

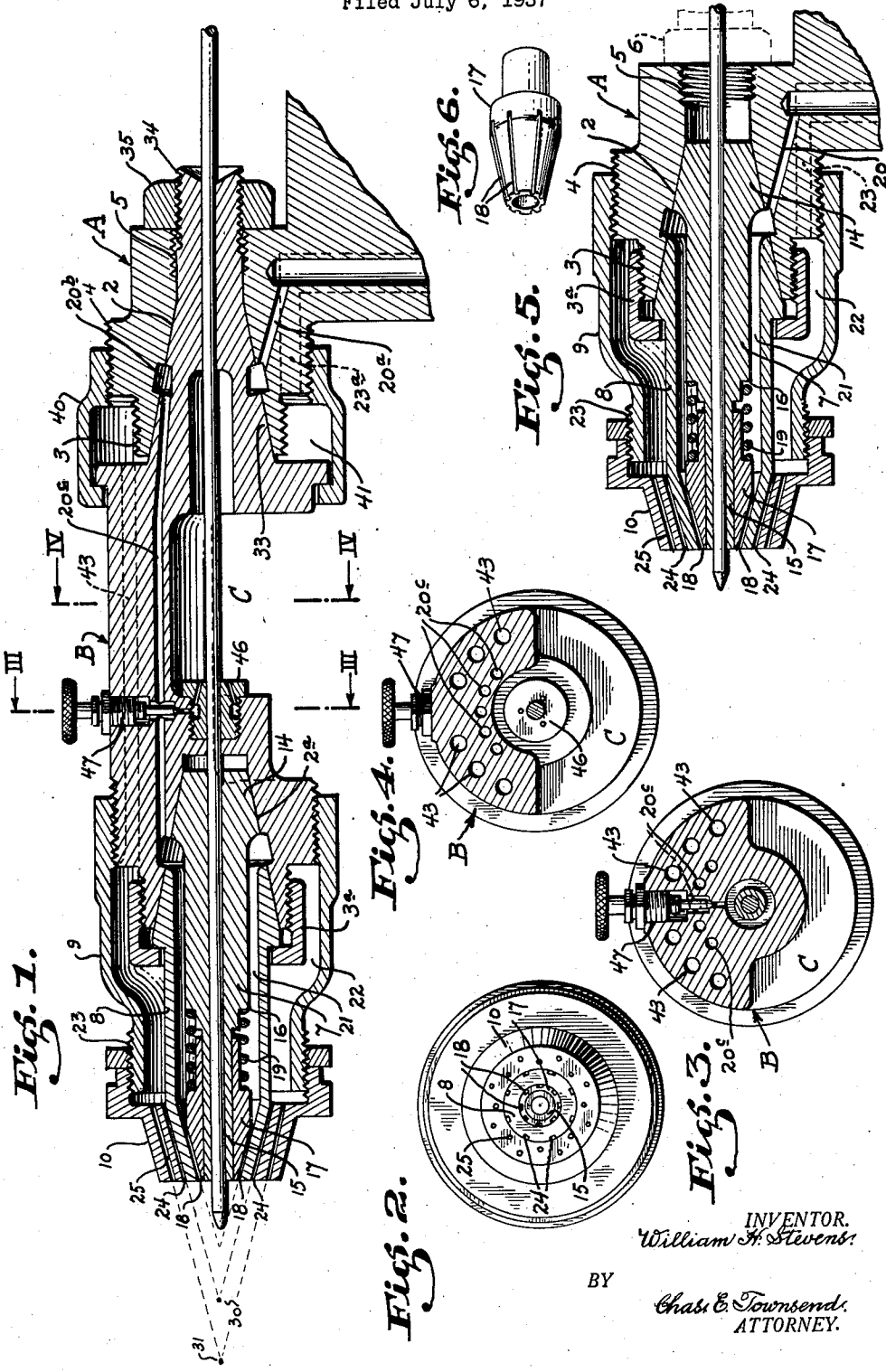
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METAL SPRAY APPARATUS

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METAL SPRAY APPARATUS

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This invention relates to a metal spray apparatus, commonly known as a metal spray gun, and particularly to the nozzle portion thereof, whereby metal in the form of wire is fused or melted and then atomized and projected against a surface to be coated.

