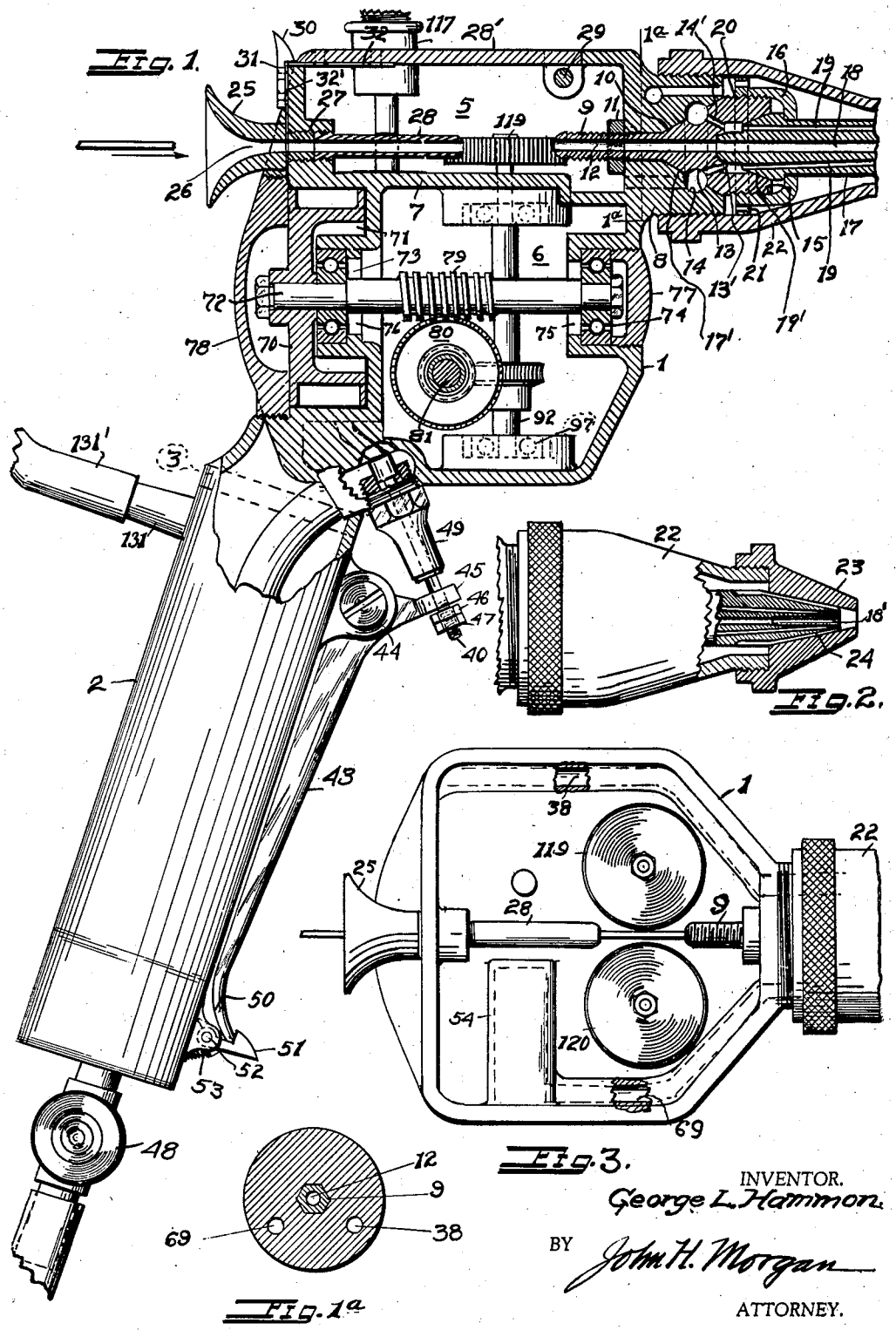
Nov. 21, 1939. G. L. HAMMON 2,181,082

METAL SPRAY GUN

Filed Dec. 17, 1934 3 Sheets-Sheet 1



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METAL SPRAY GUN

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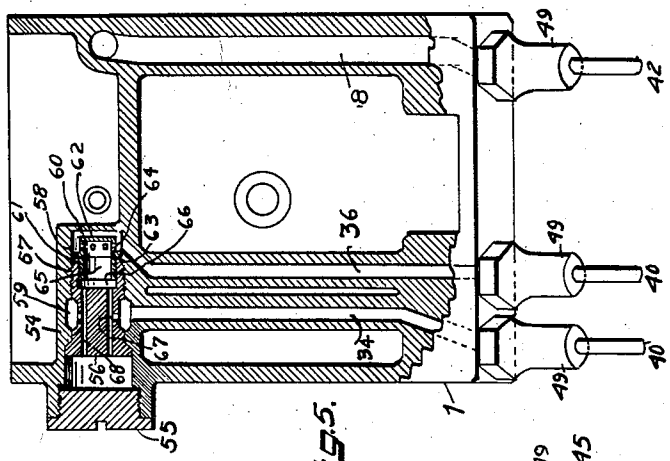


FIG. 5.

