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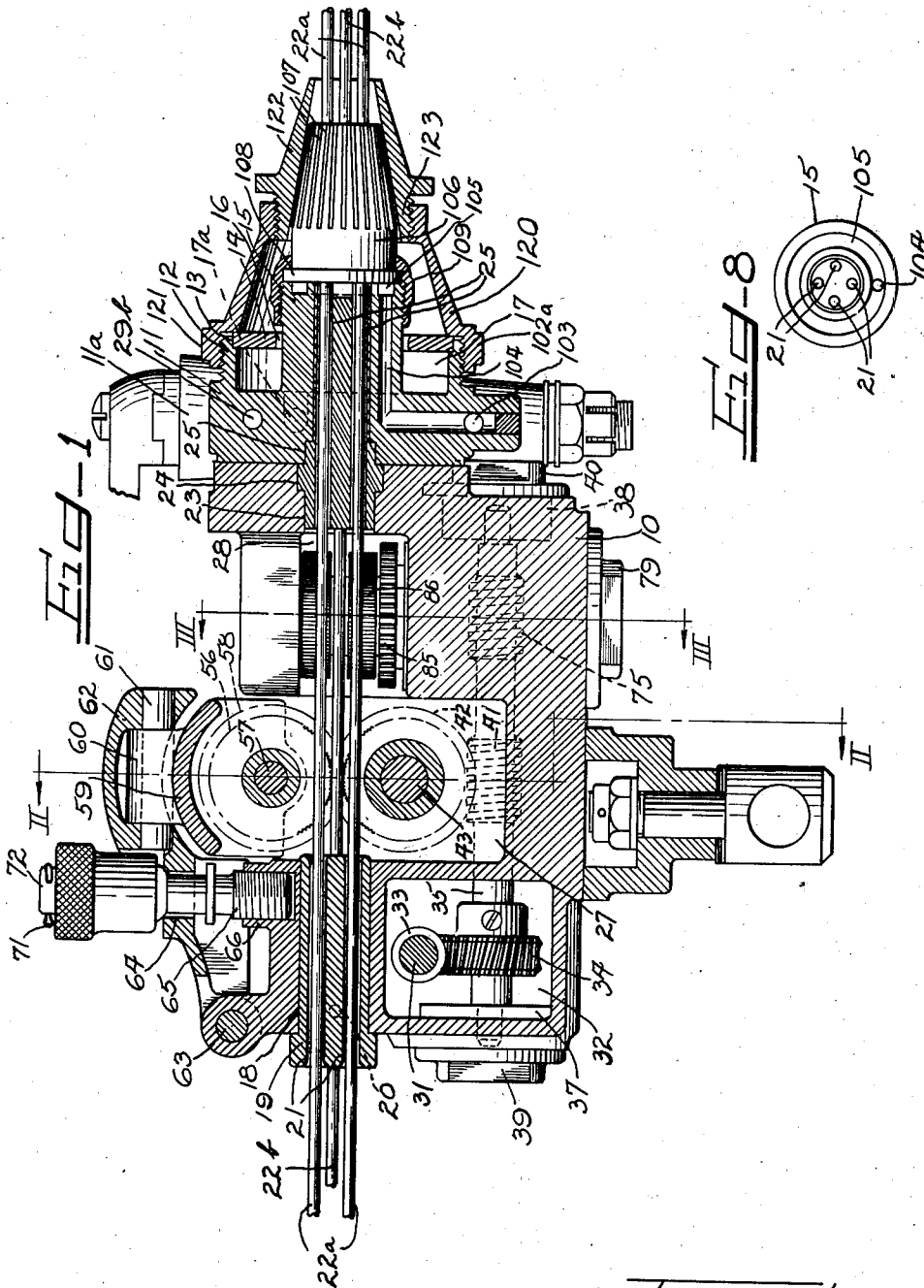
A. E. VANDERSEE

