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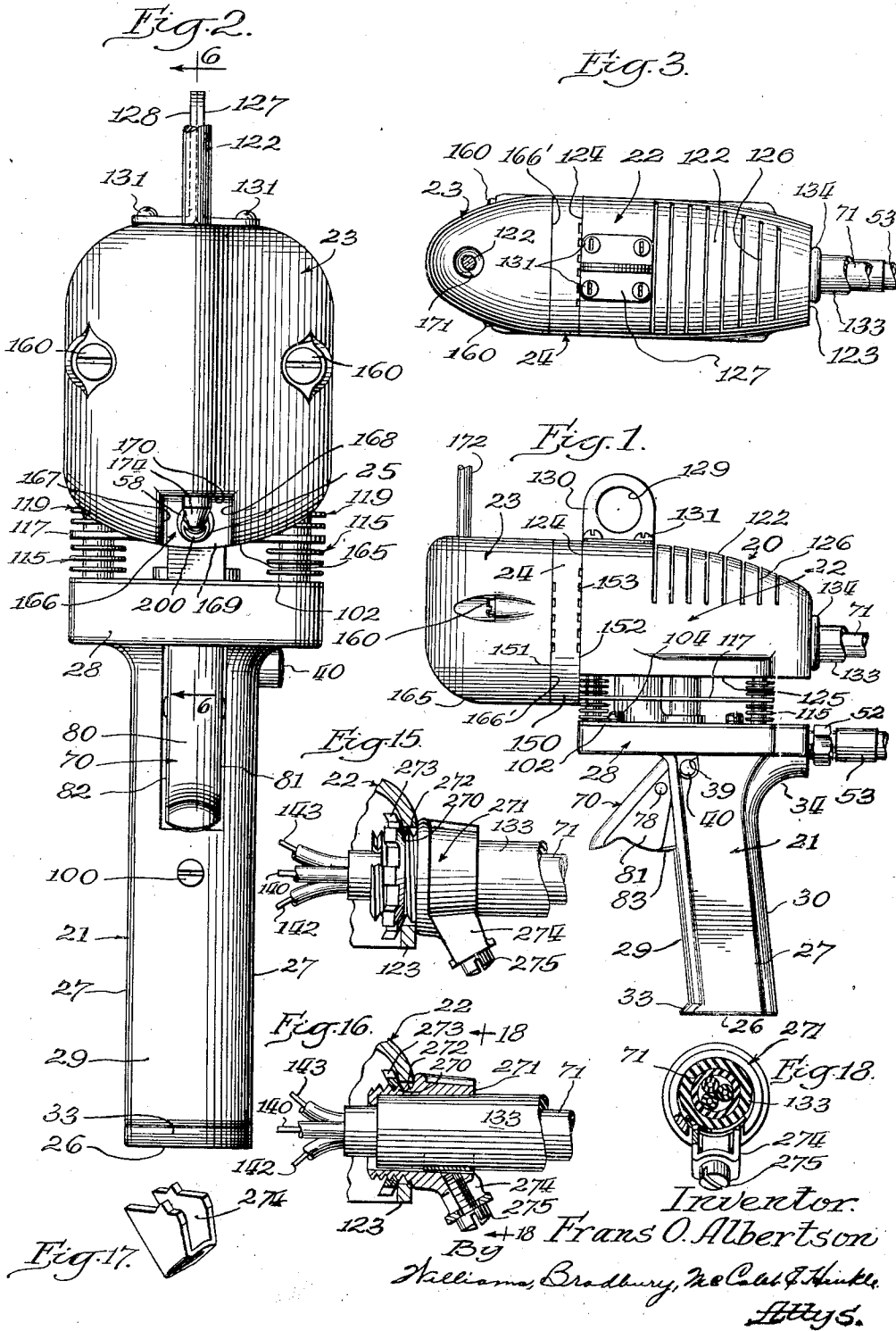
F. O. ALBERTSON

2,287,770

METAL SPRAY GUN

Filed Jan. 11, 1939

5 Sheets-Sheet 1



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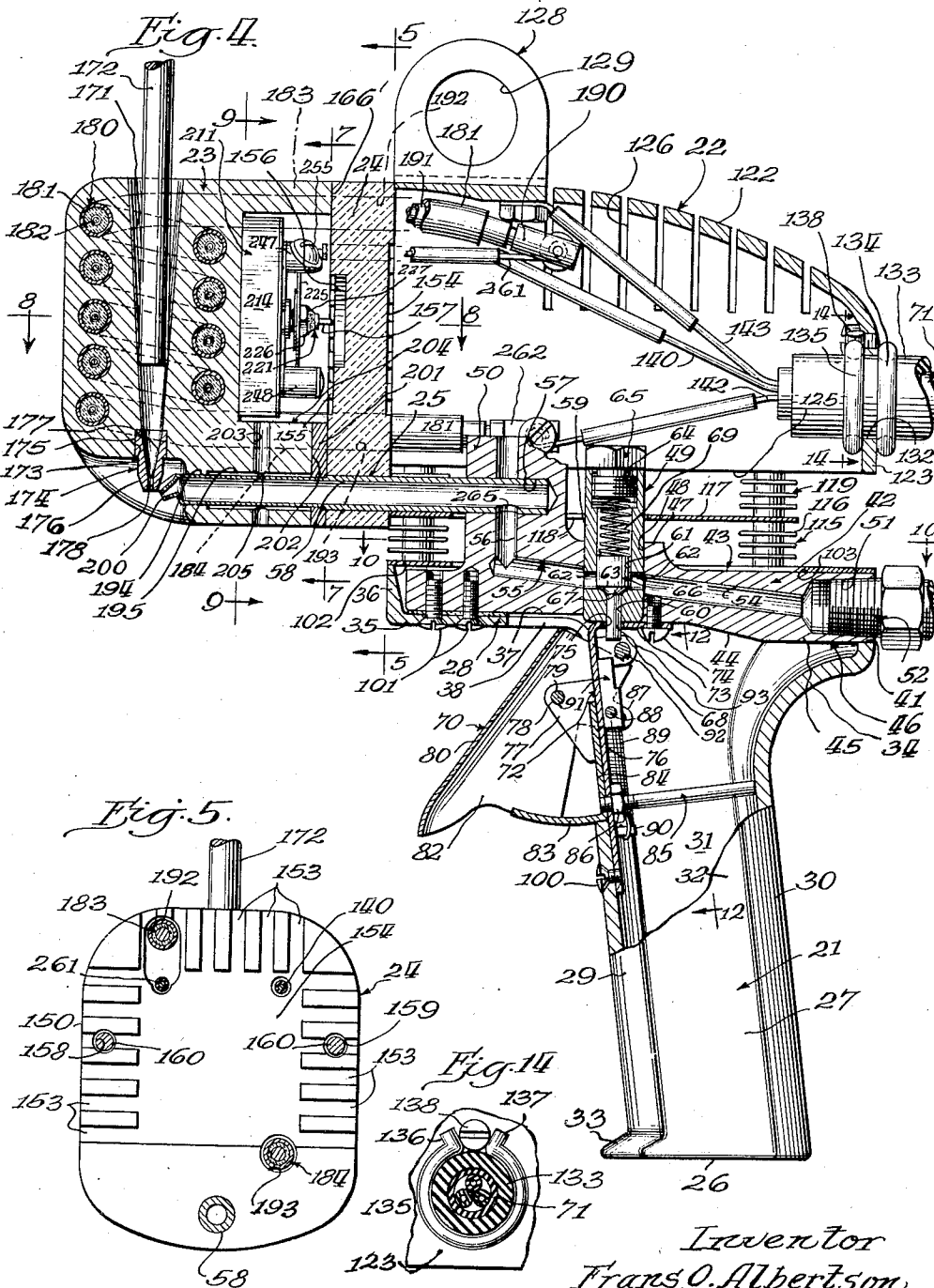
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METAL SPRAY GUN