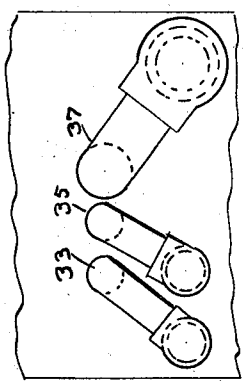


FIG. 7.

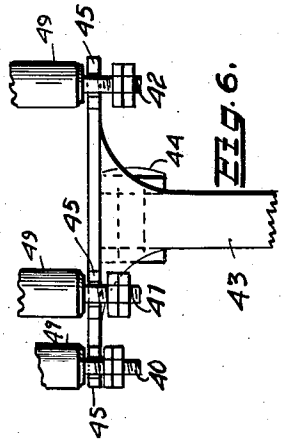


FIG. 6.

FIG. 4.

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Fig. 8.

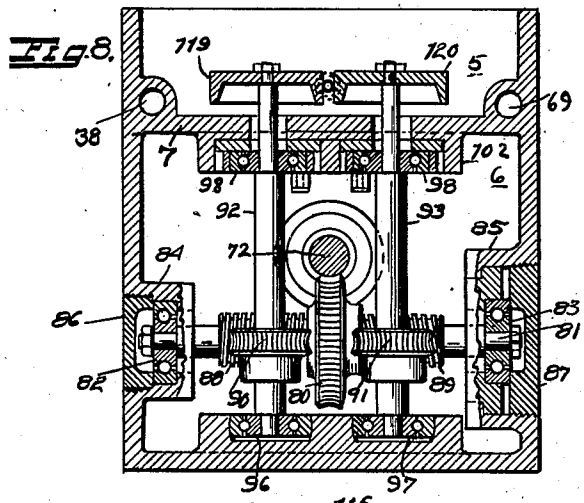


Fig. 9.

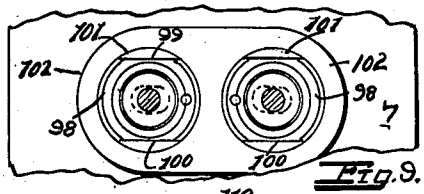


Fig. 10.

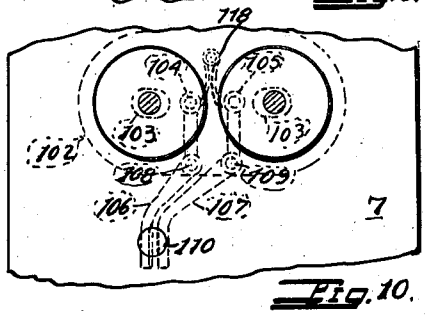


Fig. 11.