2,414,181

MULTIPLE WIRE FEED MECHANISM

Filed May 25, 1944

3 Sheets-Sheet 1



INVENTOR

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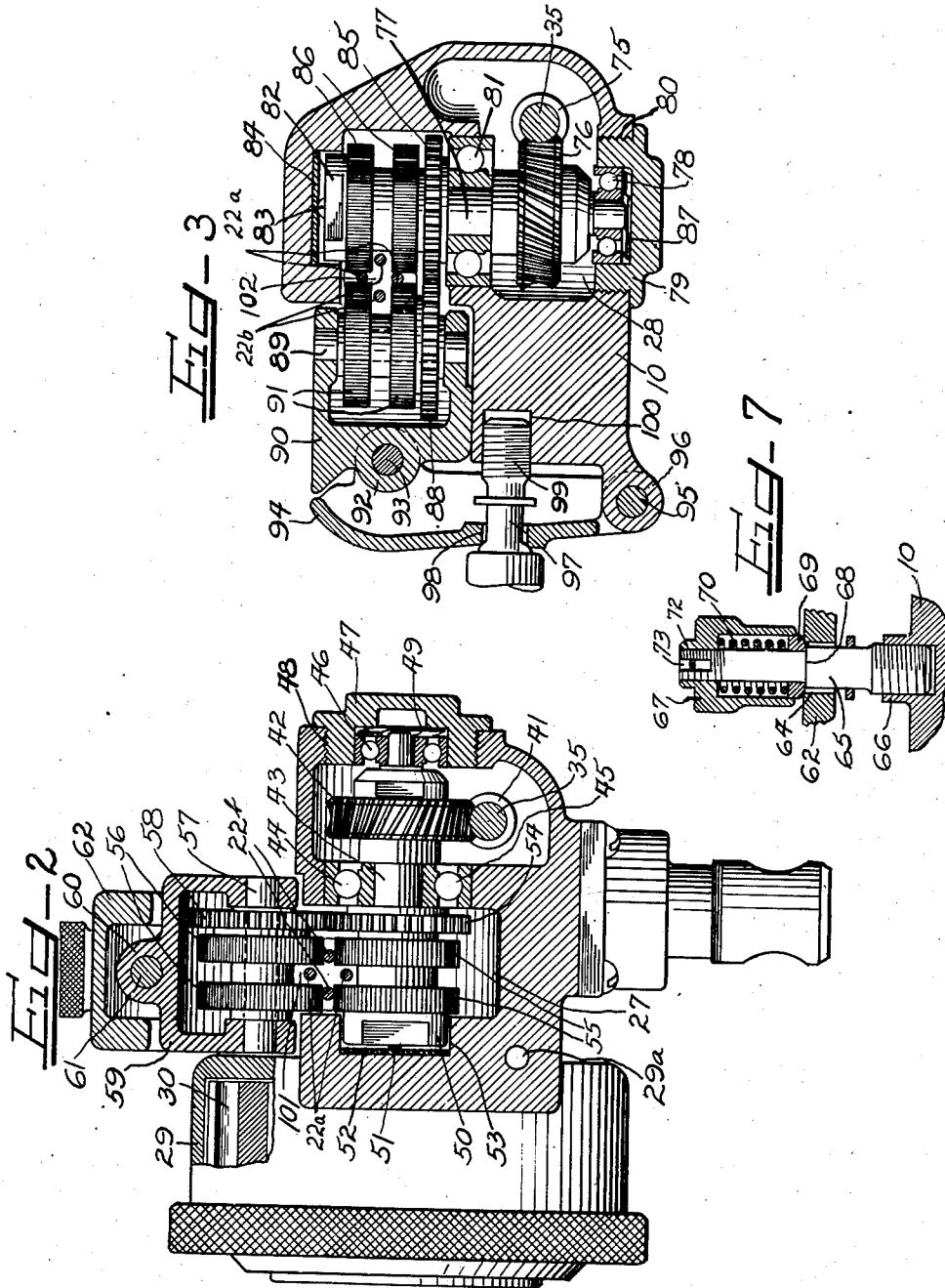
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MULTIPLE WIRE FEED MECHANISM

Filed May 25, 1944

3 Sheets-Sheet 2



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MULTIPLE WIRE FEED MECHANISM

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Fig-6

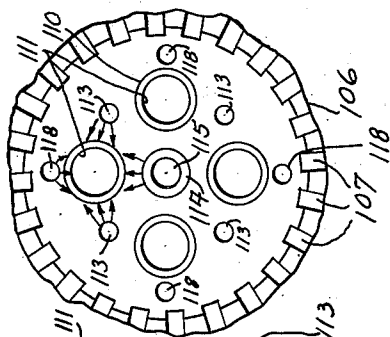


Fig-5

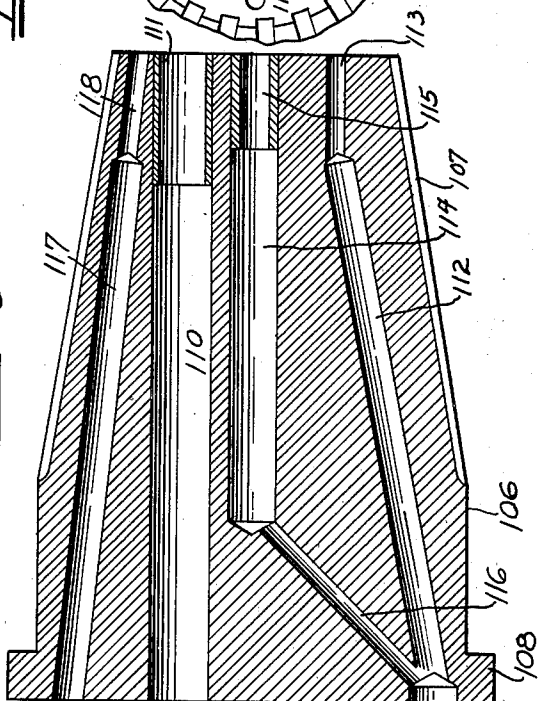
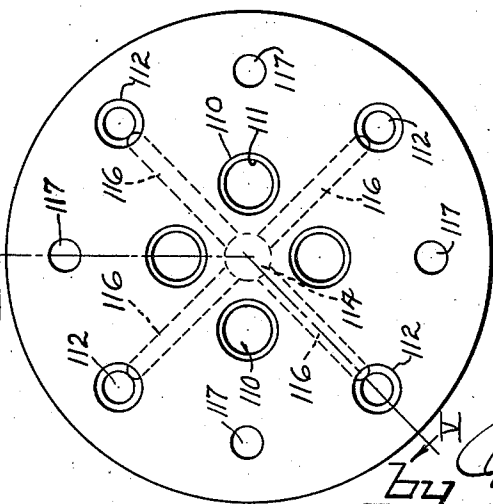


