

Nov. 14, 1950

E. L. TRIMM ET AL

2,530,186

PORTABLE SPRAYING APPARATUS FOR MOLTEN MATERIALS

Filed Oct. 13, 1947

2 Sheets-Sheet 1

Fig. 1

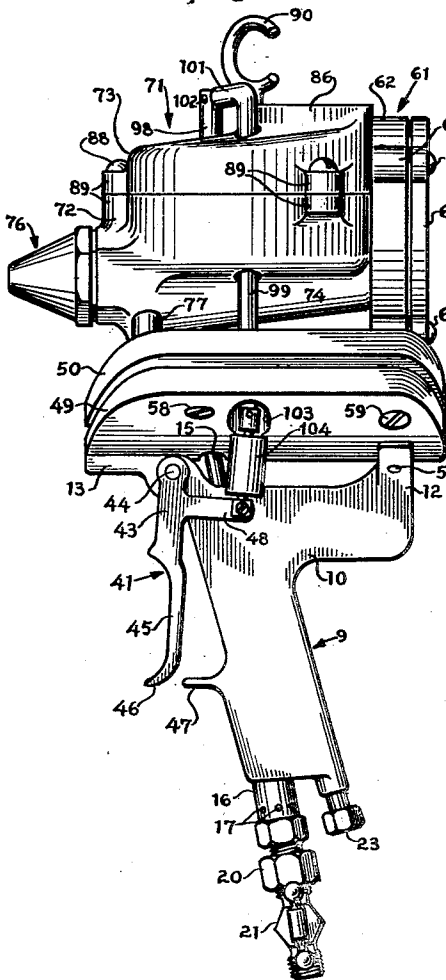


Fig. 3

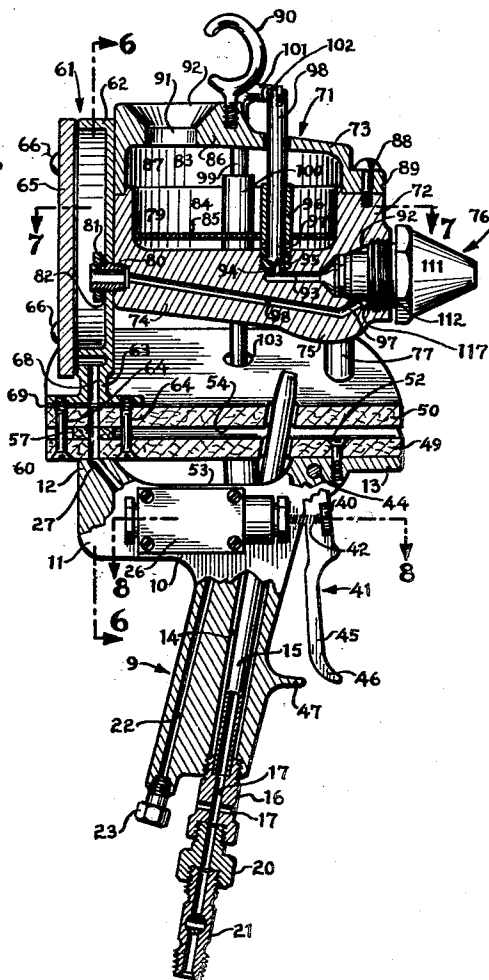


Fig. 2

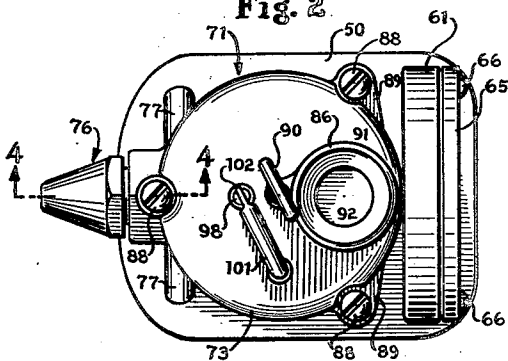
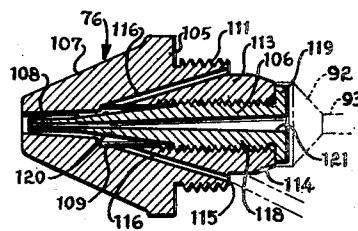