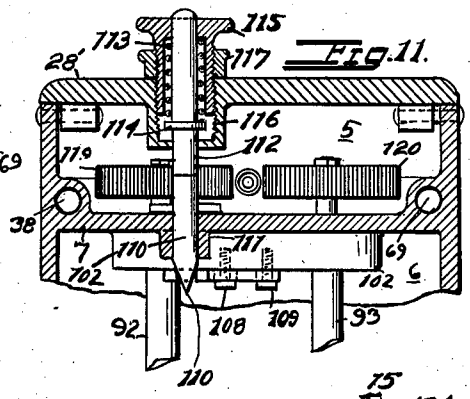


Fig. 12.

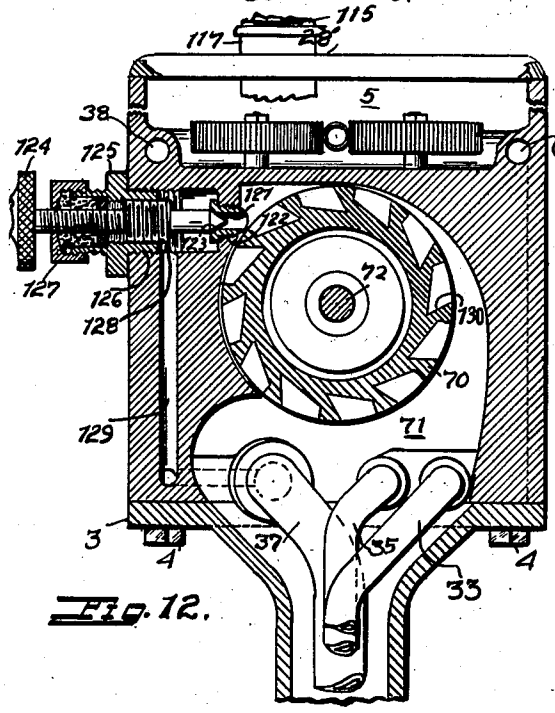


Fig. 14.

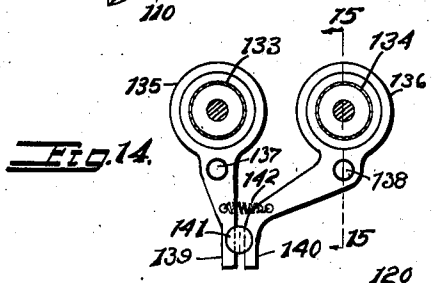


Fig. 15.

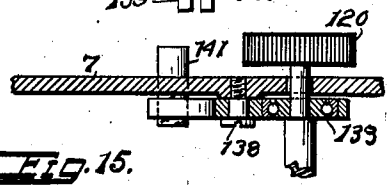


Fig. 16.

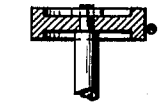
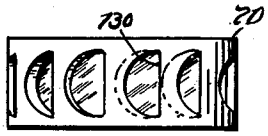


Fig. 13.



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Patented Nov. 21, 1939

2,181,082

UNITED STATES PATENT OFFICE

2,181,082

METAL SPRAY GUN

George L. Hammon, San Francisco, Calif., assignor to National Welding Equipment Company, San Francisco, Calif., a corporation of California

Application December 17, 1934, Serial No. 757,876

15 Claims. (Cl. 91—12.2)

This invention relates to improvements in metal spray gun of the class in which a metal wire is fed through a flame of intense heat. In this instance the flame of an oxy-acetylene torch is described but any suitable gas may be used, to convert the metal wire into molten metal which is blown against the surface to be coated by the action of compressed air.

Practically any commercial metal may be sprayed on surfaces of a great variety of materials. The field for this art is constantly enlarging.

The art itself being old, the present invention relates more particularly to improvements in the burner tip, the wire feeding means, the control of the fuel inlets and the air inlet, improved means of assembling the various parts and improvements in the body and general arrangement of the parts fitting therein.

Among the objects of the invention means are provided for mounting knurled feed rollers so that both of the rollers are movable toward and away from each other and means for moving the rollers to grip the wire or release it.

Another object is to provide spring means to force the rollers apart, and automatic means to force the rollers together on the metal wire when a hinged lid is closed and means to adjust the tension of the rollers on the wire.