Fig-4



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2,414,181

MULTIPLE WIRE FEED MECHANISM

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12 Claims. (Cl. 91—12.2)

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This invention is directed to an improved metallizing gun of the spray type and relates more particularly to an improved wire feed mechanism therefor.

It is an important object of the present invention to provide in a gun of the above character, an improved mechanism for feeding the wire thereto, this wire to be melted and discharged from the nozzle of the gun in a highly comminuted state.

It is another object of the present invention to provide, in a metallizing gun, an improved wire feed mechanism capable of delivering to the device an increased amount of metal per unit of power input.

It is still another object of the present invention to provide an improved wire feed for a metallizing spray gun which is capable of advancing a greater volume of wire per unit of power input than has been customary in the past.

Another object of the present invention is to provide an improved wire feed mechanism for a metallizing spray gun which is efficient and compact and yet is capable of advancing through the gun, a plurality, preferably four strands, of wire to be sprayed.

In the past many efforts have been made to increase the volume of wire which could be fed to a spray gun in order that the spraying or metallizing operation could be accomplished more rapidly. One expedient which has been attempted heretofore involves an increase in the diameter of a single strand of wire fed to the gun. However, this arrangement has proved unsatisfactory since it was found that the wire melting arrangement merely melted the outer part thereof and was unable to transform the core of the wire to molten condition. Under these circumstances it was found that while the wire disintegrated into comminuted form around the outer portion thereof the core remained intact and was constantly fed forwardly and out of the nozzle of the gun as a wire of reduced diameter. This, of course, involves a tremendous waste of metal and failed to provide the additional volume of molten material which was required.

More specifically, it is an object of the present invention to provide a multi-strand channel through a metallizing spray gun for conducting a plurality of strands therethrough, certain of these strands being engaged by an advancing mechanism at one point of their progress through the gun and others of the strands being engaged by a second advancing mechanism at another point in their advance through the gun.

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In accordance with the general features of the present invention there is provided herein a metallizing spray gun having any suitable source of power such as a turbine or the like, the turbine being arranged to rotate and drive a jack shaft which in turn extends longitudinally in the gun and is provided with worms at longitudinally spaced points thereon. Each of these worms is in line with a wire advancing mechanism, one of which advances vertically disposed strands of wire inserted in the gun and the other of which advances horizontally disposed wires. Each of these advancing mechanisms is disposed normal to the other and is provided with spaced, knurled wire gripping wheels which are opposed to similar wheels driven thereby on a suitable bearing. As one of said advancing mechanisms grips one set of wires, the other set is disposed between the knurled gripping wheels thereon to pass freely therebetween so that at one point on the longitudinal axis of the gun certain of the wires are advanced and others idle between the advancing wheels while, at another point on the longitudinal axis of the gun, the remaining wires are advanced while those engaged by the first named gripping wheels pass therebetween toward the nozzle of the gun.

It is still another object of the present invention to provide an improved wire advancing mechanism for a metallizing spray gun wherein the wire gripping, advancing wheels are rockably associated to permit the tight gripping and advancing of wire stock in the presence of slight variations in diameter thereof.

It is still a further object of the present invention to provide a metallizing spray gun of the above character which is susceptible of economical manufacture, is compact and may be easily and efficiently operated by a relatively unskilled user.

It is a further object of the present invention to provide an improved nozzle for a metallizing spray gun, such nozzle including passages for receiving a plurality of strands of wire for passage therethrough and also including gas passages therethrough which are so disposed that each of the strands of wire is subjected to heating action on all sides when gas emitted from the respective gas passages is ignited.

Still a further object of the present invention is to provide a nozzle of the above character having a central longitudinal gas passage, which has gas fed therethrough through a plurality of passages, and which is provided with a restricted outlet thereby to afford an improved nozzle effect.

The present improvements also contemplate a novel arrangement of the wires around a common center, and having individual feeds for transversely disposed pairs of the wires. The improvements also contemplate an arrangement whereby a plurality of wires leaving the nozzle of a metal spraying gun will each be surrounded by hot burning gases whereby the entire superficial area of each wire will be affected by the burning gases to cause an equal and complete melting of each wire as it leaves the nozzle of the spraying gun.

It is one of the principal objects of this invention to simplify the construction of a multiple wire feed mechanism such as contemplated herein, and to improve the efficiency, operation and dependability of such wire feed mechanism.

