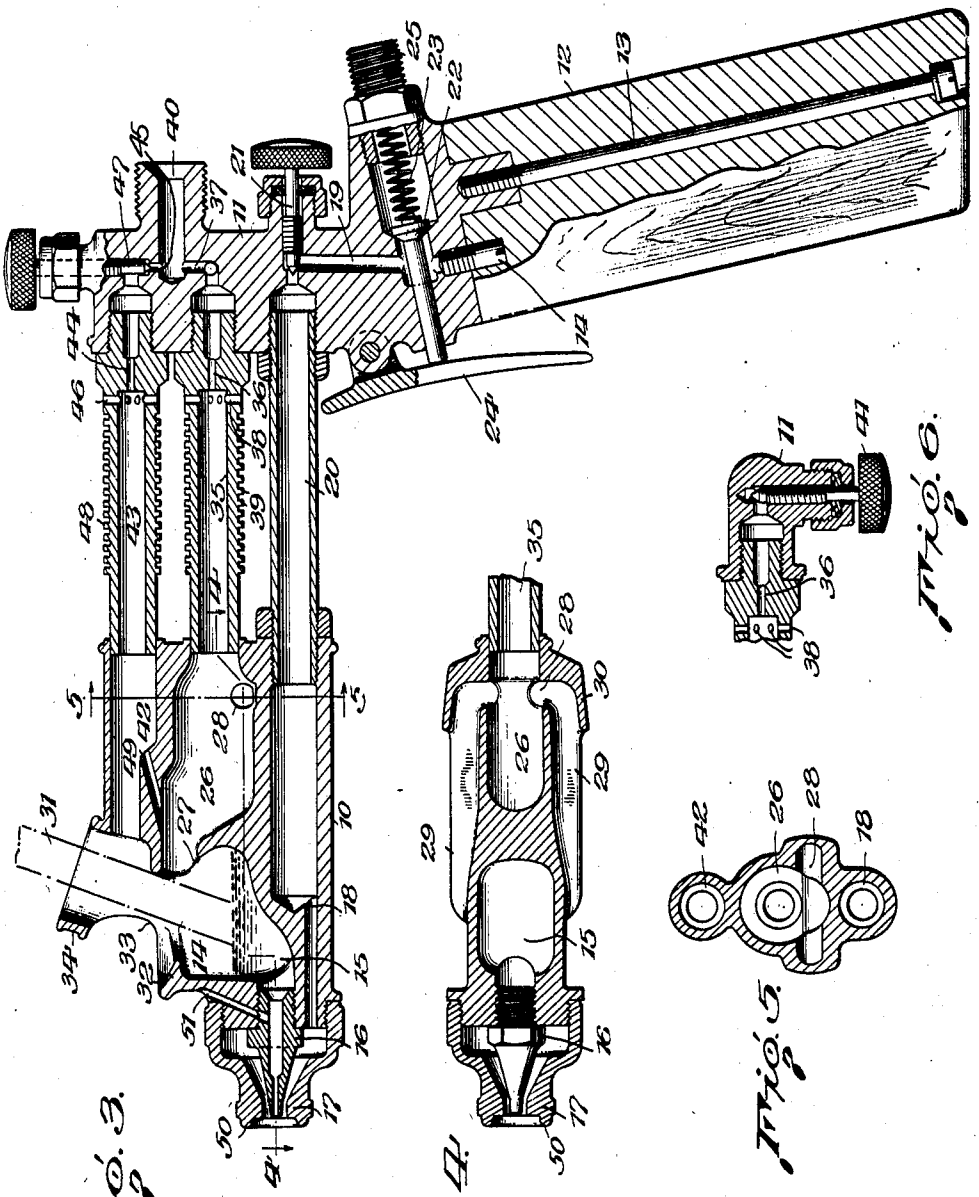


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Inventor
D. D. Taylor;
By Church & Church
his Attorneys

Patented Nov. 14, 1933 1,934,891

UNITED STATES PATENT OFFICE

1,934,891

METAL SPRAYING APPARATUS

Donald D. Taylor, Duncannon, Pa., assignor to Advance Engineering Corporation, Duncannon, Pa., a corporation of Pennsylvania

Application May 25, 1932. Serial No. 613,531

13 Claims. (Cl. 91—12.2)

My invention relates to improvements in metal spraying equipment and has to do, more particularly, with improvements in pistols for spraying such metals as lead, tin, zinc and similar metals, either pure or alloyed.