Filed Jan. 11, 1939

5 Sheets-Sheet 2



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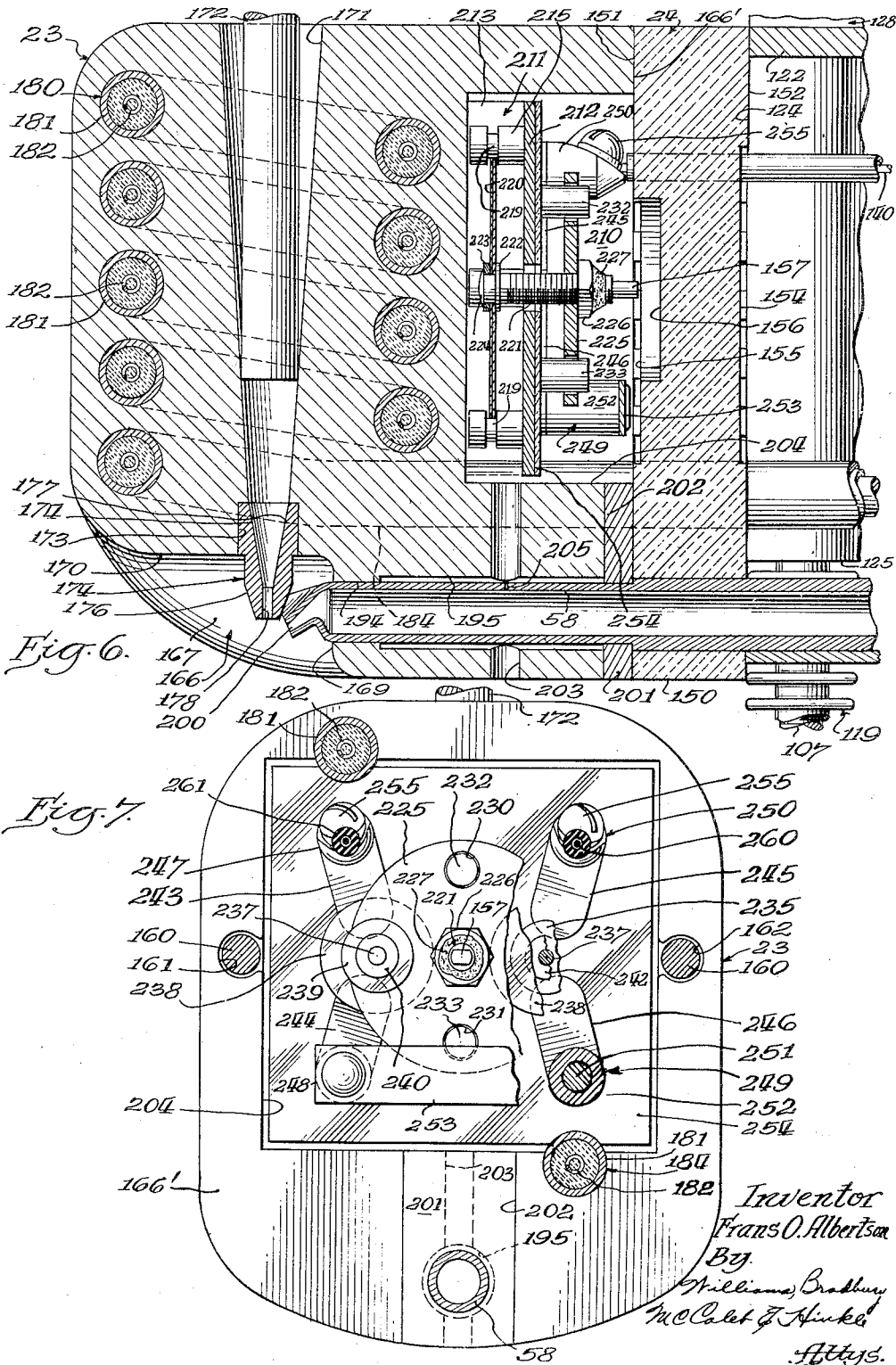
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METAL SPRAY GUN

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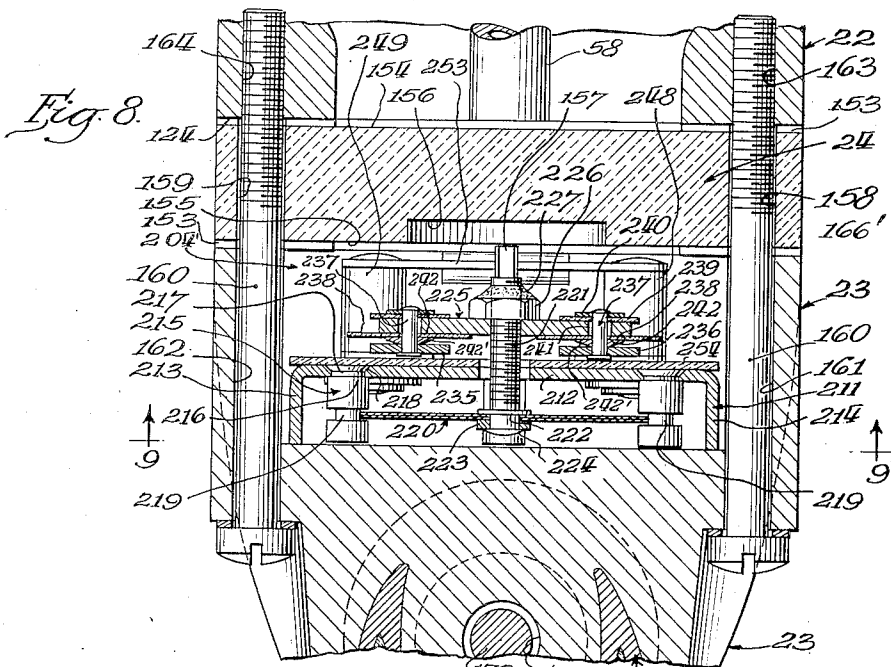
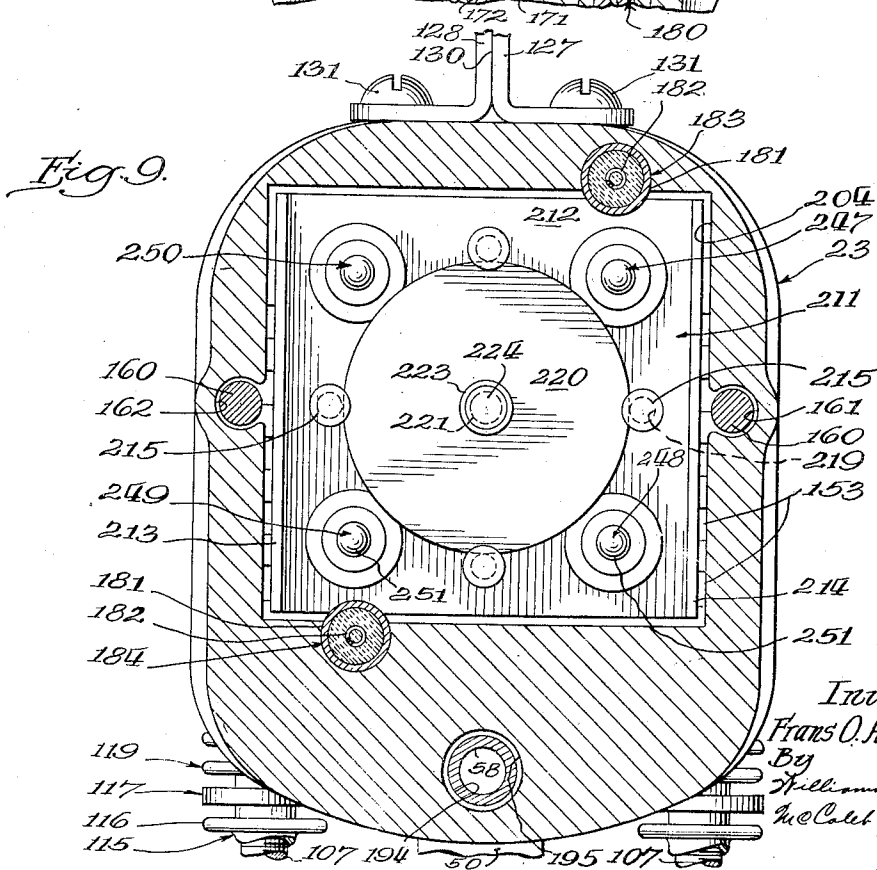
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METAL SPRAY GUN