Another object is to provide shafts for the rollers mounted in roller bearings and having driving means to allow for the tilting movement of the shafts when bringing the rollers together or separating them.

Another object is to provide an air jet turbine wheel adapted to run at a very high speed and having suitable reduction gearing to drive the roller shafts, and providing means to discharge the exhaust air through the hollow handle of the gun to act as a silencer for the exhaust air, and also to keep the gun cool for the hand of the operator.

Another object of the invention is to provide an air jet on the handle or other suitable location on the gun to receive compressed air and direct it to a respirator worn by operator of the gun by means of a hose connection thus supplying fresh air and free from the spray to the operator. The air may be taken direct from the source of supply.

Another object is the provision of the gas and air inlet valves that are adapted to lift from the valve seats in sequence, in this instance the acetylene inlet is opened first, the oxygen second and the air last.

A further object of the invention is the combination of a mixing chamber to automatically mix the gases as they flow to the burner tip, and to provide a mixer that is easily removed from the body of the gun from the outside.

Another object is to provide an air inlet jet member to the turbine having a removable tip, and one in which the air can be regulated, and also one that can be removed from the outside of the gun body. The air jet to have a direct air connection to the source of supply.

Another object is to provide feed rollers that are reversible so that when one surface of the knurled portion is worn smooth a new surface is exposed when reversed.

Other objects of the invention will appear to those skilled in this art as the description progresses.

An embodiment of the invention is shown in the accompanying drawings in which the same reference numeral is applied to the same portion throughout the several views of which there may be modifications.

Figure 1 is a sectional view of the gun, a projecting portion of the burner being broken away.

Figure 2 is a view of the burner and shows the part broken away in Figure 1.

Figure 3 is a top view of the gun, the cover being removed.

Figure 4 is a side view of the spray gun partly in section.

Figure 5 is a section on line 5—5 of Figure 4.

Figure 6 is a detached view showing the operation of the control lever on the inlet valves.

Figure 1*a* is a section on line 1*a*—1*a* of Figure 1 to show the hexagon shape of the stem on the adapter.

Figure 7 is a view from below showing the arrangement of the gas and air tubes.

Figure 8 is a sectional view showing the wire driving mechanism.

Figure 9 is a view looking from the bottom to show how the bearings and vertical shafts are moved toward, or away from each other.

Figure 10 is a view of the rollers and spreading means, the cover being removed.

Figure 11 is a section showing a portion of the cover, and the rollers and moving means, and also the tension device.

Figure 12 is a sectional view showing the operation of the air turbine, the air jet, and the exhaust passage.

Figure 13 is an edge view of the one piece turbine wheel.

Figure 14 is a view of a modified form of the means to move the feed rollers.

Figure 15 is a section on line 15—15 of Figure 14.

Figure 16 is a view in section of one of the feed rollers.

The spray gun comprises a body member 1, and a handle 2, which is hollow and has a flange 3 and is secured to the body by the bolts 4. The body is divided into two compartments, 5 and 6, by the partition 7.

In the upper compartment the metal wire feeding means is mounted and arranged to feed the wire at the desired speed to the burner and through the flame where it is melted and blown in a fine mist of metal on the surface to be coated.

The improvements in the burner comprise means to adapt it to metal spraying. There is a boss on the body member as shown at 8, and it has an opening into the chamber 5 into which the stem 9 of a taper adapter member 10 is secured by the threaded nut 11. There is an opening 12 for the passage of the wire, and an annular groove 13 in the taper member which is in alignment with an annular groove 14 in the boss. There is also a distributing chamber 13' between the taper portions 17' and 19', and communicating ports 14' between the two chambers. On the taper adapter member is a threaded portion 15 and a threaded cap 16 acts to secure the burner tip 17 with its central opening 18 in line with the opening 12. Surrounding the central opening 18 there is a plurality of small holes 19 for the fuel mixture from the grooves 13 and 14. In the tip end of the opening 18 there is a small bushing 18' of very hard material to withstand the wear better. The cap 16 has a flange 20 that is approximately the same diameter as the boss 8, and it has a plurality of holes 21 for more evenly spreading the compressed air around the burner inside the cap 22 which is threaded on the outside of the boss. A screen of suitable mesh may be used in place of the holes 21.