The primary object of my invention is to provide a metal spraying device in which the molten metal is protected from oxidation.

Another object of my invention is to provide a metal spraying pistol which will satisfactorily handle metal in bar form and maintain the metal to be sprayed at the proper heat.

Another object of my invention is to provide a metal spraying pistol in which an adequate supply of molten metal at proper temperature is always available even when the pistol is being used to spray large quantities of metal, as in the case of filling up large depressions in such objects as dented automobile bodies and fenders.

Another object of my invention is to provide a metal spraying pistol having a well or sump for holding a reserve of molten metal especially when spraying is interrupted for a short period, which pistol may be operated in the various positions commonly necessary without spilling or loss of molten metal.

Another object of my invention is to provide a metal spraying pistol which will project metal in a more finely and uniformly divided state than attainable with previous devices.

Another object of my invention is to provide a metal spraying pistol the heated body portion of which is of thin cross section and light weight, yet which is so constructed as to be adequately heated throughout its entire extent, even when employed to spray large quantities of metal.

Another object of my invention is to provide a metal spraying pistol which may instantly be adjusted for use as a smoothing torch for working the sprayed coating or filling, and may subsequently be readjusted for immediate use in resuming metal spraying.

Another object of my invention is to provide a metal spraying pistol which is substantially foul-proof, yet which, if clogged, may be automatically blown clear without disassembling its parts.

Further objects, and objects relating to details and economies of construction and operation will definitely appear from the detailed description to follow. In one instance, I accomplish the objects of my invention by the means described in the following specification. My invention is clearly pointed out in the appended claims. A preferred embodiment of my invention is illustrated in the accompanying drawings, in which:

Figure 1 is a view, taken in side elevation, of my preferred form of pistol, a portion of the handle being broken away;

Fig. 2 is a top view of the pistol shown in Fig. 1;

Fig. 3 is a vertical sectional view of the same pistol;

Fig. 4 is a detail horizontal sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a transverse sectional view taken on the line 5—5 of Fig. 3; and

Fig. 6 is a detail sectional view of the heat control valve taken on the line 6—6 of Fig. 1.

The same reference numerals refer to the same parts throughout the several views.

Referring now to the numbered parts of the drawings, in which I have illustrated a preferred form of my invention, there is shown a metal-spraying pistol comprising a head member 10 supported from a control member 11 having a handle or grip portion 12 of low heat-conductivity attached thereto by means of an assembly screw 13 and dowel pin 14. Head member 10 is preferably made in the form of a light casting of relatively infusible metal having walls of thin cross-section to reduce weight, and is provided with an open-top chamber 14 within which bar or strip coating-metal stock 31 is disposable for support and feeding. The lower portion of the chamber 14 constitutes a sump 15 capable of holding a quantity of molten metal. Threaded into the lower part of the sump 15 and communicating therewith, is a spray jet 16, preferably of steel, through which molten metal is drawn from the sump 15 by the action of an air jet 17 concentrically disposed therearound by threaded attachment to the head member 10. Air jet 17 is supplied with compressed air by means of a duct 18 formed in the head member 10 extending beneath the sump portion 15, and communicating with the air duct 19 in the control member 11 by the air tube 20. A needle valve 21 is provided for adjusting the amount of air passing to the air jet 17, and a plunger valve 22, having a spring 23 and trigger control 24, is provided for positively controlling the passage of air from the coupling nipple 25 adapted to be connected to a compressed air line (not shown). Thus far broadly described, the device is of more or less conventional form and construction. For the purpose of heating the head member 10, and progressively melting coating stock disposed in the chamber 14 to provide molten metal in the sump 15, there is provided a