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5 Sheets-Sheet 4



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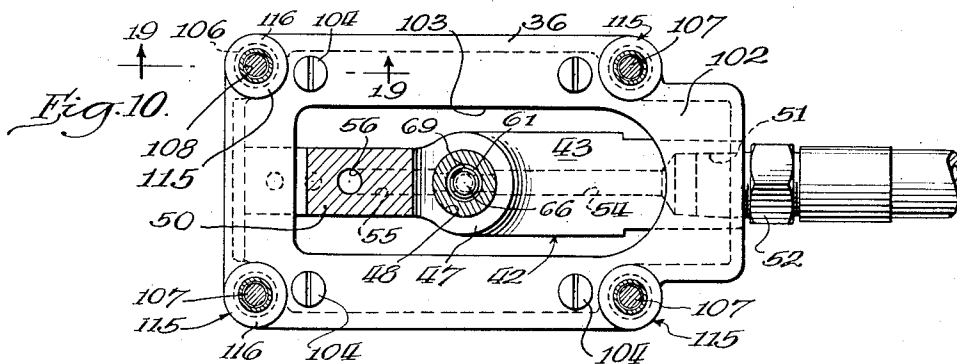
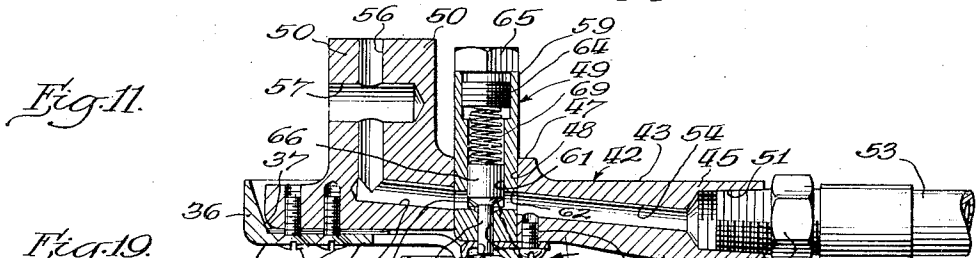
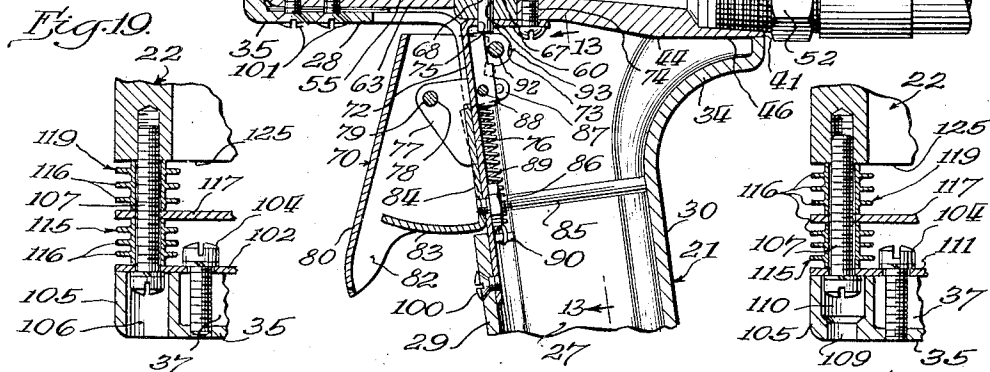
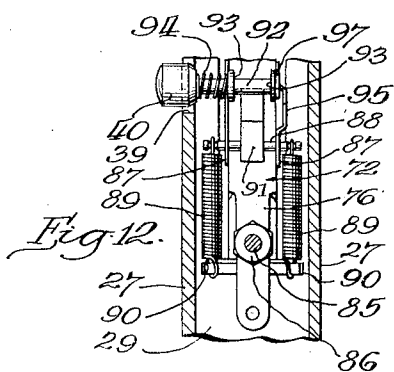
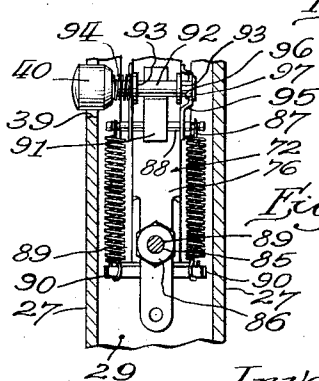
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**2,287,770**

METAL SPRAY GUN

Filed Jan. 11, 1939

5 Sheets-Sheet 5



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## UNITED STATES PATENT OFFICE

2,287,770

## METAL SPRAY GUN

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3 Claims. (Cl. 91—12.2)

The present invention relates to metal spray guns, and is particularly concerned with metal spray guns of the type adapted to melt electrically a supply of meltable metal and to spray it by means of compressed air.

The present application relates to improvements in the metal spray guns covered by my prior patent, No. 2,058,653, issued October 27, 1936, on Metal spray guns.

The metal spray guns constructed according to my prior patent and according to the present invention have been subjected to very hard usage. Although constructed solely for melting and spraying metal, operators appear to have a tendency to use the end of the gun as a hammer for flattening out parts of metal, and have also been known to hammer the gun about or jar it for the purpose of loosening metal in the nozzle.

One of the objects of the invention is the provision of an improved metal spray gun which is of a sturdier construction, adapted to withstand the hard usage to which such guns might be subjected and of such a construction that it will not be damaged by ordinary hammering or utilization of the gun for striking blows against the sprayed metal.

Another object of the invention is the provision of an improved metal spray gun which is so constructed that the handle is cooler and the heat is concentrated at the metal well so as to conserve heat and apply the heat more effectively to the work at hand, thereby facilitating the continuous use of the gun with a smaller heating element.