It is also a principal object of this invention to provide a wire feed mechanism that is of a dual feed type wherein a pair of wires may be simultaneously advanced to a metal spraying nozzle regardless of variations in diameters of the respective wires; and alternatively two pairs of wires may be simultaneously fed to a nozzle device in the same apparatus.

Another principal object of this invention is to provide a metal spraying gun with a plurality of wire feed units wherein each unit is adapted to feed a pair of side-by-side wires.

A further principal object hereof is to provide a plurality of wire feed units arranged in tandem for advancing pairs of wires or the like, and each unit having provision for the uninterrupted free passage of another pair of wires past the same.

Another object hereof is to provide a wire feed mechanism wherein at least one of the wire advancing rollers, or a pair of rollers, is yieldably urged towards the opposing roller or pair of rollers and to provide a tiltable carrier for the yieldably urged roller or pair of rollers whereby the feed will automatically accommodate itself to variations in diameters of the wire or wires being fed by the device or to feed wires of different gauge.

A further object is to provide means for feeding a plurality of wires through a metal spraying gun nozzle in concentric arrangement around a central gas discharge port that is supplied with combustible gas from a plurality of radially disposed inlet passages, such central port being augmented by a series of other gas discharge ports that are arranged in groups around each wire leaving its respective guide in the nozzle. This arrangement positively insures the melting of all sides of each individual wire and it also effects the complete and simultaneous fusing of a plurality of wires in a single metal spraying nozzle.

Still another principal object of this invention is to provide means in a metal spraying apparatus for effectively forming an alloy of a plurality of metals at the nozzle and spraying the alloy thus formed. With the arrangement herein disclosed the forming and spraying of a metal alloy is readily accomplished by advancing a plurality of wires of different metals to the nozzle by multiple feed means and regulating the speed of travel of such wires with relation to the respective fusing points of the different metals forming the alloy. This merely involves the changing of gear or speed ratio of the different gear assemblies that drive the individual wire advancing units.

It is preferred to accomplish the numerous objects of this invention and to practice the improvements in substantially the manner herein-

after fully described and as more particularly pointed out in the appended claims, reference being made to the accompanying drawings that form a part of this specification.

In the drawings:

Figure 1 is a longitudinal vertical section taken axially through a metal spraying gun showing the present improvements incorporated therein.

Figure 2 is a vertical transverse section taken on the plane of line II—II on Figure 1 showing details of one of the multiple wire feed units and a portion of the drive therefor.

Figure 3 is a vertical transverse section taken on the plane of line III—III on Figure 1 showing details of the second multiple wire feed unit and a portion of the driving means therefor.

Figure 4 is a face elevation of the rear end of the nozzle body detached from the apparatus and drawn to an enlarged scale.

Figure 5 is a longitudinal section taken on the two planes of line V—V on Figure 4 and looking in the direction of the arrows.

Figure 6 is a face elevation of the front end of the nozzle shown in Figure 5, portions of which are fragmentary.

Figure 7 is an axial section of a yieldable clamping device employed in the present apparatus.

Figure 8 is an end view of the end of a boss on the head of the spray gun body or housing.

The drawings are to be understood as being more or less of a schematic character for the purpose of disclosing a typical or preferred form of the improvements contemplated herein. In these drawings like reference characters identify the same parts in the several views.

The embodiment of the metal spraying gun shown in the drawings comprises a body 10 of asymmetric or irregular shape, preferably a casting or the like, the front or work end portion of which has a flat transverse face to which a head 11 is secured. This head is provided with an exteriorly threaded flange 12 of cylindrical shape that projects away from the head and is provided with an internal shoulder 13 to seat a washer 14. An elongated cylindrical boss 15 projects axially from the head 11 and is of such length that it extends beyond the washer 14 in the manner shown in Figure 1. The diameter of this boss 15 is less than the inside diameter of the washer 14 to provide an annular outlet passageway 16 for the chamber 17 that is formed by the annular flange 12 and the washer 14. The atomizing air for the nozzle is discharged into chamber 17 through a feed passageway 17a in the head 11, said feed passageway being under control of the valve 11a to supply pressured air from a suitable source.

The body 10, at its end opposite the head 11, is provided with a longitudinal bore 18 to receive a wire guide or bushing 19 that is secured in place by a clamp screw 20. The wire guide or bushing 19 has preferably four equidistantly spaced channels 21 that provide longitudinal guides for two pairs of wires 22a and 22b that are arranged radially around a common center, the wires of one pair being vertically disposed and the wires of the other pair being horizontally disposed, as seen in Figures 2 and 3.