gas torch having a flame chamber 26 in the head member 10, the primary outlet 27 of which is at the rear edge of the open-top of chamber 14. Supplemental or secondary flame outlets 28 are provided in the flame chamber 26, at each side thereof, and webs 29 and 30 are provided in the casting 10 which absorb and transmit heat, as well as direct the flames issuing from the outlets 28, to the sides of the casting 10 adjacent the sump portion 15 and provide adequate heating thereof to progressively reduce the stock 31 to the molten state. About the forward edge of the chamber 14, diametrically opposite the primary flame outlet 27, is an inwardly extending flange or lip 32 which serves a triple function. Being in the direct line of the flame issuing from outlet 27, it absorbs therefrom, and transmits, to the head 10, a large amount of heat. Further, when the pistol is tilted downwardly, as is often necessary in spraying upon horizontal surfaces, the lip 32 serves as a molten-metal retaining wall, and constitutes an etxension of the sump 15, preventing spilling of metal through the flame opening 33. In such positions, the guard ring 34 holds stock 31 in upright position and prevents its falling from the chamber 14. Probably the most important function of the lip 32, and one assisting in the attainment of the primary object of my invention, is its direction of a portion of the gases of combustion, issuing from flame outlet 27, downwardly and across the surface of the molten and highly heated metal disposed in the sump 15. These gases, by the time they have reached the lip 32, have undergone combustion to the extent that they are "non-oxidizing" in character, that is, when brought in contact with molten or other highly heated metal, will not effect the formation of an oxidized surface thereon. The gases, thus downwardly directed by the lip 32, pass across and completely blanket the surface of the molten metal in the sump 15, entirely isolating said surface from contact by external or atmospheric air and precluding the well-known tendency of the latter to oxidize molten metal. This atmospheric oxidation of coating metal prior to its atomization, has been one, if not the most serious of the problems confronting the users of prior art metal-spraying equipment, since it results in partial and sometimes total clogging of the spray nozzle, uneven spraying, overheating of the metal, and other difficulties, and can be remedied only by frequent cleaning of the parts of the equipment, necessitating interruption of the work. Some credit for the effectiveness of my preferred form of pistol may be due to the curved character of the walls of the upper portion of the chamber 14, by reason of which a turbulent, scavenging current of non-oxidizing gas is effected. The gaseous mixture for the flame chamber 26 is provided by the mixing tube 35, threaded, at its rear end, in the control portion 11, and provided with a gas jet 36 fed by the gas duct 37 of the control portion and air intake ports 38 through which atmospheric air is drawn. The nipple 40 is adapted for attachment to a supply line, (not shown), for acetylene or equivalent inflammable gas, and feeding thereof to the chamber 26 is adjusted and controlled by means of the needle valve 41. The mixing tube 35 is preferably provided with cooling ribs 39 which dissipate heat, tending to reduce heating of the control portion 11, and retarding active combustion of the gases passing through tube 35 until they have been intimately mixed and have reached the flame chamber 26.