Fig. 4



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2 Sheets-Sheet 2

Fig. 5

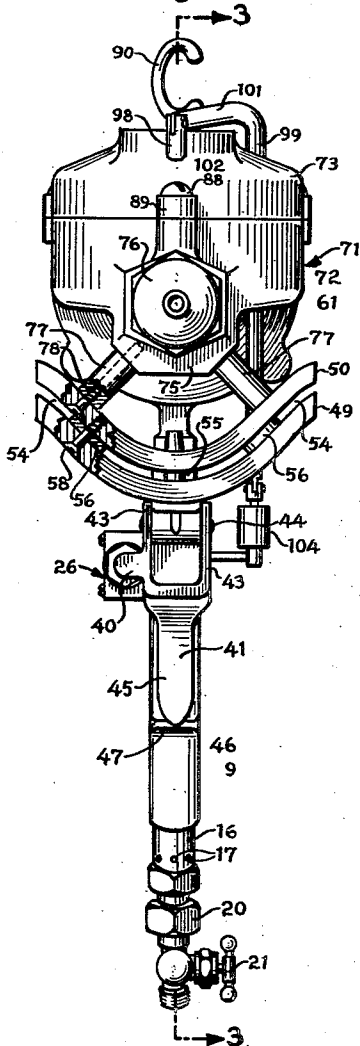


Fig. 6

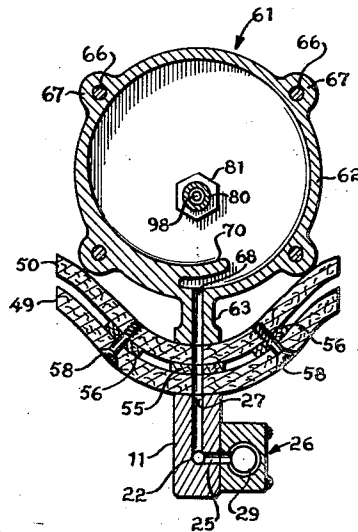


Fig. 7

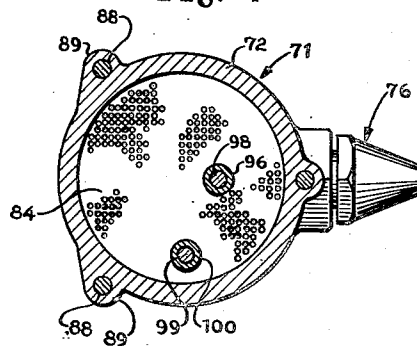
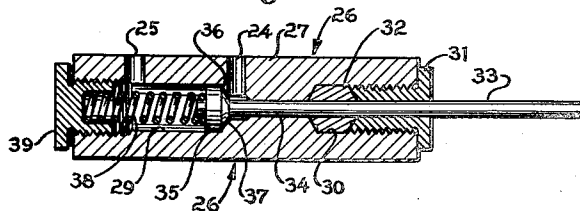


Fig. 8



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PORTABLE SPRAYING APPARATUS FOR
MOLTEN MATERIALS

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4 Claims. (Cl. 91—12.2)

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This invention relates to an improved portable and self-contained apparatus for spraying lead, and other low-melting point metals, alloys, and plastics, for metallizing, filling in, and/or coating metal surfaces, a primary object of this invention being to provide apparatus of this type which more nearly meets the ideal of small size and compactness, light weight, and good balance, to a degree that the average worker can operate with greater speed and accuracy, and with less fatigue than heretofore, thereby being able to do more and better work in less time.

Another important object of this invention is to provide a device of the character indicated above, in which the main weight or bulk of the device, including the reservoir and its contents of molten metal, are vertically aligned above the handle of the device in such a way that overhanging and unbalanced weight factors are eliminated, which would otherwise require counterbalancing either by undesirable additions of counterbalancing weights, which would increase overall weight of the device, or by exertions on the part of the operator other than those involved in lifting or supporting, and directing the spraying action of the device, such that the operator's efficiency would be substantially reduced.