On the end of the shell there is a tip 23 having a taper fitting the taper of the end of the burner, and in the burner taper there is a plurality of grooves 24. On the opposite side of the body there is a bell shaped wire guide 25 with its central opening 26 in alignment with the opening through the burner. The bell shaped member having a threaded portion 27 adapted to screw into the body. The tube 28 being provided to guide the wire close to the feeding discs, and it has a threaded end portion adapted to thread into the body.

A hinged cover 28' has the pivot screws 29, and it is held in the closed position by the catch 30 mounted on the spring member 31 by rivets and which is held in place by the bell shaped guide 25. A thin strip of metal 32 is secured to the cover and projects to engage the catch.

The fuel and air under pressure is fed to the burner tubes through the hollow handle 2 and are conveyed by ports to the burner.

The acetylene gas tube 33 connects to the port 34 which leads to the mixer. The tube 35 connects to the port 36 and to the mixer, and the tube 37 connects to the port 38 which leads to the outer shell surrounding the burner. Each of the ports 34, 36, and 38 are controlled by a valve 39 having stems 40, 41, and 42. The valves act to close the ports by means of the spring 39' and when raised allow the passage of the gases and air.

A handle lever 43 is pivoted at 44, and projecting from the lever are the forked members 45 which engage the stems, the stems having threaded ends on which are threaded nuts 46 and lock nuts 47, the nuts being so adjusted that when the lever is pressed the stem 40 moves first thus allowing acetylene gas to enter the port 34, next the stem 41 is moved allowing oxygen to enter the port 36 and the last stem 42 opens the port 38 to allow air to enter to the burner. Suitable valves 48 are provided for each of the tubes, and flexible tubing to connect the gun to the source of supply. Each of the stems 40, 41, and 42 have a valve body 49. The lever 43 has the curved end 50 adapted to be engaged by the catch 51 pivoted at 52, and having a spring 53 so when the lever is pressed against the handle the catch will snap over the end and hold the lever and all the valves open thus relieving the operator from constantly holding it down.

The gas mixer utilizes some of the principles shown in my Patent No. 1,818,949, Mixer for welding torches adapted to its use in a metal spray gun. The housing 54 is a part of the body of the gun, and opens from the outside so the mixer may be removed by taking off a screw plug 55. The body, 56, of the mixer has the threads 57 engaging threads in the wall of the opening 58. There is an annular groove 59 in the opening and body of the mixer to which the acetylene port 34 is connected. A cap 60 has a threaded portion 61 which screws into threads in the body 56. The cap has the closed end 62, and is screwed down to the shoulder 63. A plurality of small holes 64 are drilled from the outside to the opening 65 in the cap. The interior of the cap forms the distributing chamber 66. There are by-passes 67 which connect the grooves 59 to the longitudinal bores 68.

A port 69 carries the mixed fuel to the grooves 13 and 14 of the burner.

A turbine wheel 70 is mounted in the recess 71 on the shaft 72 and the ball bearings 73 and 74 on which the shaft is carried are supported in the openings 75 and 76. Caps 77 and 78 having screw threads close the openings after the shaft is assembled. The shaft may be removed by taking off the caps, then removing the ball bearing 74 whereupon the turbine and ball bearing 73 may be removed together.

A worm 79 preferably integral with the shaft 72 is in mesh with the worm gear 80 fixed on the shaft 81, and this shaft is mounted on the ball bearings 82 and 83 supported in openings in the bosses 84 and 85. Threaded caps 86 and 87 retain the bearings in place. By removing the caps and ball bearing 82 the shaft and ball bearing 83 may be removed together. On the shaft 81 are the right and left worms 88 and 89, the worms, the worm wheel 80 and the shaft 81 are made preferably integral, but may be separate parts keyed or otherwise fixed together. In mesh with the worms 88 and 89 are worm wheels 90 and 91 fixed on the vertical shafts 92 and 93 mounted on the rocking ball bearings 96 and 97. The rocking ball bearings may be any suitable ball bearing that allows for a slight rocking movement.