The end of the body 10 adjacent the head 11 has a shouldered bore 23 disposed in axial alignment with the bore 18 at the other end of the body. A flanged wire guide or bushing 24 is seated in the shouldered bore 23 and is provided with a plurality of axial channels 25, preferably four

in number, that correspond in arrangement and are axially aligned with the bores 21 in the other wire guide or bushing 19. The head 11 is provided with a shouldered bore 25 to receive a reduced portion of the bushing 24, said bore 25 being extended also into the adjacent end of the boss 15 of the head. The means which clamp the head 11 to the flat forward face of the body 10 are adapted to draw the head against the shoulder portion of the bushing 24 and clamp it against the shoulder in the bore 23 of the body thereby providing a rigid construction and assembly. The wires 22a and 22b in passage to bushing 24 will span the open recesses 27 and 28 in the portion of the body between the inner ends of the bushings 19 and 24. These recesses 27 and 28 are made in the body to receive and accommodate a plurality of wire feeding units that will be presently described.

The rear end of the body 10, the left end as observed in Fig. 1, is provided with a cylindrical housing 29 constituting a rotor or turbine chamber that is arranged with its axis at right angles to the length of the body 10. The turbine comprises the conventional form of rotor 30 carried upon a shaft 31 carried in suitable bearings and which is extended into a chamber 32 in the adjacent portion of the body and to the rear of the recess 27 before mentioned, i. e. to the left as in Fig. 1. Within the chamber 32 the turbine shaft 31 has a worm 33 anchored to it that meshes with a worm wheel 34 on the adjacent portion of a jack shaft 35 disposed at right angles to the turbine shaft. The jack shaft 35 extends longitudinally within the body 10 through the two recesses 27 and 28 and has its ends journaled in anti-friction bearings 37 and 38 in the inner portions of hollow plugs 39 and 40 which are screwed into openings in the respective rear and front ends of the body 10 in the manner shown in Figure 1. The turbine 30 is driven by pressure fluid that is admitted to the rotor chamber 29 through an input passage 29a in a convenient portion of said housing 29 that communicates with a turbine air branch 29b in the head 11, which branch receives pressure fluid through a multiple control valve 11a.

The jack shaft 35 is provided with a worm 41 beneath the feed unit for the horizontal pair of wires 22b. This worm 41 meshes with a worm wheel 42 secured to a transmission shaft 43 that is journaled intermediate its ends in anti-friction bearings 44 that are suitably secured in a bearing opening 45 made in the adjacent wall of the recess 27 so that the shaft 43 projects across the lower portion of recess 27. The outer end of the transmission shaft 43 is journaled in anti-friction bearings 46 carried in a cupped plug 47 that is screwed into a bearing opening 48 in the body 10. An end thrust spring washer 49 is seated in the cupped plug 47 back of the anti-friction bearing 46 and the other end of said shaft is provided with an end piece or head 50 having a central knob 51 that presses against a hard metal disk 52 in a seat 53 axially aligned with the shaft 43.

Within the recess 27 the transmission shaft 43 has a gear 54 secured to it, and between this gear and the head or end piece 50 there is a pair of side-by-side spaced feed rollers 55 having knurled or corrugated cylindrical faces for engagement with the respective wires of the horizontally disposed pair 22b. The opposing side-by-side pair of knurled rollers 56 are disposed in spaced relation to each other on a spindle 57 that is provided

with a gear 58 that meshes with the gear 54 on the transmission shaft 43.

The rollers 56 are arranged to rock transversely to their axis of rotation to accommodate inaccuracies or differences in diameter of the pair of wires 22b with which these rollers are engaged. A suitable carrier 59 of hollow construction is provided with bearings for the roller spindle 57, and the upper portion of this carrier has a boss 60 for pivotally or swingingly mounting carrier 59 upon a pivot pin 61 the ends of which project through the boss 60 and are suitably secured in the adjacent hollow portion of presser arm 62. As seen in Figure 2 the carrier 59 has a somewhat yoke-shape and the bearings for the spindle 57 are in the lower portions of the side members of this yoke. The presser arm 62 on which the carrier 59 is swingingly mounted is fulcrumed at its end opposite the carrier 59 upon a pivot pin 63, thus permitting the arm to lift the carrier 59 for disengaging the upper feed rollers 56 of this feed unit from the opposing feed rollers 55 that rotate upon a fixed axis.

Means are provided for yieldably urging the upper rollers 56 of the feed unit in opposition to the lower feed rollers 55. Intermediate its ends the presser arm 62 is provided with a smooth bored opening 64 to receive the smooth shank portion of a tightening bolt 65 having threads upon its lower end portion that screw into a threaded boss 66 on the adjacent portion of the body 10 alongside the top of recess 27. The bolt 65 is a part of a yieldable clamping assembly that is adapted to urge the arm 62 in a downward direction so that the rollers 56 on the swinging carrier 59 will be pressed firmly against the horizontal pair of wires 22b.