Another important object of this invention is to provide a device of the character above indicated which contains constant heat metal melting means operating at an unusually high working temperature, utilizing any available heating gas, such as illuminating gas or acetylene, and in addition, built-in means for pre-heating the spraying air before it reaches the spray nozzle so as to eliminate cooling effect at the point of the spray.

Another important object of this invention is the provision of a device of the character indicated above, which has an unusually large molten metal capacity, in an arrangement which assures a constant spray, and wherein means is provided to prevent slag from passing from the molten metal reservoir to the spray nozzle or through the valve mechanism.

Another important object of this invention is the provision of a device of the above indicated character, having a novel compound spray nozzle, involving structure in which the inner molten metal nozzle, when assembled into the outer air nozzle is perfectly and unavoidably centered therein, and wherein means is provided to trap any slag which may reach the nozzle before the slag can clog the nozzle or be sprayed therefrom.

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A still further important object of this invention is to provide a device of the character indicated above which contains a novel construction and arrangement of molten metal shut-off valve mechanism eliminating drip or after run of the molten metal and providing positive and accurate control of the flow of the molten metal from the reservoir to the spray nozzle.

A still further important object of this invention is the provision of a device of the character indicated above in which the molten metal controlling valve and a spray air valve are associated in directly cooperative relation for simultaneous operation by a single hand lever, whereby the flow of molten metal and of compressed air are properly timed and coordinated.

A still further important object of this invention is to provide a device of the character indicated above having special insulation means precluding direct transmission of heat between the molten metal reservoir and its heating means, and the handle and valve operating hand lever of the device, thereby assuring a cool handle.

Other important objects and advantageous features of this invention will be apparent from the following description and the drawings thereunto appended, wherein, for purposes of illustration and disclosure only, a presently preferred embodiment of this invention is set forth in detail.

In the drawings:

Figure 1 is a left hand side elevation of said embodiment.

Figure 2 is a top plan view.

Figure 3 is a vertical central section taken on the line 3—3 of Figure 5.

Figure 4 is an enlarged vertical longitudinal section taken through the spray nozzle.

Figure 5 is a fore end elevation.

Figure 6 is a transverse vertical section taken on the line 6—6 of Figure 3.

Figure 7 is a horizontal section taken on the line 7—7 of Figure 3, and;

Figure 8 is a horizontal section taken on the line 8—8 of Figure 3.

The herein illustrated embodiment of the invention comprises in general (a) a vertical pistol-grip handle through which heating gas and air blast conduits extend and on which is mounted valve means controlling the flow of metal and air to the nozzle; (b) combined heat insulating means and molten spray metal pot or reservoir shielding and supporting means consisting of air spaced and contact insulated plates mounted upon the upper end of the handle; (c) the melting pot or reservoir assembly mounted

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upon and airspaced above said plates and consisting of a melting pot and its cover, a special air and molten metal spray nozzle, a special valve for admitting molten metal to the nozzle, means for trapping slag in the pot and in the nozzle, and an air chamber connected by conduits to the air valve and to said nozzle, for pre-heating and stabilizing the air on its way to the nozzle.

Except for the spray nozzle, the valve parts, the conduit connectors or couplings, and the assembling studs and the like, which are preferably of cast or spun brass, the component parts of the device are preferably of cast aluminum in order to gain the advantages of light weight, adequate strength, and relatively low-heat transmission between the parts.

Referring in detail to the drawings, the numeral 9 generally designates the pistol grip handle of the device of relatively uniform oval cross section having a slight forward inclination with respect to the perpendicular and terminating at its upper end in a generally horizontal portion 10, the major portion of which projects rearwardly, as indicated at 11, to a point just rearward of the lower end of the pistol grip, where said portion 11 has an upstanding transverse V-shaped foot 12. At the forward end of the portion 10 is a forward projection including an upset foot 13 of relatively flat forwardly elongated form. These feet are provided to support thereabove the superjacent structure hereinafter described.