The slidable ball bearings each comprise a ball bearing forced into a ring 98 having flat sides 99 and 100, and a stationary member 101 set into the boss 102 in the body of the gun. Openings 103 in the partition 7 allow for the rocking movement of the shafts, and these openings are pro-

vided with suitable packing that allows for the movement of the shafts.

The means for moving the ball bearings and shafts consist of pins 104 and 105 fixed in the rings 98 on which pivot the levers 106 and 107 which levers are pivoted on the boss by the pins 108 and 109. The levers are bent off from the center line between the shafts, the ends thereof being close together and engaged by a wedge shaped member 110, the upper end portion being in the form of a round pin slidable in boss 111 on the partition 7. Suitable packing may be provided for this pin.

The pin is operated by the closing of the cover which carries a pin 112 under the adjustable tension of a spring 113 which rests on a shoulder 114 and reacts against a hollow nut 115 which has screw threads in the cover and boss 116. A lock nut 117 holds the nut in the adjusted position. The action of the wedge pin forces the levers apart and brings the shafts toward each other, and a spring 118 holds them apart, and the action of the levers force up the wedge shaped pin.

Mounted on the shafts are knurled wire feed rollers 119 and 120 adapted to grip the wire at an adjustable tension and cause it to travel toward the burner.

In the modified form of the means to move the knurled rollers to act on the wire shown in Figures 14 and 15 the ball bearings 133 and 134 are held rigidly in lever members 135 and 136 which are pivoted at 137 and 138 to the gun body, and the end portion of the levers 139 and 140 are brought close together so that the wedge member 141 may act to spread them apart and thus bring the rollers together on the wire, the pin 141 being acted on by the cover having an adjustable tension spring and pin or other suitable means. A spring 142 acts to move the rollers apart.

The rollers 119 and 120 are preferably made reversible as shown in Figure 16 so that the wire that is being fed in comes in contact with the lower portion of the knurled surface of the rollers and when this surface becomes worn the rollers are removed and turned over so that a new surface is used thus getting double wear out of the rollers.

The turbine is driven from an air jet chamber and comprises a removable tip 121 which has a threaded portion 122 which engages a threaded opening in the body member and a seat for the valve portion of the stem 123, the stem is turned by the knurled wheel 124.

There is a threaded plug 125 screwed in the opening 126 leaving an air receiving chamber between the plug and tip. A packing gland 127. Threads 128 on the valve stem engage threads in the plug 125.

The valve portion of the jet control and the valves 48 are shown in my Patent No. 1,944,428 issued January 23, 1934.

A port 129 connects the jet chamber with the air tube 37 and is independent of the air connection to the burner.

The turbine 71 has the undercut pockets 130 and is made in one piece. An air jet 131 has screw threads in an opening in the handle to throw a jet of air through a tube to a respirator worn on the face of the operator from the exhaust of the turbine, it can be shut off by turning it around, or a suitable valve may be provided.

In operation the cover is opened allowing the knurled rollers to separate, the end of a metal wire is inserted through the guiding tubes to the burner tip. Now the gas supply and air pressure is turned on to the gun by the valves 48, then the air pressure is turned on to the air jet by the knurled wheel 124 which admits air directly from the tube 37 through port 129, after the turbine is brought to the required speed the valve stem 123 is locked in position. If a respirator is to be used by the operator the tube 131' is turned on and the respirator adjusted to the face of the operator, the flexible tube 131' being in place, at this point the hand lever 43 is pressed in, thus admitting in proper sequence the gases in this instance acetylene gas first, oxygen next, and then air to the burner from the tube 37, port 38. The acetylene and oxygen going through ports 34 and 36 respectively to the mixer, and from there through the port 69 to the distributing chamber and from there to the burner tip inside air cap 22, the gases are now ignited and the cover closed which brings the knurled feed rollers together to impinge the wire which is carried through the burner and turned into molten metal and blown on the surface to be coated in a fine mist like spray.