The details of this clamping assembly are shown in Figure 7 where it will be seen that the upper portion of the bolt 65 is reduced in diameter and is threaded at its upper end to screw into the upper end portion of a hollow sleeve 67. The lower portion of the sleeve 67 bears against the arm 62 around the bore 64 through which the bolt passes. Between the upper and lower threads on the bolt there is a shoulder 68 to receive a follower ring 69 and interposed between this ring 69 and the upper end of the wide bore of the sleeve 67 there is an expansion coil spring 70 the tension of which is tightened by screwing the sleeve upon the end of the bolt 65 after the lower threaded portion of the bolt has been engaged in the threads of the boss 66. After proper adjustment of the spring has been made a cotter pin 71 is inserted through an upstanding boss 72 at the top of the sleeve 67, which cotter pin is passed through a longitudinal slot 73 in the upper portion of the bolt 65 thus securely locking the bolt and sleeve against relative rotation while maintaining the spring 70 under the desired tension. When this clamping device is screwed into boss 66 with the sleeve 67 engaged against the arm 62, the spring 70 will be under increased tension so that the rollers 56 are yieldably urged towards rollers 55. Furthermore, the carrier 59 may rock upon the pin 61 should there be any unevenness in either of the horizontal pair of wires 22b that are passing between the opposing rollers 56 and 55.

The jack shaft 35 adjacent its front bearing 38 is provided with a second worm 75 that drives a worm wheel 76 on a vertically disposed transmission shaft 77. The lower reduced end portion of transmission shaft 77 is journaled in anti-friction bearings 78 seated in a cupped plug 79

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that is screwed into a threaded opening 80 in the lower portion of the body 10. This worm and worm wheel, together with the transmission shaft 77 are in the lower portion of the recess 28 and immediately above the hub of worm wheel 76 the transmission shaft 77 is journaled in anti-friction bearings 81 as shown in Figure 3. The upper end of the shaft 77 extends to the top of the recess 28 where it is provided with an end piece 82 having a knob 83 thereon that engages an opposing hard metal plate 84. The opposite or lower end of the transmission shaft 77 is engaged by a spring thrust ring 87 that urges said shaft upwardly to engage the knob 83 with the plate 84 in the manner shown. Above its bearing 81 the transmission shaft 77 has a gear 85 anchored to it, and between this gear and the end piece 82 is a side-by-side pair of knurled feed rollers 86 arranged in spaced relation the one above the other. This is a second wire feed unit that is adapted to advance the second or vertically disposed pair of wires 22a to the nozzle end of the spray gun.

The gear 85 of this second feed unit is meshed with a gear 88 carried upon the lower end of a vertical spindle 89, parallel to shaft 77 that is journaled at its end in bearings on a yoke-shaped carrier 90 that is similar to the carrier 59 of the feed unit that advances the horizontally arranged pair of wires 22b. The spindle 89 has secured to it a pair of spaced knurled feed rollers 91 arranged in opposition to the rollers 86 on the transmission shaft 77. The carrier 90 has a boss 92 whereby it is swingingly mounted upon a pivot pin 93 mounted in spaced opposite portions of an arm 94. The arm 94 is in a vertical position and has its lower end portion fulcrumed upon a pivot pin 95 carried in a boss 96 upon the adjacent portion of the body 10. The arm 94 is yieldably urged in a direction to oppose the rollers 91 towards the rollers 86 with the wires 22a between them. The means for urging the arm in a direction to grip the wires 22a comprises a clamp assembly similar to the clamp shown in Figure 7 wherein the smooth shank portion of a bolt 97 passes through a smooth bored hole 98 in the arm 94 and has its threaded end portion 99 screwed into a threaded recess 100 in the aligned portion of the body 10 as shown in Figure 3. The remaining portion of this clamping assembly is similar to that shown in Figure 7 and the details thereof may be here omitted.

The feed units, as hereinbefore described, are preferably arranged one ahead of the other in the direction of wire travel, and each pair of rollers may be of the Siamese type. The space between the opposing Siamese rollers 55 and 56 provides a channel 101 to accommodate the vertically disposed pair of wires 22a and permits free uninterrupted movement of this pair of wires 22a past this feeding unit which advances the horizontally disposed pair of wires 22b towards the nozzle. In a similar manner the spaces 102 between the opposing Siamese rollers 86 and 91 of the second unit provide for the free passage of the horizontally disposed pair of wires 22b past this second unit which advances the vertical pair of wires 22a to the nozzle.

The arrangement hereinbefore described permits the feeding of a plurality of wires through the body or housing of the metal spraying gun and each feed unit is constructed and arranged to accommodate the passage and free movement of the other pair of wires. If desired, only one feed unit may be used for the purpose of feed-

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ing two wires to the nozzle. Also if it is desired to provide a spray which is an alloy of two metals, one pair of wires may be of one metal and the other pair of wires may be of another metal, forming the respective components of the alloy desired. The wires being of different density and having different fusing points will require different feeds for advancing them to the nozzle and this differential of feeds may be controlled by merely changing the gear ratio of a worm and worm wheel of one or both of the respective feed units. This adapts the machine for a wide range of usefulness and without altering its mode of operation.

The components of the oxyacetylene gas for the nozzle are received from suitable sources and are separately fed from valve 11a into a mixing chamber 103 in the head 11, from which they enter a branch 104 leading through the boss 15 of the head, as shown in Figure 1, to be discharged into an annular channel or chamber 105 in the end face of said boss.