As shown in Figure 3, the forward part of the handle 9 is formed with a forwardly inclined vertical bore 14 through which the heating gas blowpipe 15 extends to emerge at the top of the handle at a point just rearward of the front foot 13. The blowpipe is mounted in concentrically spaced relation in the bore 14 by an ordinary perforated plug 16 threaded into the lower end of the bore and having air admitting passages 17 communicating with its gas passage 18. A coupling 20 may be used to connect to the plug 16 a gas shut-off hand valve 21 which in turn is connected to a suitable source of illuminating or heating gas, including acetylene (not shown).

Spaced rearwardly from the blowpipe bore 14 in the handle 9 is the compressed air or blast conduit 22 whose lower end is equipped with an adapter 23 threaded therein and arranged for connection to a suitable air blast hose (not shown). The upper part of the air conduit 22 curves upwardly and rearwardly to connect with the inlet and outlet parts 24 and 25, respectively, of the air blast control valve 26, which is preferably mounted on the right hand side of the upper portion 10 of the handle. Above this valve the uppermost portion of the air conduit 22 opens through the top of the rear foot 12 as indicated at 27.

The air control valve 26 comprises a body 28 suitably fixed to the side of the handle portion 10, which includes, as shown in Figure 8, the axially spaced non-communicating bores 29 and 30 opening through opposite ends of said body. A gland 31 threaded in the outer end of the bore 30 bears against a packing 32 for the valve stem or rod 33 which projects through and beyond the gland 31 in one direction, and through a conforming body bore 34 in the opposite direction into the bore 29 where it has fixed thereto a conforming cylindrical valve element 35 having a conical face 36 for cooperation with a reduced valve seat 37 at the forward end of the bore 29.

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The air intake part 24, mentioned above communicates with the aperture of the valve seat 37, while the outlet port 25 communicates with the bore 29 at a point spaced rearwardly from the normal seated or closed position of the valve element 35 shown in Figure 8. Threaded in and closing the rear end of the bore 29 and acting as an abutment for the helical valve closing spring 38 interposed between it and the valve element 35 is the hollow stud 39.

The air valve is actuated open by pressure exerted upon the forward end of the stem 33 by a lateral ear 40 on the hand lever or trigger 41, when the latter is compressed rearwardly toward the forward side of the handle 9 by the operator. A helical spring 42 is circumposed upon the valve stem 33 and expands between the gland 31 and the ear 40 to return the lever 41 forwardly to starting or initial position when released so that the spring 38 can immediately, but independently, return the valve 35 to its initial or closed position.

The hand lever or trigger 41 comprises a depending Y-shaped member whose arms 43 are positioned at opposite sides of the forward foot 13 and pivoted on a pivot pin 44 transversing the rear part of said foot. The valve operating ear 40 is on the right hand arm 43. The lower or standard portion 45 of the hand lever is vertically concaved and transversely rounded to accommodate the hand of the operator, and its forwardly curved lower end 46 is adapted to be arrested in rearward movement by engagement with a stop 47 projecting forwardly from the handle 9, in the extreme rearward compression of the lever. The left hand arm 43 has a rearward extension 48, to the rear end of which is operatively connected the lower end of the molten metal valve operating mechanism hereinafter described.

Mounted directly upon the feet 12 and 13 of the handle 9 are the similar inverted saddle-like metal plates 49 and 50, which are of generally rectangular shape with rounded corners. The rearward part of the lower plate 49 seats conformably in the aperture of the V-shaped rear foot 12 and is fixed in place by studs or pins 51 traversing the divergent sides of the foot. The forward part of the lower plate 49 rests coextensively upon the forward foot 13 and is fixed thereto by a stud 52 threaded downwardly thereinto through the plate, as shown in Figure 3. So fixed in place the lower plate 49 is airspaced from the handle 9 to the extent of the length and vertical depth of the space 53 between the feet 12 and 13 and the upper portion 10 of the handle 9.

The upper plate 50 coextensively overlies the lower plate 49 but is spaced upwardly therefrom to provide the airspaces 54 on the opposite sides of a central, longitudinally extending insulation strip or block 55 which is positioned between the plates along their middle in order to achieve the desired parallel airspacing thereof, in conjunction with small isolated pieces 56 of insulation spaced at opposite sides of the strip 55 near the forward ends of the plates, and a rearwardly positioned transverse insulation strip 57. The island pieces 56 are traversed by assembling studs 58 which are threaded upwardly through the lower plate 49 into the upper plate 50. Other assembling studs 59 are similarly threaded through the rear portions of the plates and traverse the rear transverse insulation strip 57.