The object of the present invention is to generally improve and simplify apparatus of the character described; to provide a nozzle having a wire guide therein, said guide being readily removable and interchangeable to accommodate wire of varying size or gauge; to provide a wire guide, one end of which supports a grooved plug which seats in the nozzle and cooperates therewith to form a plurality of gas discharge orifices, said wire guide, plug, and nozzle being separable and removable to permit cleaning of the grooves or passages formed in the plug; to provide a nozzle having an interior burning nozzle, a head therefor, and within the burning nozzle a wire guide; to provide a common seat in the head for the reception of the inner end of the burner nozzle and the inner end of the wire guide; to provide a seat in the outer end of the burner nozzle for the reception of a grooved plug; to provide a spring within the burner nozzle to force the plug and the wire guide against their respective seats; to provide a screw connection between the burner nozzle and the head, whereby the spring is compressed and the burner nozzle is connected to the head; to provide a cooperating burner and air nozzle, in which the air nozzle is provided with a plurality of air-discharging passages disposed on varying angles to cause a portion of the air to atomize the molten metal, and other portions of the air to direct and confine the atomized metal as it is being discharged; and further to provide a nozzle of the character described having a main and a secondary burner nozzle, in which the secondary nozzle is utilized to preheat the metal wire before it reaches the main burner nozzle, and the waste heat from the secondary burner nozzle is used to heat the air employed to atomize the molten metal.

The nozzle is shown by way of illustration in the accompanying drawing, in which

Fig. 1 is a central, vertical, longitudinal section of the nozzle, said section showing an intermediate head to permit preheating of the wire and heating of the air applied for the atomization of the metal;

Fig. 2 is an end view of the nozzle;

Fig. 3 is a cross section taken on line III—III of Fig. 1;

Fig. 4 is a cross section taken on line IV—IV of Fig. 1;

Fig. 5 is a section similar to Fig. 1, but showing the intermediate head removed.

Fig. 6 is a perspective view of the inner tapered nozzle plug.

Referring to the drawing in detail, and particularly to Fig. 5, A indicates a head member of suitable construction, in which is formed an interior cone-shaped seat 2, and on the exterior, threaded connections 3 and 4. A threaded opening 5 centrally disposed with relation to the seat is also formed in the head, and screwed into the same is a tube 6 which forms a preliminary wire guide as will hereinafter be described.

Disposed centrally of the nozzle as a whole is a main wire guide 7 and surrounding the same is a burner tube 8, an air tube 9, and a nozzle head 10. The main wire guide is tubular and elongated, as shown, and its inner end is enlarged and tapered as shown at 14 to seat in the inner end of the cone-shaped seat 2. The outer end of the wire guide is reduced in diameter as at 15, and is provided with an annular shoulder 16. Slidably mounted in the outer or reduced end of the wire guide is a tapered plug 17, the outer surface of which is provided with a series of grooves which, together with the outer end of the burner tube 8, form a plurality of gas-discharging orifices 18. The outer end of the burner tube is tapered and provided with an interior seat to receive the plug. A spring 19 is interposed between a shoulder formed in the inner end of the plug and the shoulder 16, and the spring exerts sufficient pressure to maintain the inner end of the wire guide and the outer end of the plug in engagement with their respective seats, the pressure being sufficient to prevent gas leakage. The burner tube 8 is larger in diameter than the wire guide 7, and an annular chamber is thus formed between them, as indicated at 19, into which gas is delivered through a passage 20, the gas delivered being a mixture of oxygen and hydrogen or the like. The inner end of the burner tube 8 is enlarged in a manner similar to the inner end of the wire guide, and it is tapered to engage and fit the outer end of the cone-shaped seat 2. A nut 3a engages the thread 3, and when this nut is tightened, it forces the tapered inner end of the burner tube into the seat and at the same time increases the pressure of the spring 19, to insure proper seating of the plug and the inner end of the wire guide.

The burner tube 8, as previously stated, is sur-

rounded by an exterior air tube 9. This is larger in diameter than the burner tube, and an annular chamber 22 is thus formed into which air is interposed, under comparatively high pressure, through a passage indicated by dotted lines at 23. The air tube is secured to the head by the screw connection indicated at 4. The outer end of the air tube is threaded as shown at 23, and the nozzle 10 is screwed in at this point. This nozzle is tapered in the interior to set against the outer end of the burner tube. The outer tapering face of this tube is grooved in a manner similar to the plug, and a plurality of discharge orifices or passages are thus formed as indicated at 24, to which air under comparatively high pressure discharges. This air is utilized for the purpose of atomizing and projecting the molten metal, and if these passages alone were used, the metal would be rapidly dispersed and spread over a comparatively large area. This is not desirable, and means accordingly have been provided for confining the spray as much as possible. This is accomplished by forming a second series of discharge orifices in the nozzle 10 as indicated at 25. These are disposed on a less angle than the orifices 24, and as such cause the air discharged to converge at a point a considerable distance in front of the nozzle, and thus serve to confine the molten spray to the area desired. That is, the air discharging through the orifices 24, and which functions to atomize the molten metal, will converse for instance at the point indicated at 30 in Fig. 1, while the air discharging through the orifices or passages 25 will converge at a point 31 and as it does so, it will obviously serve to assist in confining the spread of the atomized metal.