Another object of the invention is the provision of an improved metal spray gun, in which the ends of the nozzles are protected against injury and the air nozzle and metal nozzle are so arranged that they are automatically placed in predetermined relation to each other when the gun is assembled.

Some difficulty has been encountered due to operators of the guns endeavoring to adjust the location of the air nozzle, and this adjustment is something which should be done only by experts.

Another object of the invention is the provision of an improved metal spray gun connection in which the air nozzle is not adjustably mounted with respect to the metal nozzle, and in which the air nozzle is provided with means for assuring its location in a predetermined position with respect to the metal nozzle so that air nozzles can be replaced by those unskilled in the assembly of such guns.

Another object of the invention is the provision of an improved unit construction of guns of this type, in which the gun is constructed of a plurality of units so that they are readily replaceable and can be replaced by one unskilled in the assembly of such guns, by merely ordering a new replacement unit from the factory.

Another object of the invention is the provision of an improved gun construction from which all frangible parts have been eliminated and in which all units of the construction have been made so sturdy and serviceable that they may be used for a long period of time without necessity for replacement or repair and so that there is no possibility of porcelain particles getting between the contacts of the switch.

Another object of the invention is the provision of an improved metal spray gun having improved means of controlling the operation of the gun, so that as soon as the gun is used for spraying there is an immediate increase in the heat supplied to the gun, which is necessary, due to the melting of metal in the spraying operation. When the spraying operation begins, the continuous supply of mold metal to the gun requires a greater amount of heat, as the cold metal must not only be raised to the melting temperature, but the heat of fusion must be applied thereto, and this additional supply of heat required for continuous operation of the gun under the best conditions is insured by the controlling devices included in the present construction.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the five sheets of drawings accompanying this specification,

Fig. 1 is a side elevational view of a metal spray gun constructed according to the invention;

Fig. 2 is a front elevational view of the gun, shown in full size;

Fig. 3 is a top plan view of the gun;

Fig. 4 is a vertical sectional view, taken on a plane passing vertically through the center of the spray gun, showing the details of construction thereof;

Fig. 5 is a sectional view, taken on the plane of the line 5—5 of Fig. 4, looking in the direction of the arrows;

Fig. 6 is an enlarged sectional view, taken on the same plane as Fig. 4, but showing the thermostatic switch in section also;

Fig. 7 is an enlarged sectional view, taken on the plane of the line 7—7 of Fig. 4, looking in the direction of the arrows;

Fig. 8 is an enlarged sectional view, taken on the plane of the line 8—8 of Fig. 4, looking in the direction of the arrows;

Fig. 9 is an enlarged sectional view, taken on the plane of the line 9—9 of Fig. 4, looking in the direction of the arrows;

Fig. 10 is a sectional view, taken on the plane of the line 10—10 of Fig. 4, looking in the direction of the arrows;

Fig. 11 is a fragmentary sectional view, taken on the same plane as Fig. 4, showing the details of construction of the air control valve unit, and the valve locked in open position;

Fig. 12 is a fragmentary sectional view, taken on the plane of the line 12—12 of Fig. 4, looking in the direction of the arrows, showing the trigger, obtained in the unlatched position;

Fig. 13 is a fragmentary sectional view, taken on the plane of the line 13—13 of Fig. 11, showing the trigger, with the trigger shown in the latched position;

Fig. 14 is a fragmentary elevational view of the cable anchor, seen from the inside of the housing 22, and taken on the plane of the line 14—14 of Fig. 4;

Fig. 15 is a fragmentary sectional view, similar to Fig. 4, showing a modified and preferred form of cable anchor, which may also be utilized with my metal spray gun;

Fig. 16 is a similar view with the cable anchor in section, on the same plane;

Fig. 17 is a view in perspective of the stirrup used in the cable anchor;

Fig. 18 is a sectional view on the plane of the line 18—18 of Fig. 16;

Fig. 19 is a fragmentary sectional view showing the mode of support of the gun on its handle unit;

Fig. 20 is a similar view of a modification.

Referring to Fig. 1, 20 indicates in its entirety a metal spray gun constructed according to the invention. The gun may consist of a plurality of separable units, such as, for example, the handle unit 21, a rear housing unit 22, a front housing unit or metal melting unit 23, an insulating unit 24, and an air nozzle unit 25.

The handle unit 21 may consist of a cast metal member (Fig. 4) provided with a closed lower end wall 26, handle side walls 27, and an upper enlargement 28. The handle walls may consist of the front and rear curved handle walls 29, 30 and the flat and parallel side handle walls 31, 32 integrally joined together to form a tubular member adapted to have a substantial fit in the hand.

At the lower end of the front curved wall 29 of the handle there is a forwardly projecting lug 33 which engages below the lowermost finger and serves to keep the handle from slipping upward in the hand.

The enlargement 28 comprises a backwardly and upwardly extending curved wall 34 and a flat bottom wall 35, both of which carry the upwardly extending boundary flange 36, providing a relatively shallow chamber 37 in the upper open end of the handle for receiving the valve mechanism.

The handle unit is provided with an aperture or slot 38 in the flange 35 and extending downwardly into the front handle wall 39 for receiving the trigger of the valve control mechanism. It is also provided with an aperture 39 (Fig. 1) for projection of the latching button 40 of the

trigger control mechanism, and the upwardly extending flange 36 has a groove 41 in its rear wall for receiving a complementary projecting portion of the valve supporting body 42.

The air control mechanism may be constructed as a separate unit carried by the valve supporting body 42. The valve supporting body 42 comprises a cast metal member having a flat upper surface 43 and a flat lower surface 44. It has an extension 45, which has a lower, substantially cylindrical surface 46, fitting in the groove 41. At its central part there is an enlargement 47 having a through bore 48 for receiving the valve body 49, which is of cylindrical shape, having a tight frictional fit in the bore 48.

At its forward end the valve supporting body 42 has an upward extension 50 for extending a conduit upward to meet the air nozzle unit 25. The body 42 is formed at its rear end with a threaded bore 51 for receiving a standard air conduit fitting 52, which is connected to the air hose 53.

The air hose 53 is connected to a source of air under pressure, which is preferably at from 65 to 70 pounds per square inch pressure, but which may vary considerably, as the standard air supply which is used for filling tires may be used.

The threaded bore 51 communicates with a diagonally upwardly extending conduit 54, which communicates with the vertical, cylindrical bore 48. Conduit 54 is continued on the opposite side of the vertical bore 48 by conduit 55, and communicates with an upwardly extending conduit 56, which extends out of the upper end of the casting 42. The conduits 54 and 55 may be bored from the right end of the casting and the conduit 56 from the top of the casting 42.

Conduit 56 communicates with a horizontal bore 57, which is adapted to receive the end of the air nozzle unit 25 and is bored from the left end of casting 42 (Fig. 4).

The metal tube 58 of the nozzle unit 25 has a close sliding fit in the bore 57 so that it effects a substantially air-tight joint between the tube 58 and the bore 57. The valve unit 49 may comprise a tubular brass member 59, having a relatively small bore 60 at its lower end, communicating with a larger bore 61 at the transverse bore 62.

There is a frusto-conical valve seat 63 at the lower end of the enlarged bore 61 and at the upper end of the tubular body 59 there is a threaded counterbore 64 for receiving the threaded plug 65, which closes the upper end of the valve body.

The valve 49 is provided with a valve member in the bore 61, comprising a substantially cylindrical valve member 66, having a frusto-conical seating surface 67 and a cylindrical stem 68 slidably mounted in the bore 60 and projecting therefrom.