The nozzle of the spray gun comprises a body 106 having a cylindrical portion and a tapered portion, the latter having a plurality of elongated air channels 107 cut longitudinally in its surface. An annular flange 108 affords means whereby the body 106 may be mounted in abutting relation to the channeled end face of the boss 15 by means of clamping collar 109 that is screwed upon the exteriorly threaded portion of said boss. The body 106 of the nozzle assembly has a plurality of longitudinally disposed parallel bores 110, preferably four in number, arranged radially around a common center to provide guides for the two pairs of wires 22a and 22b. The discharge ends of the bores 110 have bushings 111 inserted therein to reduce their diameters so that they are only slightly larger than the gauge of the wires passing therethrough. The other ends of these bores 110 are registered with the respective bores 25 that guide the wires through the boss 15 of the head 11.

A plurality of obliquely disposed gas passageways 112 are bored longitudinally through the body 106 in the manner shown in Figure 5 and have their outlet end portions reduced as at 113 to provide jet-forming mouths. The inlet portions of these gas passageways 112 communicate with the annular channel 105a in the end of boss 15 and receive the oxyacetylene gas therefrom. There is also a central or axial gas passageway 114 extending part way through the body 106 and provided at its discharge end with a jet-forming bushing 115. The inlet end of this passageway 114 communicates by a plurality of branches 116 leading from the inlet ends of the oblique gas passageways 112. Other obliquely disposed passageways 117, having reduced jet-forming mouths 118 are bored obliquely through the body 106, as shown in the upper portion of Figure 5, and have their inlet ends communicating with the annular chamber 105 in the end of the boss 15.

The cap which surrounds the nozzle body 106 is of tapered design in longitudinal section and comprises a frusto-conical or tapered skirt 120 having an interiorly threaded flange 120a at its base portion that is shouldered and is screwed upon the threaded exterior of the flange 12 of the head, with its shoulder pressed against the washer 14 to maintain the latter in position. The other portion of the cap comprises a tapered or frusto-conical tip 122 having a threaded cylindrical base 123 that is screwed into the adja-

cent threaded end of the skirt portion 120. The tapered interior surface of the tip corresponds with the tapered surface of the body 106 and it is screwed into the skirt portion until these tapered surfaces engage each other so that the atomizing air will pass through the longitudinal channels 107 to be discharged into the end of the tip that projects beyond the end face of the tapered body 106, as shown in Figure 1. Unscrewing the tip 122 will, of course, increase the size of the air passage to vary the atomizing function.

By reference to Figure 6 it will be seen that the four wires leaving the nozzle body 106 are surrounded by a plurality of streams of ignited gases. All of the wires leaving their guides 111 receive a portion of the flame from the central jet 115, and each wire also receives the flames of two of the jets 113 as well as one of the jets 118 that may be said to be individual to each wire. The jets are concentrically arranged around a common center at the axis of the central jet 115. Thus, each wire is subjected to gas flames from at least four jets, with the result that the whole exposed surface of each wire is affected by flames that are directed towards it from a plurality of directions. Hence the fusing of the metal is complete and extremely rapid and therefore the feed of the wire may be materially increased in speed well above the speed heretofore employed in spray guns. Furthermore, the central jet is rendered extremely efficient, due to the fact that substantially all of the ignited gases issuing therefrom is utilized against metal issuing from the several wire guides around the central jet.

It will also be apparent that the two wires or two pairs of metal wires having different fusing or melting points may be fed through the gun and sprayed at the nozzle in the form of an alloy of two or more metals.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. A spray gun for spraying metal from a pair of metal wires comprising a housing; a nozzle at an end of said housing; and means for advancing the pair of wires through said housing to said nozzle comprising a first pair of side-by-side feed rollers rotatable on a fixed axis; a second pair of side-by-side feed rollers opposing the rollers of said first pair; means for driving said pairs of feed rollers in unison; a carrier in which said second pair of feed rollers are journaled; a yieldable arm fulcrumed on said housing; and means swingably mounting said carrier on said arm to thereby adapt said second pair of feed rollers for rocking bodily movement transverse to the line of travel of the wires to accommodate opposing rollers to variations in the respective wires.

2. A spray gun for spraying metal from a plurality of pairs of metal wires comprising a housing; a pair of vertically spaced guides in said housing; a pair of horizontally spaced guides in said housing; a nozzle at the delivery end of said housing having bores registered with said housing guides for receiving wires fed therethrough; a first feed unit in said housing including a pair of Siamese rollers rotatable on a fixed axis; an

opposing pair of Siamese rollers yieldably urged towards the other Siamese rollers, said pairs of rollers arranged upon horizontal axes in superposed relation for gripping and advancing the horizontal pair of wires to said nozzle with the vertical pair of wires freely movable in a space between the respective upper and lower Siamese rollers; a second feed unit including a pair of Siamese rollers rotatable on a fixed vertical axis; an opposing pair of Siamese rollers rotatable on a vertical axis and yieldably urged towards the other Siamese rollers having a vertical axis, the rollers of said second unit adapted to grip and advance the vertical pair of wires to said nozzle with the horizontal pair of wires freely movable in spaces between the respective Siamese rollers of the second feed unit; a prime mover, a shaft driven by said prime mover; and geared means operatively connecting said shaft to the respective first and second wire feed units.