It will be seen from the above description taken with the drawings that a very complete and efficient means have been provided in applying the art of metal spraying.

Having thus described my invention what I wish to secure by Letters Patent of the United States is as follows, but modifications may be had in carrying out the invention as shown in the accompanying drawings and the particularly described form thereof within the purview of the annexed claims.

I claim:

1. A metal spray gun of the class described comprising a body, a burner, a pair of movably mounted feed rollers adapted to feed a wire to said burner, means to drive said feed rollers, means to move both of said rollers towards each other to grip the wire, and to move said rollers away from each other to release the wire.

2. A metal spray gun of the class described comprising a gun body, a metal melting burner for said gun body, a pair of movably mounted feed rollers adapted to feed a metal wire to said burner, means to drive both of said rollers, means to move both of said rollers towards each other to grip the wire, means to adjust the tension of said gripping means, means to move said rollers away from each other to release said wire.

3. A metal spray gun of the class described comprising a gun body, a handle for said body, a metal melting burner for said body, a pair of metal wire feed rollers movably mounted adapted to feed a wire to said burner, means to move both of said rollers simultaneously to grip or release said wire.

4. A metal spray gun of the class described comprising a gun body having two compartments, means to guide and feed a metal wire in one of the compartments, and means to drive the feeding means in the other compartment, a burner projecting from said body, a hollow handle for said body, means to supply the burner with fuel and compressed air through the handle, and compressed air to the driving means through said handle, and means to exhaust compressed air through said handle to cool the handle, and direct the exhaust downwardly below the operator's hand.

5. A metal spray gun of the class described comprising a body member, a burner for said body, means to guide a wire to said burner, a feed roller on each side of the path of said wire, vertical shafts for said rollers, ball bearings for the upper part of said shafts, means to mount said bearings slidable to move toward or away from each other, ball bearings for the lower portion of said shafts, means to provide a rocking motion for said bearings, adjustable means to move the upper bearings on said shaft whereby said rollers may grip said wires, and spring means to separate said rollers.

6. A metal spray gun of the class described comprising a body member, a burner for said body, an opening through said burner to admit a metal wire, guiding means for said wire, a pair of opposed rollers adapted to grip and propel said wire through the burner opening, fuel passages from a source of supply to said burner, a mixer interposed in said passages, a shaft for each of said rollers, driving gear for said shafts, means to move said shafts towards and away from each other without throwing them out of said driving gear when said rollers are simultaneously brought together to propel said wire, and moved away from each other simultaneously to release said wire.

7. A metal spray gun of the class described comprising a hollow body member having two compartments upper and lower, wire guiding and propelling means in the upper compartment, driving means for said propelling means in the lower compartment, a burner having an opening therethrough for said wire, fuel passages from a source of supply to a mixer, said mixer mounted in a housing having an opening from the side of said body, a mixer body member having threads adapted to screw into said opening, distributing and mixing chambers connected by longitudinal bores with by-passes leading therefrom, a further distributing chamber at the end of said mixer body, a hollow cap in said chamber having radial perforations, a supply tube connected to said chamber, a supply tube connected to said by-passes, and means to admit the different fuel in predetermined sequence.

8. A metal spray gun of the class described comprising a body member, a burner having an opening therethrough for a wire, guiding means for said wire, feed rollers for said wire, vertical shafts for said rollers, means to move both of said shafts to grip or release said wire, worm wheels on said shafts, a cross shaft having bearings in said gun body, a right hand worm for one of said worm wheels, and left hand worm for the other of said worm wheels on said cross shaft, a worm wheel on said cross shaft, a drive shaft having a worm in mesh with the worm wheel on said cross shaft, an air turbine wheel on said drive shaft, an air inlet jet for said wheel, a threaded removable tip for said jet, an adjustable valve for said jet adapted to seat in said tip, a hollow handle open at its lower end for said gun body, and a passage way from said turbine to said hollow handle whereby the exhaust from said turbine is discharged through said handle.