A compression coil spring 69 engages the upper end of the valve member 66, and has its opposite end seated against the end of the plug 65. The valve member 66 effects a substantial closure of the air bore 62, inasmuch as the body 66 is interposed between the ends of the bores 62 and has a substantial fit in its valve socket. The fit, however, is such as to permit a sliding movement of the valve member 68, and the valve member may be opened by means of a trigger 70, which acts on the stem 68 and lifts the valve body 66 until there is communication between the bores 62.

According to the present construction the electric heating element of the gun is controlled by means of a thermostatic switch, and energization

of the conductors leading to the thermostatic switch is controlled by merely plugging in an electric wall plug connected to the cable conductors, which are housed in the rubber covered cable 71.

The cast metal valve-supporting body 42 may support a sheet metal bracket 72, which carries the trigger mechanism. The bracket 72 has a horizontal attaching flange 73, which is secured by means of a screw bolt 74, passing through the flange and threaded into the body 42. It also has an aperture 75 for passing the valve stem 68, and it has a downwardly extending flat body 76 for supporting the trigger mechanism.

The body 72 has a pair of forwardly extending parallel sheet metal flanges 77, which pivotally support the trigger 70 and have apertures 78 for passing the trigger pintle 79.

The trigger 70 may comprise a sheet metal member having a curved forward yoke 80 and a pair of parallel side walls 81, 82 (Fig. 1 and Fig. 4). The side walls 81, 82 have the pintle 79 riveted in them after the pintle has been assembled with the bearing flanges 77. The body flange 76 of the bracket 72 may also support a curved guide member 83, comprising a flange which is a sliding fit between the side walls 81, 82 of the trigger, but which is shorter than the open space below the end of the trigger, so as to be spaced from the yoke 70, and permit the actuation of the trigger. The curved guide flange 83 is secured to a body flange 84, which is secured to the body flange 76 by a threaded stud 85.

The stud 85 is threaded into a bore in the body flange 84 and passes through a bore in the body flange 76, and is locked in place by means of a nut 86. The length of the stud 85 is such that its end engages the opposite or rear curved wall 30 of the handle in order to prevent the bending of the bracket 72, and to hold the bracket in proper position.

The body flange 84 has its upper end fitting between the bearing flanges 77 so that only one screw bolt 85 is necessary to secure these parts together.

The side flanges 81, 82 of the trigger have a pair of rearward extensions 87, which have a pin 88 extended through them, and projecting laterally at each side, so that one end of each of the two springs 89 may be hooked over each end of the pin 88. The body flange 76 of bracket 72 has a pair of laterally extending lugs 90 so that the opposite end of each of the two springs 89 may be hooked over a lug 90.

Thus, by means of the springs 89, the pin 88 and extensions 87 of the trigger are drawn downward, and the trigger 70 is urged outward to the position of Fig. 4. The pin 88 also extends through a valve-actuating bar 91, comprising a small metal bar, having an aperture for the pin 88, and having its body slidably engaging the body flange 76 of the bracket 72.

The valve-actuating bar 91 is substantially rectangular in cross-section and of smaller cross-section at its upper end, the upper end being confined between the bracket 72 and the push button pin 92, which carries the push button 40.

The valve-actuating bar 91 is adapted to be slid upward by means of pin 88, when the trigger 70 is pulled back. In its upward movement the end of the bar 91 engages the stem 68 of the valve and opens the valve. The bar 91 is, however, urged downward by the two springs 89, which also urge the trigger 70 outward.

The trigger mechanism is also preferably provided with means for latching the trigger with the valve in the open position, which may comprise the pin 92. The bracket 72 is provided with a pair of rearwardly extending flanges 93, having apertures for slidably receiving the pin 92, which carries the push button 40 at one end. At its opposite end the pin 40 has a stop washer secured between a shoulder on the pin and the rivet end of the pin.

A coil spring 94 is compressed between the button 40, and one of the flanges 93, and surrounds the pin 92 (Fig. 12). Thus the push button is urged into the position of Fig. 12 by the spring 94, but after the trigger 70 has been pressed, the push button may be moved inward to the position of Fig. 13.

The trigger has an extension 95 on one of its side flanges 82, which reaches up into position to engage with the pin 92. The extension 95 has a stop surface 96 on its rear side so that when the push button 40 is pressed to the position of Fig. 13, after the trigger has been pressed, the stem 92 will engage the stop surface 96 and hold the trigger in that position.

The stem 92 is furthermore held in that position itself by means of the washer 97, which engages the outside of the flange 95, as in Fig. 13. Thus the trigger may be pulled and latched in the position of Fig. 13, that is, with the valve open, by means of the push button 40.

If, thereafter, the trigger is again pulled, its flange 95 will move out from under the washer 97, and the spring 94 will immediately snap the latch and pin 92, from the position of Fig. 13 to that of Fig. 12, so that the trigger is released by an auxiliary pull and subsequent release of the trigger.

Thus the air valve mechanism 69 may be latched in the closed position, if desired, or it may be left subject to control solely by means of the trigger 70.

The valve and trigger mechanism carried by the body 42 may be inserted in the upper, open end, or chamber 37 of the handle unit 21, as a unit; and may be secured therein by a plurality of screw bolts, such as, for example, the screw bolt 100, which extends through the forward wall 29 of the handle, and is threaded into the bracket 72 by means of the two screw bolts 101, which pass through the lower flange 35 of the upper handle extension and are threaded into the body of the casting 42.

The unit construction of this trigger and valve mechanism is illustrated as shown in Fig. 11. The upper, open end of the handle may be closed by means of a metal plate 102, which substantially fits over the chamber and engages the outer wall 36 thereof, and has a centrally located rectangular aperture 103 for passing the upwardly projecting valve parts, as shown in Fig. 10.

The complete structure, including the plate 102, handle, and trigger mechanism below the plate, constitute a unit which may be handled as such in the assembly of the parts and in the replacement of the parts.

In the event of any trouble with the valve or trigger, the user of the gun may send to the factory for a valve and handle replacement unit, which can be immediately shipped and substituted in his spray gun with a minimum amount of effort, and with the assurance that the parts can be assembled very easily and will operate perfectly.

In some embodiments of the invention, as shown, for example, in the modification of Fig. 19, the plate 102 may be made of insulating material and secured to the handle by a plurality of screw bolts 104 passing through apertures in the plate and threaded into threaded bores in the bottom flange 35 of the handle chamber 37.

The handle is also provided with thickened walls at 105, at each of the four corners of the handle chamber 35, the walls having through apertures 106 for receiving screw bolts 107, which secure the handle unit to the rest of the metal spray gun. The structure at one of the corners of the handle is shown in detail in Fig. 19, the heads of the bolts 107 being disposed in the bores 106, and the heads of the screw bolts 107 engaging the under side of the metal plate 102.

Referring to Fig. 20, this shows a modification in which the handle unit is provided with bores 109 slightly smaller than the heads of screw bolts 107, and with a counterbore 110 for receiving the heads of the screw bolts 107 at the top.

The insulating plate 111, which may be made of the same material as the insulation 24, is provided with bores 112 for passing the screw bolts 107, and is secured to the handle unit 21 by a plurality of screw bolts 104, as previously described. In this case the bolts 107 will be retained in the handle assembly by means of the plate 111, so that the handle may be removed with its bolts intact, and difficulty in assembly, due to the bolts dropping out, is avoided.