Where a metal wire having a comparatively low melting point is being used, for instance aluminum wire or tin, etc., preheating of the wire before it reaches the main burner nozzle, to wit, the flame produced by the gas discharging through the orifices 18, is not required, but when a metal wire is being employed which has a comparatively high melting point, for instance steel wire, and particularly steel wire of a high carbon content, better results are obtained if the wire may be preheated before reaching the main burner nozzle. To accomplish this, an intermediate head may be employed as shown at B in Fig. 1. This head is provided with a tapered end 33 adapted to fit the seat 2 formed in the head A, and it is secured therein by a threaded extension 34 and a nut 35. The intermediate head is fairly long and its opposite end is provided with a cone-shaped seat 2a similar to the seat 2, this seat being provided for the reception of the inner end of the burner tube 8 and the inner end of the wire guide 7. The gas from the burner tube is delivered from the head through a passage 20a which is connected with an annular passage 20b; this in turn connects with a plurality of passages 20c formed in the intermediate head, and these in turn connect with the annular chamber 19 formed between the main wire guide and the burner tube 8. The intermediate head is also secured to the main head A by means of a nut 40 which is applied to the screw connection 4. The opposite end of the nut engages a shoulder in the inner end of the intermediate head, and thereby assists in supporting the intermediate head, and the nozzle secured in the outer end thereof. At the same time, the nut forms an annular chamber 41 to which air under pressure is delivered through the passage indicated in dotted lines at

23a. From there, the air passes through passages 43 formed in the intermediate head, and these in turn deliver the air to the annular chamber formed between the burner tube and the air tube.

A recess such as shown at C is formed in the intermediate head. At one end thereof is a secondary burner nozzle 46 to which gas is delivered from the passage 20c through an orifice which is controlled by means of a needle valve 47. The flame is projected against the wire by means of the burner nozzle 46, and preheating thereof will thus take place before the wire enters the main wire guide and finally the main burner nozzle where fusing and melting take place, and as considerable temperature may be imparted by means of the burner nozzle 46, it is obvious that the final work of bringing the wire up to melting temperature is materially reduced, thereby permitting a more rapid melting and atomization of metal wires having a high melting point.

The intermediate head is also employed for the purpose of heating the air employed for atomizing and confining the metal spray. That is, the waste heat from the flame produced by the secondary burner nozzle 46 will obviously rise and heat the central portion of the intermediate head, and in fact all of it, by conduction, and as numerous air passages 43 are formed therein, the velocity of the air passing therethrough will be low, and the air temperature may be very materially raised before it reaches and passes through the orifices of the nozzle 10. This heating of the air is also an advantage as it decreases the tendency of the air to chill and bring about too rapid cooling of the melting metal as it is being atomized.

In actual operation, it will be understood that the head A will be provided with a hand grip, not here shown, and a valve mechanism which will not only control the flow of compressed air delivered to the gun, but also the flow of combustible gases to the burner nozzle, and similarly, that a wire-feeding means of a similar character will be employed. In the present instance, when the wire is being fed through, it may or may not be preheated, as desired, as it is optional with the operator to use or remove the intermediate head B. By extending the tube indicated at 6 to a point adjacent the wire feeding rolls, any kinking or bending of the wire prior to reaching the main wire guide is obviated. This main wire guide, and the preliminary guiding tube 6 will obviously be made of a hard steel or similar metal, to resist wear as much as possible, while the plug 17 and the remaining portions of the nozzle will be made of a heat-resisting and heat-dissipating alloy. By providing a plurality of air jets at the forward end of the nozzle, better atomization and confining of the atomized metal is insured, with the result that a dense, close-grained, deposit of small particles is obtained. The deposit is, furthermore, uniform and can be formed of practically any metal desired, as use of the preheating arrangement shown permits the use of wire formed of metal having a high melting point. The nozzle structure shown permits the several parts to be quickly separated for removal, interchange, cleaning, etc. The screw connection 3 formed between the inner end of the burner tube 70 and the gun, insures perfect seating of the inner end of the burner tube. The screw connection 23 formed between the nozzle 10 and the outer end of the burner tube permits perfect seating at that point, and by making the wire guide 7 of

two separate pieces, to wit, the plug and the wire guide, and by employing the spring 19, perfect seating of the plug and the wire glide with relation to their respective seats is insured. Hence, accurate machining such as has been previously required in guns of this character is substantially eliminated. The grooves formed in the exterior face of the plug and in the exterior face of the burner tube are at all times accessible for cleaning, and so are the orifices formed in the secondary burner indicated at 46. Hence dependable operation and uniform results are insured.