9. A metal spray gun of the class described comprising a body member, a burner having a tip with a central opening, a plurality of longitudinal openings surrounding said central opening from the inner end to the outer end, a plurality of grooves on the outer end, taper surfaces on the inner end adapted to engage taper seats, a base member having taper seats adapted to receive the taper portions of said tip member, an outer cap member fitting over the end of the tip and engaging the grooved taper surface of said tip, communicating ports and distributing chambers from a fuel supply to said longitudinal openings, and a communicating port and a distributing chamber from an air supply to the passages formed by the grooves in the taper surface and the outer cap.

10. A metal spray gun of the class described comprising a body member, a burner having a tip in one piece, a central opening through said tip, one end of said tip having a taper portion spaced from the end and a smaller taper portion on a reduced portion of the tip, the other end of said tip having a taper end with longitudinal grooves therein, a bushing of harder material in the central opening in the discharge end of said tip, longitudinal openings surrounding said central opening, an adapter member having a taper surface engaging a taper receiving surface in said gun body, a threaded stem on said adapter having a threaded nut to hold it in place, a threaded portion on said adapter, a threaded cap engaging said threaded portion, a shoulder on said tip adapted to be engaged by said cap, and an outer cap enclosing said tip, communicating ports and distributing chambers from a fuel supply to said longitudinal openings, and a communicating port and a distributing chamber from an air supply to the passages formed by the grooves in the taper surface and the outer cap.

11. A metal spray gun of the class described comprising a body member, a burner on said body, means to supply gas to said burner, a pair of movable knurled rollers adapted to feed a metal wire to said burner, said rollers being mounted so that in one position the wire is contacted by certain portions of the rollers, and said rollers being adapted to be reversed in position to bring the wire in contact with other surfaces of said rollers whereby additional wearing surfaces are provided for the rollers.

12. A metal spray gun of the class described comprising a body member, a burner on said body, means to supply suitable gas and air under pressure to said burner to produce a melting flame, a pair of movable rollers adapted to frictionally engage a metal wire, means to move both of said rollers simultaneously to release or engage said wire, and means to adjust the tension of the rollers on said wire.

13. A metal spray gun of the class described comprising a body member, a burner on said body, a pair of opposed rollers adapted to impinge a wire and feed it to said burner, a movable shaft for each of said rollers, upper and lower bearings for said shafts, a lever adapted to carry each of said upper bearings, pivots for said levers on said body, adjustable tension means acting on said levers to bring said rollers together, and a spring to separate them, and means to drive said shafts.

14. A metal spray gun of the class described comprising a body member, a taper recess in said body, a hexagon opening leading from said recess into said body, an adapter having a stem to fit said opening, screw threads on said stem, a nut engaging said threads on the inside of said body, a distributing chamber formed between said recess and the body of the adapter, a communicating port from a source of mixed gases to said chamber, spaced recesses in said adapter having taper surfaces, a one piece tip

member having taper surfaces to fit said last mentioned recesses, a distributing chamber, a plurality of longitudinal openings through said tip communicating with said second distributing chamber, ports connecting said distributing chambers, a shoulder on said tip, a cap having screw threads on said adapter to hold said tip in position, a flange on said cap, openings in said flange, an outer cap adapted to be guided by said flange in engaging screw threads on said body, a taper on the outer end of said tip, a plurality of grooves in said taper portion, and a tip cap fitting over said taper and engaging threads on said outer cap.

15. In an apparatus of the character described, a pair of rocker arms, a bearing at one end of each rocker arm, a vertical shaft journaled in each bearing, a wire feeding wheel secured on each shaft, means engageable with the opposite ends of the rocker arms whereby movement is imparted to bring the wire feeding wheels towards each other to grip a wire, and means for driving the vertical shafts and the wire feeding wheels secured thereto in unison.

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