Plate 111 may be made either of insulation or of metal, but when made of insulation it provides a better insulating connection between the handle and the rest of the metal spray gun assembly because there is no direct metal-to-metal connection between the handle and other parts of the metal spray gun.

The screw bolts 107 are preferably provided with spacer members 115 immediately above the plate 102 at each of the four corners of the handle unit, and the spacer members are preferably formed with radially extending fins 116. The spacer members comprise tubular metal members having a plurality of radially extending fins for radiating heat which is conducted to this part of the metal spray gun from the electric heating element.

Above the spacer elements, bolts 107 preferably support another heat radiating plate 117, which is provided with apertures for passing each of the bolts 107, and with a centrally located rectangular aperture 118 for passing the valve assembly 49 and upwardly extending lug 50.

The plate 117 is preferably constructed of metal, and is adapted also to radiate heat, and is spaced from both the rear housing 22 of the gun and the handle structure, so that air may pass between these parts, and such heat as is conducted to the parts may be dissipated.

Immediately above the plate 117 the bolts 107 support additional similar spacer members 119, similar in structure to the spacers 115, for spacing the plate 117 from the rear housing member 22.

The rear housing member 22 may consist of a cast metal member, such as aluminum, which is open at the bottom and at the front end. It is provided with two side walls (Fig. 3) which are joined by a top wall 122 of substantially U shape, and by a rear wall 123, which may be substantially flat.

The end 124 of the rear housing 22 is open, as is also the lower side 125 (Fig. 1). The walls

of the rear housing 22 are thickened adjacent the ends of each of the screw bolts 107, and provided with threaded bores for receiving the screw bolts 107.

At its upper side the rear housing 22 may be provided with a plurality of ventilation slots 126 for the purpose of permitting the air to pass through this housing from the open bottom 125, up through the slots 126, in order that heat may be dissipated. The upper wall 122 curves gradually upward from the flat rear wall 123, and is provided at its forward end with a pair of sheet metal right angle brackets 127, 128, which are provided with a transverse aperture 129 adapted to be used to hang up the gun.

The angle brackets 127, 128 have their vertical flanges welded together at 130, and have their horizontal flanges secured to the rear housing 22 by the screw bolts 131, which pass through apertures in the horizontal flanges, and are threaded into the metal body of housing member 22.

The rear housing member 22 may serve as a junction box or a connection box for the electrical conductors, and for this purpose the rear wall 123 is provided with an aperture 132 for passing a rubber hose 133, which is a close fit on the rubber conductor cable 71, which contains three insulated conductors.

The hose 133 is anchored in the housing member 22 by means of a pair of wire clamping members 134, 135, one on the outside of the wall 123, and the other on the inside. The wire clamping member 134 comprises a simple ring of stiff brass wire, which is clamped about the hose 133 so tightly that it forms a groove therein, and causes the hose to clamp the rubber covered cable 71. Thus the hose 133 is suitably anchored to the rubber covered cable 71 by the ring 134, so that the gun may be lifted by means of the hose, if desired, and the cable is caused to assume an easy bend where it emerges from the rear housing 22 inside the hose 133.

The ring 134 also serves as a shoulder for engaging outside of the wall 123 and determining the position of the hose 133 with respect to the housing 22.

The wire 135 is similar in structure except that its two ends 136, 137 are bent radially outward and engage on both sides of the head of a screw bolt 138, which is threaded into a threaded bore from the inside of the housing 22 immediately adjacent the aperture 132. Radial portions 136, 137 of the wire ring 135 serve to prevent rotation of the hose 133 and conductor cable 71 in the housing bore 132.

The ring 135 also clamps the hose 133, forms a groove therein, and causes the hose to clamp the rubber cable 71, and the ring 135 engages the inside of the wall 123. Both rings definitely determine the position of the hose 133 and cable 71 with respect to the housing 22 and anchor the hose, and cable to the housing in such manner that the cable 71 is protected.

The cable 71 is preferably provided with the two conductors 140, 142, which are adapted to connect the heating element of the gun with the ordinary lighting circuit. A third insulating cable 143 is utilized for grounding the gun, and at the plug end of the cable 71 may be connected to the conduits which house the wires of the lighting system, which are, of course, grounded. Porcelain sleeves may surround conductors 140, 142, 143.

The conductor 143 is grounded on the housing

122 by means of being connected to a screw bolt 144, which is threaded into a threaded bore in the housing 22. The insulating unit 24 preferably comprises a block of electrical insulation which is also adapted to withstand heat impact without damage.

The insulating block 24 is substantially rectangular in cross-section and provided with rounded corners so that its outer surface 150 is flush with the outer surface of the housing member 22 and housing member 23.

The block 24 is provided with substantially flat front and rear surfaces 151, 152, except that these surfaces are preferably provided with a multiplicity of radially extending grooves 153 leading to a central flat recessed field 154, 155 on the back and the front for the purpose of permitting the egress of air from the interior of the housing.

The front side 151 of the block 24 is also provided with a substantially cylindrical bore 156 to provide space for the switch member, which has an axially projecting adjustment screw 157.

The insulating block 24 is provided adjacent each side with a transverse bore 158, 159 for passing the screw bolts 160, which pass through bores 161, 162 in the front housing member 23 and are threaded into threaded bores 163, 164 in the rear housing member 22 (Fig. 8). Block 24 may consist of a heat treated composition comprising asbestos and a phenolic resin binder molded to shape.

Thus the insulating block and two housing members are secured together by two screw bolts 160, and the spray gun may be taken apart merely by removing these bolts. The insulating block 24 is tightly clamped between the two housing members 22, 23, and it is adapted to withstand impacts to which either housing member may be subjected, without damage.

The front housing member 23 of the spray gun preferably comprises a member of cast aluminum or other metal of high heat conducting capacity, and the housing member is substantially rectangular in front elevation, but provided with rounded upper corners and with a convexly curved lower surface 165. The rear surface 166' of the front housing member 23 is substantially flat and fits against the insulating block 24 with the outer surface of the front housing member 23 flush with the outer surface of the block 24.

At the front lower corner of the front housing member 23 it is preferably provided with an angular recess 166 defined by the side walls 167, 168, rear wall 169, and top wall 170. The recess 166 is for the purpose of housing the ends of the metal nozzle and air nozzle and preventing damage to these nozzles, which it accomplishes, since the nozzles do not project beyond the boundaries of the recess 166.

The front housing member 23 is preferably formed with a metal well comprising a downwardly tapering frusto-conical bore 171, the upper end of which is substantially larger than the diameter of the solder sticks or wires 172 of the metal to be melted.

The lower end of the casting is preferably smaller than the diameter of the solder sticks, and it communicates with a larger counterbore 173, which is adapted to receive the metal nozzle tip 174. The metal nozzle tip 174 is constructed of high speed steel adapted to withstand the high temperatures to which it is subjected, and it has an external cylindrical surface 175 which is a tight frictional fit in the bore 173. The nozzle

tip 174 tapers, being provided with an external frusto-conical surface 176, and it is provided with an internal frusto-conical recess 177, terminating in a relatively small cylindrical bore 178, which is the nozzle aperture. The nozzle 174 may also be threaded into the bore 173.

The frusto-conical bore 177 provides a continuation of the frusto-conical metal well 171. The metal well 171 is centrally located with regard to the substantial body of metal, of which the front housing member 23 is constructed, and embedded in the metal of the member 23 is a helically coiled electric heating element 180 (Fig. 4).