A second torch, similar to the first torch above described, but differing in essential purpose and character of flame, is disposed above the first torch and is provided with an elongate flame chamber 42 for directing a long tongue of flame forwardly through the opening 33 in the head member 10 to a position well beyond the pistol. Like the first torch, it is provided with a mixing tube 43 having a jet 44 for the inflammable gas fed by the duct 45 communicating with the nipple 40 to which the gas supply line (not shown) is coupled. Ports 46 are provided through which air is drawn into the tube 43, and a valve 47 controls the amount of inflammable gas fed through jet 44. Cooling ribs 48 similar to those 39 of the mixing tube 35 are also provided. This second torch is provided primarily for the purpose of heating the coating after it has been applied to the desired object so that the coating may be wiped or paddled to smooth or modify its surface. By first opening valve 47, and then closing valve 41, the second or coating-heating torch may be ignited from the stock-heating torch and the pistol may be immediately brought into use for coating-modifying purposes. For the purpose of sufficiently heating the chamber 14 to maintain the metal in the sump 15 in highly heated condition while the piston is being used in its coating-finishing capacity, so that spraying may be instantly resumed upon opening valve 41 and closing valve 47, a by-pass opening 49 is provided in flame chamber 42. A small tongue of flame is thus directed downwardly through this opening 49 at an angle, and impinges upon the walls and lip 32 of chamber 14, compensating for heat being lost therefrom through radiation, and also maintaining a blanket of non-oxidizing gas upon the surface of the molten metal in the sump. Since no metal is being sprayed at this time, and no replenishment of the molten metal supply from the solid stock 31 is necessary, the amount of heat furnished through the opening 49 is small as compared with that provided by the main torch when spraying.

Due to the fact that oxidation of the coating metal does not occur in my pistol, clogging of the metal spray jet is an unusual occurrence. However, particles of foreign material may find their way into the chamber 14 and reach the jet, causing obstruction thereof. In prior pistols for spraying metal, such obstruction would necessitate the suspension of spraying, allowing the pistol to cool, and the dissembly of the device to permit cleaning with a wire or other tool. My invention has, as a feature of advantage over these constructions, the provision of a nozzle construction which is self-cleaning. The air jet 17 is provided with a forwardly extending annular flange 50 which has a flat edge disposable against any flat object and constituting therewith a closed chamber about the orifices of the metal jet 16 and air jet 17. Thus, by temporarily removing the bar 31 of coating-metal stock, placing the flange 50 against a flat surface, turning the pistol upside down or to one side, and pressing the trigger 24, compressed air from the duct 18 will fill the thus constituted chamber, and, by reason of the pressure built up therein, blow back through jet 16 and the sump 15, clearing the jet of any obstructing matter, whereupon the stock 31 may be replaced in the chamber 14, melted in the sump 15, and metal-spraying may be resumed without the delay incident to dissembly of the device, as necessary in prior art pistols.

Another important feature of my invention, and one by which sprayed coatings of more uniform

grain are attainable, results from the provision of an air bleeder duct 51 in the head member 10, through which duct a small stream of air is drawn into the metal flowing through the jet 16. The introduction of air at this point provides a more finely divided spray of metal than usual and, due to the short period of contact of this air with the molten metal before atomization takes place, does not result either in the formation of oxide upon the particles or in clogging of the jet.

The operation of the illustrated embodiment of my invention should be obvious from the above description of its parts. Acetylene or equivalent inflammable gas passes through the nipple 40, is throttled by valve 41, is mixed with air entering through the ports 38, and passes through tube 35 into the chamber 26 where combustion takes place. Burning gases pass outwardly through port 27, and impinge upon the stock 31, heating it to a temperature just short of that necessary to effect melting thereof. Some of the burning gases passed into chamber 14 through port 27 pass outwardly through the opening 33, but a large portion thereof come into contact with the walls of the chamber 14, heating the sump 15 by conduction to effect melting of the stock 31 therein. The secondary or supplemental ports 28 in the chamber 26 also allow tongues of flame to pass outwardly therefrom, and the webs 29 and 30 direct these flames longitudinally along the casting 10, further heating it and its sump portion 15. Actual melting of the stock 31 is thus effected by its contact with the sump walls and whatever molten metal is retained therein. From the sump 15, molten metal is drawn through the jet 16 by the rush of air through the orifice of the air jet 17 controlled by the valves 21 and 22. Bleeder duct 51 allows a small amount of atmospheric air to be entrained with the stream of molten metal passing through jet 16, and provides a more uniform and finely divided spray than would otherwise be effected by the associated jets 16 and 17. After a substantial coating or filling has been applied, the bar or strip of stock 31 may be removed and the coating-finishing torch may be started by opening valve 47, whereupon a long tongue of flame will be directed by chamber 42 through opening 33, and the applied coating may be paddled or otherwise worked. Valve 41 may be closed when the spraying operation is thus interrupted, since the heat required to maintain the metal in the sump 15 in a highly heated condition need only compensate for radiation from the head 10. This heat is furnished by the port 49 which directs a small portion of the combustible gases from chamber 42 into chamber 14. Ports 49 and 27 under these conditions, like port 27 alone when the chamber 26 is being used, direct a portion of the gases of combustion against lip 32, which, in turn, directs the gases over the surface of the molten metal in the sump 15 forming, a non-oxidizing blanket of gas thereover and isolating the surface from the oxygen of the external atmosphere. It will be noted that the air tube 20, in conjunction with mixing tubes 35 and 43, serve to hold the castings 10 and 11 in assembly and alinement.