When assembled the rear transverse strip 57 and adjacent portions of the upper and lower

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plates together provide a continuation 60 of the airblast passage 22, with whose upper termination 27 the continuation 60 registers, as shown in Figure 3. The upper end of the gas blowpipe 15 projects above the forward part of the upper plate 50 through openings provided through the plates.

The vertically and transversely arranged flat cylindrical casing 62 of the air chamber 61 has a longitudinally elongated foot 63 depending from the bottom thereof and secured in place along the middle of the upper plate 50 immediately above the rear spacing strip 57 by studs 64 threaded upwardly through the plates and into the foot 63 on opposite sides of the strip 57. The open side of the casing 62 faces rearwardly and is closed by a removable disk cover 65 secured by studs 66 traversing circumferentially spaced pairs of lugs 67. The foot 63 is vertically traversed by a continuance 68 of the air blast passage continuance 60 with which its lower end is registered, with an apertured gasket 69 placed to seal the connection, and whose upper end opens into the casing 62, beneath a spirally produced baffle 70 provided therein to cause the incoming air to take a spiral whirling path around the casing 62 and thereby be stabilized in motion and preheated by the heat resident in the chamber 61 by reason of the proximity of the chamber 61 to and its contact with the metal melting and containing reservoir 71, which is positioned immediately forwardly of and is partially supported by the casing 62 of the air chamber 61.

The metal reservoir 71 comprises a heavy, relatively shallow cylindrical cup-like casting 72, and a removable cover 73. The cup's heavy thick bottom has its greatest thickness or depth where the underside of the bottom declines forwardly and downwardly longitudinally of the device, as indicated at 74, to a point 75 located immediately above the blowpipe 15, whose flame is directed against this forward point of greatest thickness, which is also closest to the spray nozzle 76 which is mounted on the forward part of the bottom of the cup. At opposite sides of the forward point 75 of the bulge 74 diagonal spacing sleeves 77 are arranged between laterally outward points of the upper plate 50 and the reservoir to support the forward end of the reservoir in airspaced relation to the upper plate, and assembling studs 78 pass upwardly through the upper plate and through the sleeves and thread into the bulge 74.

The rear end of the reservoir is flattened as indicated at 79 to conformably engage and be supported by the forward side of the air chamber 71, to which it is rigidly connected by a hollow bolt 80 threaded into the reservoir and passing through an opening in the air chamber wall, and having a clamping nut 81 operating against an interposed washer or gasket 82.

The metal containing space 83 of the reservoir is plain cylindrical, with a slag screen 84 spaced above its bottom 85 to prevent egress of slag from the space 83. The space 83 is covered by the domed cover 73 seating outside a ridge 87 on the upper end of the reservoir, and removably held in place by screws 88 passing through paired peripheral lugs 89. The center of the cover 73 is provided with a hanging hook 90, by means of which the device may be conveniently hung up when not in use or when the device is being heated up for use, thereby correctly supporting the device under these conditions and leaving the operator free for other tasks as well as eliminating the need for special or improvised equipment for cor-

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rectly supporting the device under such conditions.

To the rear of the hook 90 the cover is thickened at 86 and formed with a circular filling opening 91 having a flared upper portion 92 facilitating accurate dropping or pouring of material into the reservoir 71 with the cover in place.

The lower forward end of the reservoir casting 72 is provided in line with the bulge 74 with a conical opening 92 accommodating the spray nozzle 76 hereinafter described. The conical opening 92 is arranged on a horizontal axis and at its tip opens into the forward end of the axially aligned molten metal conduit 93 whose rearward end communicates with the outlet opening 94 of the valve seat 95 on the lower end of the tubular valve body 96 of the molten metal valve mechanism, hereinafter described. The lower side of the conical opening 92 communicates with the forward, upturned end 97a of the forwardly declining airblast conduit 98a, which is formed through the reservoir bulge 74 and whose rearward end communicates with the bore of the hollow bolt 80, and thereby with the interior of the air chamber 61. It is obvious from this arrangement that spraying air passing through the chamber 61 and through the most highly heated part of the molten metal reservoir 71, which is the bulge 74 and its hot spot 75, will be heated to a very high temperature, in this case substantially 1500° F. at which temperature the device is usually operated, so that there can be no cold air effects at the tip of the spray nozzle 76.