This heating element 180 is of the type having an outer metal jacket 181 of copper or brass, or other suitable metal, and having an inner resistance wire 182, which is helically coiled inside the jacket 181, the turns of wire being insulated from each other and from the jacket 181 by a suitable refractory insulating composition, initially in the form of a powder.

The helical heating element 180 has a pair of rearwardly projecting straight extensions 183, 184 (Fig. 4), which are necessary to extend the connections to the rear part of the spray gun, and for the reason that the end portions of the heating element are not readily bendable.

The end portions of the heating element have metal connectors 190 extending therefrom for engagement with the wires of the circuit, and the connectors 190 are insulated from the metal jacket 181 by layers of mica 191 or other suitable insulation.

In other embodiments of the invention the insulating block 24 may support electric socket connectors 190 attached to the conductors 140 and 142, and the heating element 180 may be so arranged that its end connectors slidably engage in the socket connectors carried by the insulating block 24.

The heating element 180 may be purchased in straight form on the open market, and preliminary to its incorporation in the metal body 23 it is coiled in helical form on a mandrel with its coils spaced from each other and provided with the straight extensions 183, 184. The heating element is held in a suitable jig, and the metal body 23 is cast about the heating element 180 so that the heating element is embedded in the body 23 surrounding the metal well 171 and having the extensions 183, 184 projecting therefrom.

The insulating block 24 has suitable apertures 192, 193 for passing the extensions 183, 184. At its lower end the metal body 23 is provided with a horizontal bore 194 for supporting the air nozzle 25 and having an enlarged counterbore 195, leaving a clearance about the major portion of the air nozzle 25.

This clearance prevents direct transmission of heat from the body 23 to the air nozzle 25 and over the length of the counterbore 195.

The air nozzle 25 is preferably constructed as a unit, and provided with means for detachably mounting it in the metal spray gun in proper position with respect to the metal nozzle 174, so that users of the guns cannot adjust the air nozzle and get it out of its proper position.

It is preferable that this position be determined at the factory.

The air nozzle unit 25 comprises a metal tube 58, which extends from the bore 57 forward through the insulating block 24, counterbore 195, and bore 194. At its left end (Fig. 4) adjacent the metal nozzle 174, the air nozzle unit 25 is provided with an arcuate aperture 200, the shape of

which is best shown in Fig. 2. The arcuate air nozzle aperture 200 is located in such position as to embrace the space at the end of the metal nozzle 174, the two nozzles being arranged to converge toward the same point, except that the air nozzle directs an arcuate stream of air against the metal emerging from the metal nozzle. The metal is thereby atomized and sprayed in a horizontal direction.

In order to predetermine the location of the air nozzle unit 25 with respect to the metal nozzle, the tube 58 is preferably fixedly secured to a rectangular metal block 201, which is adapted to fit in a complementary socket or slot 202 in the metal body 23.

The block 201 is confined in the slot 202 by means of the insulating block 24, which engages on the rear side of the block 201.

The vertical walls of the slot 200 determine the rotative position of the tube 58 and nozzle 200 with respect to the metal nozzle 174. The position of the block 201 on the tube 58 also serves to determine the longitudinal adjustment of the air nozzle unit 25 with respect to the metal nozzle.

The air nozzle unit 25 is very conveniently inserted as a unit or removed as a unit, and replacements may be kept on hand so that it is unnecessary to make any adjustments, and a gun which needs repair in this respect can be repaired very quickly by providing it with a new air nozzle unit.

The metal body 23 is provided with a bore 203, which communicates with the counterbore 195. The bore 203 extends beyond the counterbore 195 to the bottom of the metal member 23, for the reason that the hole is drilled through from the bottom to a thermostat chamber 204.

The air tube 58 is provided with relatively small pin hole 205 for the purpose of permitting the leakage of air under pressure from the air tube 58 into the thermostat chamber 24, where the cooling air is directed against the thermostat for a purpose further to be described.

This takes place, of course, only when the valve member 66 is moved to open position, and in the present metal spray gun the air valve is completely closed when the trigger is in the position of Fig. 4, as distinguished from some of the devices of the prior art, in which constant leakage of air was contemplated for the purpose of cooling the gun.

The air aperture 205 is so located that it may act as a nozzle, directing air through the enlarged aperture 203 against the thermostat 220 of a thermostat switch.

The air tube 58 is provided with an aperture 265, which is downwardly directed when the air nozzle is in proper position, and which registers with the bore 56. The close fit of the air nozzle 58 in the bore 57 effectively closes the upper end of the bore 56 and places the air tube 58 in airtight communication with the bores 55 and 56, leading to the supply of air under pressure.

The metal spray gun is provided with a thermostatic switch for the purpose of controlling the energization of the electric heating element 180, and the thermostatic switch structure is best shown in Figs. 6, 7, and 8.

The thermostatic switch comprises a unit 210, which is preferably supported upon a sheet metal base 211. The base 211 may have a flat sheet metal body 212 and a pair of side flanges 213, 214 at right angles to the body 212 (Fig. 8). The base 212 has a frictional fit in the socket 204 of the housing member 23.

The supporting base 211 has a plurality of cylindrical metal posts 215 fixedly secured therein by means of an annular shoulder 216, a reduced cylindrical portion 217, and a riveted portion 218 secured in a bore in the body 212.

The posts 215 may be four in number and equally spaced from each other, and provided with annular slots 219. The annular slots 219 are adapted to receive the edge of a bi-metallic thermostatic member 220 of the type having a predetermined concavity formed therein, so that when the bi-metallic element 220 is heated to a predetermined temperature, the expansion of one of its metals is resisted until a predetermined stress is set up, when the bi-metallic element 220 snaps from a downward concavity to an upward concavity in Fig. 8.

The clearance between the slots 219 and the bi-metallic member 220 permits this without placing undue strain upon the bi-metallic element. The bi-metallic element 220 is fixedly secured at its center to a switch-actuating post 221, which has an annular shoulder 222 and a washer 223, and its end portion is riveted over at 224.

The post 221 is thus adapted to be moved back and forth in a vertical direction in Fig. 8 by the thermostat 220. At its upper end the post 221 is threaded, and it supports a switch cross-head 225, which has a threaded bore engaging the threads of post 221. The cross-head 225 may be locked in position by a lock nut 226, and further secured in place by fusing material 227 about the end of the post 221 and nut 226.

The cross-head 225 is shown in Fig. 7, and it may comprise a circular metal member having a pair of apertures 230, 231 for receiving the guide posts 232, 233. These guide posts are fixedly secured to the base 212 by riveted formations similar in character to the mode of securing the posts 215.

The cross-head 225 may also support a pair of contact members, comprising the discs 235, 236. The discs 235, 236 are preferably insulated from the cross-head 225 by the following means. Each contact 235 or 236 is secured by means of a rivet 237, which passes through the contact and through a mica washer 238, second mica washer 239, and metal washer 240. The cross-head 225 has a clearance at 241 about the rivet 237 so that the rivet is electrically insulated from the cross-head 225.

The disc 242 has a lower convex surface 242' so that the contact 236 has a limited universal movement and tends to engage two fixed contacts equally. The fixed contacts are shown in Fig. 7 and indicated at 243-246.