The metal-spraying pistol I have illustrated and described constitutes what I regard to be a preferred embodiment of my invention. I am aware, however, that my invention may be embodied in non-portable, as well as portable equipment, and that, in some aspects, it is not limited to metal-spraying equipment, being capable of embodiment in devices for the direct application of metal in molten condition. Likewise, while I have described my preferred embodiment as intended for use with compressed air as the atomizing medium, and acetylene as the combustible gas, its use is obviously not so limited. Any of the metals of moderately low melting points may be sprayed with my device, and the term "bar or strip stock" is intended to cover all forms and shapes of metal capable of use therein. The term "coating" is likewise intended to cover heavy coatings or fillings such as are formed in packing joints, filling dents, and similar operations. I therefore claim my invention broadly, as indicated by the appended claims.

What I claim is:

1. In an apparatus for applying metal coatings, a member having an open-top chamber into which the end of a bar or strip of coating-metal stock is disposable for support and may be fed, the lower portion of which chamber constitutes a sump for holding a quantity of molten metal, means for melting the inserted portion of the metal bar or strip as it is fed into said chamber to maintain a supply of molten metal in said sump, said melting means comprising a gas torch directing its flame across the upper portion of said chamber to impinge upon the walls of the chamber and the stock supported therein, a nozzle in communication with said sump and through which molten metal is discharged, and a flange associated with the walls of said chamber for directing a portion of the burnt gases from said torch downwardly upon the surface of the highly heated metal in said sump and thus provide a blanket of non-oxidizing gas thereover, isolating said surface from the external atmosphere.

2. In a metal spraying pistol, a body member having a shallow open-top chamber in which coating-metal stock in strip or bar form is vertically supported and feedable, the lower portion of which chamber constitutes a sump for holding a quantity of molten metal, means for melting the bar or strip stock to maintain a supply of molten metal in said sump, a forwardly-directed metal spraying nozzle in communication with said sump, a compressed air nozzle associated with said metal nozzle for effecting atomization and projection of metal in spray form, and a substantially horizontal lip extending rearwardly from the front wall of the chamber partially thereacross to constitute a molten-metal-retaining wall or extension of said sump when said pistol is tilted to downwardly direct the spray from its nozzle.

3. In a metal spraying pistol, a body member having a shallow open-top chamber in which coating-metal stock in strip or bar form is vertically supported and feedable, the lower portion of which chamber constitutes a sump for holding a quantity of molten metal, means for melting the inserted portion of the metal bar or strip as it is fed into said chamber to maintain a supply of highly heated metal in said sump, said melting means comprising a gas torch directing its flame across the upper portion of said chamber to impinge upon the stock and the forward wall of said chamber, a forwardly-directed metal-spraying nozzle in communication with said sump and through which molten metal is discharged, and a flange or lip associated with the forward wall of said chamber for directing a portion of the burnt gases from said torch downwardly upon the surface of the molten metal in said sump and provide a non-oxidizing gas blanket thereover, isolating said surface from the external atmos-

phere, said lip extending inwardly of said forward chamber wall to constitute, with said forward wall, an extension of said sump when said pistol is tilted to downwardly direct the spray from its nozzle.