3. A spray gun for spraying metal from metal wire comprising a housing; a plurality of wire guides through said housing arranged in diametrically disposed pairs; advancing means engaged with one pair of the wires at one point in the travel of said pair through said housing; another advancing means engaged with a second pair of wires at a point in their travel through said housing that is removed from the point of engagement of the first pair of wires; a prime mover; and transmission means operatively connecting the respective advancing means to said prime mover for simultaneously moving all of the wires through said housing.

4. In a spray gun for spraying comminuted metal fed thereto as wire, means for guiding a plurality of strands of wire through the gun and means for advancing said strands including a plurality of advancing mechanisms comprising opposed circular feed members, each feed member having spaced wire gripping portions and intermediate portions for receiving in free, non-engaging relationship wire advanced by another like advancing mechanism.

5. In a nozzle for a spray gun of the type adapted to spray metal from a plurality of wires fed thereto, a plurality of wire guide channels, a central gas passage having an outlet surrounded by outlets of said wire guide channels, a plurality of radial gas passages having outlets surrounding each wire channel outlet whereby substantially all of the ignited gas from said central gas outlet is impinged upon the wires to melt the same and the ignited gas from the radial gas outlets melts the outer sides of the wires, and an annular air pressure stream around all of the gas passage outlets and converging inwardly to aid combustion of the gases and atomization of the metal.

6. In a spray gun for spraying comminuted metal fed thereto as wire, means for guiding a plurality of strands of wire through the gun and means for advancing said strands including a plurality of sets of feed rollers, the axes of the rollers of each set being at right angles to the direction of wire movement and also at right angles to each other, one set being disposed so that the rollers thereof engage with and advance a first strand of wire and so that a second strand is aligned with the space between said rollers and another set being disposed so that the rollers thereof engage with and advance the second strand and so that the first strand, advanced by the first named set of rollers is aligned with the space between the rollers thereof.

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7. A spray gun for spraying metal from metal wire comprising a housing; a nozzle at an end of said housing, means for advancing a plurality of wires through said housing comprising two sets of feed rollers arranged one ahead of the other in the direction of wire travel, each set including two pairs of opposed rollers with the axes of the rollers of one set horizontal and the axes of the rollers of the other set vertical, a pair of opposed rollers adapted to separately grip and advance one of the wires to said nozzle; separate gearing for rotating each pair of each set of said feed rollers to independently advance said wires; and means for actuating said gearing.

8. A spray gun for spraying metal from metal wire comprising a housing; a plurality of wire guides through said housing arranged around a common center, a nozzle at the discharge end of said guides; means for advancing a plurality of wires through said guides comprising two sets of feed rollers arranged one ahead of the other in the direction of wire travel, each set including two pairs of opposed rollers with the axes of the rollers of one set horizontal and the axes of the other set vertical, a pair of opposed rollers adapted to grip and advance one of the wires to said nozzle; separate gearing for rotating each pair of each set of said feed rollers to independently advance said wires; and means for actuating said gearing.

9. A spray gun for spraying metal from metal wire comprising a housing; a plurality of wire guides through said housing arranged around a common center; a nozzle at the discharge end of said guides, a plurality of spaced sets of feed units arranged one ahead of another in the direction of wire travel and disposed with the axes of the rollers of one set at right angles to the axes of the next set; each set including a pair of opposed feed rollers adapted to grip and advance one of the wires through a guide to said nozzle; and means for driving all of the rollers of the several sets.

10. A spray gun for spraying metal from a pair

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of metal wires comprising a housing; a plurality of wire guides through said housing; advancing means engaged with certain of the wires at one point in their travel through said housing; another advancing means engaged with other wires at a point ahead of the point of engagement of said first mentioned advancing means with said certain wires taken in the direction of wire movement; a prime mover; and transmission means operatively connecting the respective advancing means to said prime mover.

11. In a nozzle for a spray gun of the type adapted to spray metal from a plurality of wires passing through it, comprising means forming a plurality of wire guide channels, means forming a central gas passage having an outlet surrounded by the outlets of said wire guide channels, means providing a plurality of radial gas passages having outlets surrounding each of the wire channel outlets whereby substantially all of the ignited gas from the said central gas outlet strikes the wires to melt the same and the ignited gas from the radial gas outlets melts the outer surfaces of the wires, and means providing an annular air pressure stream around all of the gas passage outlets and converging inwardly to aid combustion of the gases and atomization of the metal.

12. In a spray gun for spraying comminuted metal fed thereto as wire, means for guiding a plurality of strands of wire through the gun, means for advancing a pair of wires in parallel and laterally spaced relation, means for advancing a second pair of wires in parallel and laterally spaced relation with the plane of the second pair of wires at an angle to the plane of the first pair of wires, the arrangement being such that the advancing means for one pair of wires straddles the plane of the other pair of wires to thereby provide free passage of said one pair of wires with respect to the other advancing means as said one pair of wires is moved by its advancing means.

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