The molten metal valve mechanism comprises the cylindrical valve body 96 having its lower end threaded into the bottom 85 of the reservoir space 83 at a point forward of the center of said space, with its hereinabove described valve seat opening 94 opening into the molten metal conduit 93 leading to the spray nozzle 76. The valve body 96 rises through the screen 84 to about the level of the top of the reservoir cup and has metal inletting holes 97 below the screen 84 to permit only slag screened molten metal or plastic material, as the case may be, to enter the interior of the valve body from the space 83.

A valve plunger 98 slides through the top of the valve body 96 and has a pointed lower end for cooperation with the valve seat 95. The plunger acts to cut off the entry of molten metal into the valve body by occluding the holes 97 in advance of reaching closing relation to the valve seat 95, so that the slug of molten metal ahead of the plunger is not augmented by any drip from the holes 97 but is forcibly ejected through the opening 94 into the nozzle feeding passage 93 as the plunger approaches its seat. This action also operates to prevent accumulation in the valve or the passages of any significant amounts of molten metal which might interfere with accurate and full valve action, and reduces to a minimum the amount of metal or plastic therein required to be returned to a fluid state from a cooled solid state to permit operation of the mechanism and freeing of the passages after a period of idleness or disuse of the device.

For elevating and depressing the valve plunger 98, an inverted L-shaped connecting rod 99 is provided, which slides vertically through a sleeve 100 vertically traversing the molten metal reservoir casting 72 at the lefthand side of the center of the space 83. The lateral arm 101 of the connecting rod reaches laterally inwardly and is pivoted in a slot in the upper end of the plunger 96, as indicated at 102. The lower end of the

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connecting rod 99, which passes loosely through openings 103 provided in the plates 49 and 50, is operatively connected with the rear end of the hand lever arm 48 by a porcelain or equivalent heat insulating material link 104, which is pivotally connected to the connecting rod and hand lever arm, so that when the hand lever 41 is compressed rearwardly against the handle 9 the connecting rod 99, and hence the plunger 98 will be elevated, and molten metal permitted to flow continuously from the reservoir space 83 to the nozzle 76, as long as the hand lever is compressed or as long as the supply of molten metal in the space 83 lasts.

The same compression of the hand lever 9 pushes the air blast control valve stem 33 rearwardly so that a continuous blast of air flows to the spray nozzle 76 concurrently with the flow of molten metal to the spray nozzle 76, this spraying air, as heretofore pointed out, being highly heated by its passage through the device on its way to the spray nozzle. The melting temperature of the device is controlled by the choice of heating gas and by manipulation of the gas valve 21 for adjusting the flame of the blowpipe 15.

The special spraying nozzle 76, which seats in the conical opening 92 in the lower forward end of the molten metal reservoir, comprises a preferably brass body, composed, as shown in Figure 4, of an outer member 105 and an inner member 106. The outer member 105 comprises a frusto-conical tip 107 formed with an axial bore 108 having a slight rearward flare, terminating midway of the tip in an enlarged cylindrical bore 109. A minor forward portion of the bore 109 is plain but the remainder thereof, which extends through the outer nozzle member 105 through its rear end, is internally threaded, as indicated at 110 to receive and assemble the inner nozzle member 106.

Behind the tip 107 the outer nozzle member 105 has an externally threaded axial portion 111 of substantially reduced diameter which is adapted to mount the nozzle in the opening 92 by engagement with the threads 112 provided in the outer end of said openings. Behind the threaded portion 111 the outer nozzle member has a smooth cylindrical portion 113 of reduced diameter, followed by a portion 114 tapered to conformably fit the tapered walls of the conical opening 92. Opening through the rear face of the shoulder 115 defined by the portions 111 and 113 at circumferentially spaced intervals, are the rear ends of relatively small air passages 116. The air passages 116 converge forwardly toward the axis of the nozzle and their forward ends open through the sidewalls of the smooth enlarged bore portion 109 just to the rear of the rear end of the smaller flaring bore portion 108.