4. In an apparatus for applying metal coatings, a member having an open-top chamber into which coating-metal stock in strip or bar form is feedable, the lower portion of which chamber constitutes a sump for supporting the lower end of said bar or strip stock and holding a quantity of molten metal, a nozzle in communication with said sump and through which molten metal is discharged, a gas torch directing its flame into and across the upper portion of said chamber to impinge upon and heat the portion of the bar or strip stock disposed therein to a temperature just short of that required to effect melting thereof, and supplemental gas torches to each side of said chamber for directing tongues of flame upon the external surfaces of said chamber adjacent the sump to effect heating of the sump walls and contents, by conduction, to temperatures above the melting point of the bar or strip stock so as to maintain a constantly replenished supply of molten metal in said sump.

5. In a metal-spraying pistol, a body member having an open-top chamber in which coating-metal stock in strip or bar form is vertically disposed and feedable, the lower portion of which chamber constitutes a sump for supporting the lower end of said bar or strip stock and holding a quantity of molten metal, a metal-spraying jet in communication with said sump and through which molten metal is discharged, an atomizing air jet associated with said metal-spraying jet and having a charging duct associated with the walls of said sump for absorbing heat therefrom, a gas torch directing its flame into and across the upper portion of said chamber to impinge upon and directly pre-heat the portion of the bar or strip stock disposed therein to a temperature just short of that required to effect melting thereof, and supplemental gas torches to each side of said chamber directing tongues of flame upon the external surfaces of said chamber adjacent the sump to effect heating of the sump walls and contents, by conduction, to temperatures, above the melting point of the bar or strip stock so as to provide a supply of molten metal and heated air for said jets.

6. In a metal-spraying pistol, a body member having an open-top chamber in which coating-metal stock in strip or bar form is vertically disposed and feedable, the lower portion of which chamber constitutes a sump for supporting the lower end of said bar or strip stock and holding a quantity of molten metal, a metal-spraying jet in communication with said sump and through which molten metal is discharged, an atomizing air jet associated with said metal-spraying jet and having a charging duct associated with the walls of said sump for absorbing heat therefrom, a gas torch directing its flame into and upon the walls of said chamber and the portion of the bar or strip stock disposed therein, melting said stock to supply said sump, a second gas torch disposed above said first torch, providing a long range tongue of flame clear of said chamber walls for heating coatings applied by said air and metal-spraying jets, a common gas supply duct for said torches, and valve means for selectively controlling said torches for independent action.

7. In a metal-spraying pistol, a body member having an open-top chamber in which coating-metal stock in strip or bar form is vertically disposed and feedable, the lower portion of which chamber constitutes a sump for supporting the lower end of said bar or strip stock and holding a quantity of molten metal, a metal-spraying jet in communication with said sump and through which molten metal is discharged, an atomizing air jet associated with said metal-spraying jet and having a charging duct associated with the walls of said sump for absorbing heat therefrom, a gas torch directing its flame into and upon the walls of said chamber and the portion of the bar or strip stock disposed therein, melting said stock to supply said sump, a second gas torch disposed above said first torch, providing a long range tongue of flame clear of said chamber walls for heating coatings applied by said air and metal-spraying jets, a common gas supply duct for said torches, valve means for selectively controlling said torches for independent action, and a supplemental stock-heating torch associated with and constituting a by-pass of said second gas torch, which supplemental torch heats the stock in said chamber maintaining it in condition for immediate resumption of spraying while the pistol is being employed for heating previously deposited coatings, said first and second mentioned gas torches being closely disposed with respect to each other so as to permit ignition, one by the other, through manipulation of said valve means.