While certain features of this invention have been more or less specifically described and illustrated, it is nevertheless to be understood that various changes may be resorted to within the scope of the appended claims, and similarly that the materials and finish of the several parts employed may be such as the manufacturer may decide or varying conditions or uses demand.

Having thus described my invention, what I claim and desire to secure by Letters Patent is as follows:

1. In an apparatus of the character described, a head member, having a cone-shaped seat formed therein, an elongated wire guide, tapered at one end to fit and engage said seat; a burner nozzle surrounding and enclosing the wire guide, said nozzle having a taper at its inner end, which also engages the cone-shaped seat; a cone-shaped seat within the outer end of the nozzle; a tapering plug longitudinally adjustable on the outer end of the wire guide, engaging and seating the cone-shaped seat of the nozzle, said nozzle being larger in diameter than the wire guide, to form an annular chamber between the wire guide and the nozzle; means for delivering a combustible gas to said chambers; and a plurality of grooves formed in the outer face of the plug, through which the gas discharges.

2. In an apparatus of the character described, a head member, having a cone-shaped seat formed therein, an elongated wire guide, tapered at one end to fit and engage said seat; a burner nozzle surrounding and enclosing the wire guide, said nozzle having a taper at its inner end, which also engages the cone-shaped seat; a cone-shaped seat within the outer end of the nozzle; a tapering plug longitudinally adjustable on the outer end of the wire guide, engaging and seating the cone-shaped seat of the nozzle, said nozzle being larger in diameter than the wire guide, to form an annular chamber between the wire guide and the nozzle; means for delivering a combustible gas to said chamber; a plurality of grooves formed in the outer face of the plug, through which the gas discharges; a spring interposed between the wire guide and the plug, to force them against their respective seats; and a screw connection between the burner nozzle and the head, to secure the nozzle to the head, and for simultaneously applying pressure to the spring.

3. In an apparatus of the character described, the combination with the main burner nozzle and

the guide for directing a metal wire through the nozzle into a flame produced by the burner nozzle, of a secondary burner nozzle disposed ahead of the wire guide, and adapted to direct a flame against the wire, to preheat the same before the wire enters the flame of the main burner nozzle.

4. In an apparatus of the character described, the combination with the main burner nozzle and the guide for directing a metal wire through the nozzle into a flame produced by the burner nozzle, of a secondary burner nozzle disposed ahead of the wire guide, and adapted to direct a flame against the wire, to preheat the same before the wire enters the flame of the main burner nozzle; means for directing compressed air around and in front of the main burner nozzle to atomize the metal fused by the flame, and means for utilizing the heat of the secondary burner nozzle to heat the air before it reaches the fused metal.

5. In an apparatus of the character described a main and a secondary burner nozzle, means for supplying a combustible mixture from a common source to each nozzle to maintain a flame area in front of each nozzle, means for feeding a metal wire first through the flame area produced by the secondary nozzle, to preheat the wire, and then through the flame area of the main nozzle to fuse the metal, means for utilizing the heat of the flame from the secondary nozzle to heat compressed air, and means for projecting the heated compressed air into the flame area of the main nozzle to atomize the fused metal.

6. In an apparatus of the character described a main and a secondary burner nozzle, disposed in alignment with each other, said nozzles having a common central passage formed therein and extending through them, means for supplying a combustible mixture to each nozzle to maintain a flame area in front of each nozzle, means for feeding a metal wire first through the flame produced by the secondary nozzle, to preheat the wire, and then through the common passage into the flame area of the main nozzle, to fuse the metal, and means for atomizing and projecting the fused metal.

7. In an apparatus of the character described a main and a secondary burner nozzle, disposed in alignment with each other, said nozzles having a common central passage formed therein and extending through them, means for supplying a combustible mixture to each nozzle to maintain a flame area in front of each nozzle, means for feeding a metal wire first through the flame produced by the secondary nozzle, to preheat the wire, and then through the common passage into the flame area of the main nozzle, to fuse the metal, a third nozzle surrounding the main burner nozzle, means for directing compressed air through the third nozzle into the flame area of the main nozzle, to atomize the metal fused by said flame, and means for utilizing the heat of the secondary nozzle flame to heat the compressed air before it enters the third nozzle.

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