As shown in Figure 3, the reduced smooth portion 113 is by its proportioning and position, spaced from the sidewall of the conical opening 92, in such a way as to define an annular air space 117, into the bottom of which the forward end 97a of the air blast conduit 98a opens to supply the passages 116 with air under pressure.

The inner nozzle member 106 comprises an externally threaded portion 118 terminating at its rear end in a disk head 119 of somewhat larger diameter. Beyond the threaded portion 118 and beginning at the rear end of the smooth bore portion 109 the inner member 106 has a forwardly tapering needlelike nose 120 reaching almost to the forward end of the nozzle tip 107, the nose or needle 120 being concentrically spaced from

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the bore portions through which it extends. The inner nozzle member 106 is longitudinally adjustable within the outer member 105 to adjust the spray of molten metal and air as required.

The disk head 119 is proportioned and positioned to engage the sidewalls of the conical opening 92 near the entrance thereto of the molten metal passage 93, and thereby define a substantially conical slag trap into whose lower part below the level of the passage 93, any slag coming through the passage 93 with the molten metal can subside and be trapped out of the flowing metal and thereby prevented from going on through the axial spray passage 121 provided through the inner nozzle member 106. As shown in Figure 4, this passage 121 is gradually forwardly tapered, so that its greatest diameter is at the rear end thereof and its smallest diameter at the forward end of the needle part 120, whereby a slight but advantageous ram effect is obtained.

It will be obvious that the reservoir 71 may be initially charged with fusible metal or plastic material through the opening 91, and that thereafter as the metal or plastic is exhausted from the reservoir in service, the reservoir may be recharged through the opening 91 while in use and without pausing for removal of the cover 73.

It will be understood that any change or changes in the construction and relative arrangement and composition of the component parts may be made within the scope of the appended claims, without departure from the invention.

We claim:

1. A device for spraying molten metal, including an upwardly-extending handle, an operating lever mounted upon the exterior of said handle, a molten metal reservoir above said handle, heating means for applying molten metal heat to said reservoir, said means being above said handle, radiant and conducted heat shielding means for the hand of an operator grasping said handle and lever, said shielding means including a horizontally-disposed lower plate having substantially vertically-disposed outer edges and an upper horizontally-disposed plate having substantially vertically-disposed outer edges, said upper plate being spaced above the lower plate, with an air space between said plates, means carrying said lower plate upon the upper end of said handle, means mounting said upper plate upon said lower plate, the vertical planes of said edges of said plates being outwardly of said handle and lever, means mounting said reservoir upon and above said upper plate and within the vertical planes of said edges of said upper plate, means mounting said heating means upon and above said upper plate and within the vertical planes of said edges of said upper plate, a spraying nozzle mounted on a forward part of said reservoir, said nozzle being provided with molten metal passage means and with air blast passage means, molten metal conduit means leading from said reservoir to said nozzle molten metal passage means, air blast conduit means leading to said nozzle air blast passage means, and combined valve means comprising valving components biasing the conduits of said molten metal and airblast conduit means, and means operatively connecting said components together and to said operating lever.

2. A device according to claim 1 in which said means mounting said upper plate upon said lower plate includes a traverse strip disposed between and in face contact with said plates, said strip

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has an upwardly-extending opening there-through; said plates have aligning openings, axially aligning with said first-named opening; and said air blast conduit means includes the walls of said openings.

3. A device according to claim 1 in which said plates have side edge portions and curve upwardly at said side edge portions so as to extend outwardly of the lower areas of the sides of said reservoir and heating means.

4. A device according to claim 1 in which said plates have side edge portions and curve upwardly at said side edge portions so as to extend outwardly of the lower areas of the sides of said reservoir and heating means, and the means carrying said lower plate upon said handle includes spaced apart feet extending upwardly and outwardly from said handle with said lower

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plate cradled upon said feet and spaced above said handle whereby an air space exists between said handle and said lower plate.

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