8. In a metal-spraying pistol, a body member having an open-top chamber in which the coating-metal stock is received, the lower portion of which chamber constitutes a sump for holding a supply of molten metal, means for heating the chamber to maintain a supply of molten metal in said sump, a metal-spraying nozzle comprising a jet for molten metal fed by means of a duct communicating with said sump, a compressed air jet associated with said jet for molten metal for drawing molten metal therefrom and effecting its spray projection, and a bleeder duct for introducing a small amount of atmospheric air into the stream of molten metal passing from said sump just before it is passed through its jet orifice.

9. In an apparatus for applying metal coatings, a member having a chamber therein, the upper portion of which is provided with a charging opening for metal stock and the lower portion of which constitutes a sump for molten metal, means for heating metal stock disposed in said chamber to provide molten metal in said sump, a nozzle in communication with said sump and through which molten metal is discharged, and means for preventing access of atmospheric air to the surface of the heated metal within said chamber without interfering with introduction of metal stock through said charging opening, said means comprising a jet directing and constantly maintaining, upon the surface of the heated metal stock in said chamber, a blanket of gas non-oxidizing in character.

10. In an apparatus for applying metal coatings, a member having a chamber therein, the upper portion of which is provided with a charging opening for metal stock and the lower portion of which constitutes a sump for molten metal, means for heating metal stock disposed in said chamber to provide molten metal in said sump, a nozzle in communication with said sump and through which molten metal is discharged, and means for preventing access of atmospheric air to the surface of the heated metal within said chamber without interfering with introduction of

metal stock through said charging opening, said means comprising a jet directing and constantly maintaining, upon the surface of the metal stock disposed in said chamber, a continuously renewed blanket of hot gas of non-oxidizing character.

11. In an apparatus for applying metal coatings, a member having a chamber therein, the upper portion of which is provided with an opening through which a bar or strip of metal stock is disposable and the lower portion of which constitutes a sump in which the lower end of said bar or strip of stock is supported, means for melting the melted stock in said sump, a nozzle in communication with said sump and through which molten metal is discharged, and means for preheating said stock before it reaches said sump and preventing access of atmospheric air to the heated metal in said chamber without interfering with feeding of metal through said opening, said means comprising a torch directing and constantly maintaining, upon the surface of the heated metal in said chamber, a stream of gas in the last stages of combustion.

12. A metal spraying pistol comprising a frame provided with a handle grip at its rear end and a body member at its forward end, which body member has a stock-melting chamber therein the upper portion of which is provided with a charging orifice and the lower portion of which constitutes a shallow sump for molten metal, means for heating said body member to reduce stock in said chamber to the molten state, a spray nozzle mounted upon said body member for atomizing and projecting metal, said nozzle comprising an air jet fed by a valve-controlled compressed air duct and a jet fed with molten metal from said sump, said jets having orifices in close association, and means for clearing said sump and its associated jet of accumulated solid debris without disassembling the parts of said pistol, said means comprising a flange encircling both of said jets, extending therebeyond and terminating in a flat annular edge disposable squarely against the flat surface of an object to provide therewith a closed chamber about said jets such that compressed air passing from said air jet into said thus-constituted chamber will be forced back through said jet and through said melting chamber and its charging orifice.

13. A metal-spraying pistol including, a body member having an open-top chamber in which coating metal stock in strip or bar form is vertically disposed and feedable, the lower portion of which chamber constitutes a sump for supporting the lower end of said bar or strip stock and holding a quantity of molten metal, a metal-spraying jet in communication with said sump and through which molten metal is discharged, an atomizing air jet associated with said metal-spraying jet and having a charging duct associated with the walls of said sump for absorbing heat therefrom, a gas torch directing its flame upon the walls of said chamber, heating said chamber and the portion of the bar or strip stock disposed therein, melting said stock to supply said sump, a second gas torch disposed adjacent said first torch, providing a long range tongue of flame clear of said chamber walls for heating coatings after application by said air and metal-spraying jets, a gas supply duct common to said torches, and valve means for selectively controlling said torches for independent action.

DONALD D. TAYLOR.