The base 211 of the switch may carry a plurality of connector posts 247-250. Each connector post is again insulated from the base by means of mica in the same manner as described with respect to the rivet 237, having mica above and below the metal body 212 and a clearance between the aperture in the metal body 212 and a centrally located rivet 251. Each of these posts is similar in structure, and therefore only one need be described.

The metal rivet 251 is surrounded in the posts 248 and 249 by a tubular spacer 252, and the posts 248, 249 are connected by a metal connector band 253. The posts 247-250 may, however, be solid metal posts secured in the same manner to the base 211 above the mica plate 254 (Fig. 8). Each of the posts 247-250 is connected to the fixed contacts 243-246, respectively.

The fixed contacts may comprise sheet metal strips of suitable metal, arranged so that the pairs of contacts are adapted to be engaged by the movable contacts 235, 236, which bridge the fixed contacts, as shown by the over-lapping portions in Fig. 7. The posts 247 and 250 are provided with connector screws 255, located in threaded bores in the posts and adapted to clamp wires to the posts.

The connections are readily seen from Fig. 4. The ground connection of the conductor 143 of the cable has already been described. The conductor 140 is connected to a conductor 260, which is connected to the binding post 250 of the thermostatic switch. Thence the circuit may be traced through the contacts 245, bridging the contact 235, fixed contact 246, binding post 249, strip conductor 253, binding post 248, fixed contact 244, removable contact 236, fixed contact 243, binding post 247, conductor 261, heating element terminal 190, heating element 180, heating element terminal 262, and conductor 142.

Thus it will be apparent that the thermostatic switch has both of its contacts in series with the heating element and the energized line. The circuit is broken at two points by the movable contacts 235, 236.

Referring to Fig. 15, this is a fragmentary sectional view similar to Fig. 4, but showing the preferred form of cable anchor which has been utilized in later commercial embodiments of the invention.

In this case the bore 270 receives a conventional junction box fitting 271 of the type having a threaded shank 272 which passes through the bore 270, and secured by means of a nut 273.

The fitting 271 has a clamping member 274 actuated by a screw bolt 275 for clamping the rubber hose and forcing it into tight engagement with the rubber covered cable contained therein. Thus the hose and cable are both anchored to the spray gun by means of the fitting 271.

The operation of the metal spray gun is as follows: The conductor cable 11 is provided with a conventional plug, which may be plugged in at any lighting circuit socket, and controlled with other switches, if desired. The plugging in of the gun energizes the gun and, as the thermostatic switch is in closed position when the gun is cool, the circuit is closed through the heating element.

This causes the gun to heat up, and heat is transmitted directly from the heating element to the metal body 23, which has the heating element embedded within it, and heat is most effectively applied to the metal 172, to be melted in the metal well 171.

The heating of the gun continues until it reaches a predetermined temperature, at which the thermostatic switch is actuated to open the circuit. During this time the gun may or may not have its hose connected to the air under pressure, but the air is shut off at the valve 66 during the preliminary heating up of the gun, and air is only turned on when the gun is in use.

In the preliminary heating up of the gun, the heating element is turned off at, for example, approximately 750 degrees F.

The gun is now sufficiently heated so that it can be used at any time by putting the meltable solder in the well and turning on the air to effect a spraying action. It is at a suitable temperature for the melting of the solder, but not at the preferred temperature for continuous operation.

When the gun is permitted to cool with the air

turned off, it is found that the switch is again closed at approximately 600 degrees F. Since the air is turned on by means of the actuation of the trigger 70, air under pressure issues from the air nozzle 200 and from the bleeder nozzle 205.

The cooling effect of the air from the nozzle 205 on the thermostat causes it to move the switch to closed position at once, and an immediate supply of additional heat is provided for supplying the heat of fusion of the meltable metal and keeping the gun at the desired temperature for continuous operation.

When the current is turned on and the air is turned on, the gun is maintained at a temperature of from substantially 800 to 850 degrees F. As soon as the air is turned off and the spraying of metal ceases, the air ceases to discharge against the thermostat, and the thermostat is soon heated by the heat from the gun and heating element to a point where it shuts off the current, but maintains the gun at a predetermined preliminary temperature.

The operation of the gun from the point of view of spraying is substantially the same as described in my prior applications. The meltable metal issues from the metal nozzle 174, and is engaged and atomized by the air under pressure issuing from the arcuate air nozzle 200, and the metal is sprayed against an adjacent surface.

The present gun is so sturdy that it can be subjected to hammering, which frequently occurs when the guns are handled by unskilled operators.

The thermostatic switch is protected from particles of porcelain which would otherwise get in between the switch contacts and prevent the energization of the gun and the insulating block 24 is of such material that it cannot be broken by the hard usage to which these guns are put.

The thermostatic switch is adapted to maintain the gun at one temperature in readiness for use, and at a second operating temperature during its use. By means of the discharge of cooling air upon the thermostatic switch the thermostatic switch is caused to be closed at once when the air is turned on and the spraying operation begun, and an additional supply of heat is provided for the heat of fusion of the metal to be melted.

The gun is maintained at a suitable temperature during operation, for continuous operation, so that there will be no interruption in the spraying of metal and no chance for metal to oxidize before additional metal is applied to it.

The present gun is more sturdy and may be more economically manufactured and provided with better heat insulation than the devices of the prior art, and the air nozzle and other units may more conveniently be replaced, by users, so that the operators may be supplied with spare parts, and do not have to send the spray guns back to the factory for repair.

The units of the gun are so arranged that the spare parts automatically fit into proper position, and no adjustment is necessary.

While I have illustrated a preferred embodiment of my invention, many modifications may be made without departing from the spirit of the invention, and I do not wish to be limited to the precise details of construction set forth, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, what I

claim as new and desire to secure by Letters Patent of the United States, is:

1. In a spray gun for metal having a nozzle for metal, an air nozzle unit comprising a metal tube having means at one end for connection to an air conduit, and having an air nozzle disposed at the opposite end, said air nozzle having a narrow, arcuate aperture, said tube having intermediate its ends, a metal alignment block located in predetermined longitudinal position on said tube for determining the spacing of said nozzle from said metal nozzle, and said block having shoulders for engaging complementary shoulders on said gun for determining the rotative position of said nozzle and tube with respect to said metal nozzle.

2. In a gun for spraying metal, a handle unit comprising a hollow metal member formed with an upwardly open enlargement at the top, and an air control unit comprising a metal member having means for connection to a source of air under pressure, and having a conduit extending through said metal member, a valve body located in a transverse bore in said metal member, said transverse bore communicating with said first-mentioned conduit, and said valve body having a

transverse bore registering with said first-mentioned conduit, a valve member in said valve body for interrupting communication of said conduit by closure of said bore in said valve body, said valve body having a downwardly projecting stem, and trigger means carried by said handle for actuating said valve body by engagement with said valve stem.

3. In a metal spray gun, the combination of a metal body having a heating element and having a metal well for receiving metal to be molten, said metal well having a discharge aperture, and an air nozzle unit, said air nozzle unit comprising a metal tube having means at one end for connection to an air conduit, and having an air nozzle disposed at the opposite end, said air nozzle having a narrow, arcuate aperture, said tube having intermediate its ends, a metal alignment block located in predetermined longitudinal position on said tube for determining the spacing of said nozzle from said metal nozzle, and said block having shoulders for engaging complementary shoulders on said gun for determining the rotative position of said nozzle and tube with respect to said metal nozzle.

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