ABSTRACT: Briefly, the disclosure relates to a powder metal-spraying torch which utilizes a gravity powder feed arrangement that maintains reasonably uniform powder spray rates for powders with varying characteristics. Additionally, the metal-spraying torch is arranged to control the spray pattern shape and density as well as the relationship of the fed powder to the flame.
3,620,454

FLAME SPRAY TORCH

This invention relates generally to flame spray torches and more particularly to an improved flame spray torch.

Heretofore, it has been known that flame spray torches and feed systems for the flame spray process where no molten pool is generated, are complex in structure, do not offer any meaningful flexibility in the control of the pattern and density of the spray, do not permit the flame spraying of a wide variety of powder grades and require complex powder feeding systems with gas assist vehicles that add additional variables to the gas flame. Additionally, the existing flame spray torches are incapable of fusing the sprayed deposit and fusion is accomplished with additional equipment.

It is the general object of the invention to avoid and overcome the foregoing prior art practices by the provision of a flame spray torch with a simple powder feed system.

A further object of this invention is to provide a flame spray torch that can control the pattern and density of the powder spray.

Another object of the invention is to provide a flame spray torch that can be used to fuse the sprayed deposit.

Still another object of this invention is to provide a flame spray torch that can maintain optimum spray characteristics for powder sprays with different flow rates.

Yet another object of this invention is to provide a flame spray torch arranged to feed powder to a predetermined location of the flame area.

The foregoing objects of the present invention and other objects which will become apparent as the description proceeds are achieved by providing a powder flame spray torch with flame means and feed means for feeding powder to be flame sprayed. Variable placing means are provided which are operatively associated with the flame means for placing the powder in a predetermined area in the flame. Additionally, spray control means control the powder spray.

For a better understanding of the invention reference should be had to the accompanying drawings wherein like numerals of reference in the several views indicate similar parts and wherein:

FIG. 1 is a vertical cross-sectional view illustrating the flame spray torch of the present invention;
FIG. 2 is a bottom view of the flame spraying torch of FIG. 1 illustrating the base of the flame spray torch;
FIG. 3 is a top view illustrating a slider lock assembly; and
FIG. 4 is a vertical sectional view taken along the lines 4-4 of FIG. 1 in the direction of the arrows.

The flame spray torch 10 shown in FIG. 1 has a housing 12 constructed and arranged to have a handle portion 14, a base portion 16, a feed portion 18 and a top portion 20. On the housing 12 is connected a powder feed assembly 22 and a flame assembly 24. It is known by those skilled in the art that the class of powder flame spray torches which encompass the torch of the present invention functionally pass alloy metal powder through the flame so that the alloy powder is heated to a plasticized state, below the melting point of the alloy, and is sprayed deposited upon a base metal.

The top portion 20 of the housing 12 is provided with a fitting 25 adapted to receive a receptacle 27 for holding the alloy powder. To meter the feeding of the powder, a powder feed control means such as a feed actuator plate 28 is slidably disposed in a slot 26 located in the housing top portion 20 below the fitting 25. The feed plate 28 is provided with a valve handle 30 which extends above the housing 12 and permits the sliding of the feed plate 28 within the slot 26, which is longer than the feed plate 28, reciprocally toward and away from the housing feed portion 18.

It will be understood by those skilled in the art that the metallic powder used in these metal spray torches varies in particle size, from approximately 25 mesh and finer, and in alloy composition. It is further known that the varying particle size and the varying alloy compositions varies the rates flow of the spray powders. Ideally, optimum powder spray results for particular applications are obtained with within specific powder spray densities which are determined by the powder flow rates. For the alloy powders and mesh sizes usually employed in these metal spray torches, by experimentation, the spray feed flow conditions, it was found that powder flow and spray feed rates for powder flowing through circular orifices in sizes ranging from 0.078 to 0.120 inch, the powder flow for different alloys in mesh sizes ranging from minus 50 to plus 400 mesh can be maintained substantially constant. In order to achieve the desired constant spray rates the feed plate 28 can be provided with a number of powder flow orifices 32 such as the orifices shown in FIG. 1 which provide the flow orifice diameter range from 0.078 to 0.120 inch and which by sliding the feed plate 28 can be selectively aligned with the powder flow orifice 32 in the housing to variably control the flow feed of powder from the receptacle 27 and thus maintain the optimum required powder flow and spray density conditions.

The powder is fed from the receptacle 27 through the flow orifice 32 through suitable conduits 34 and into a variable spray control means such as the variable spray control assembly 36.

The variable spray control assembly 36 has a housing 38 holding a cylindrical tube assembly 40 comprising at least two central core hollow cylinders 42 slidably fitted telescopically within each other and communicating with the powder flow conduits 34 to carry powder therethrough to be discharged through the core discharge end 44. The housing 38 is provided with control settings 46 which through suitable latching means such as the latching assembly 48 control the distance that the core discharge 44 of the flame assembly 24. It will be understood that the latching assembly 48 has a holding pin 52 that is normally urged against one of the concave control settings 46 by a spring 54 and thereby hold the variable spray control assembly 36 at a predetermined position. A rod 55 connected to the pin 52 and extending out of the housing 12 when depressed toward the housing 12 serves to move the holding pin 52 out of the control setting 46 to permit the variable spray control assembly 36 to be relocated from one predetermined fixed position to another by simply sliding the variable spray control assembly 36 from one position to another.

It will be understood by those skilled in the art that flame spray torches the density and physical shape of the powder spray pattern is of great importance because of the shape of the spray patterns can be varied in one torch it permits the torch to be utilized in surfacing large plates as well as on thin shafts. In the present invention, it was found that in the case where the powder is gravity fed to the flame of the flame assembly 24, the contour and density of the powder spray is determined by the incidence of the powder flow on the gas jet, the contour and by the penetration of the powder within the flame cone. In the present invention, the distance that the discharge end 44 is located from the flame, directly controls the spray pattern area and density. It was further found that the distances closest and furthest away from the flame produce the wider patterns while the mean distances from the flame provide for narrower spray patterns.

As shown in FIGS. 1, 2 and 4 the base portion 16 of the housing 12 is provided with sliding alloys 56 constructed to receive the counterpart sliding element 58 of a placing means such as placing assembly 60. The placing assembly 60 is slidably placed to slide on the housing 12 and is constructed to freely receive the tube portion 62 of the flame assembly 24 as shown in FIG. 1. Consequently, the sliding action of the placing assembly 60 determines the horizontal distance that the flame end 50 will be placed from the powder discharge end 44.

It is known that a gas flame such as an oxygen and acetylene flame is constructed in two portions; the outer portion which comprises the major portion of the flame, and the inner portion which is the flame closest to the torch. The outer flame is a neutral flame and is of lesser heat strength than the inner flame which is a hotter flame that is also on oxidizing flame. There are many alloys which must be maintained away from the hotter and oxidizing portion of the flame. Further, there are a few powders which either by their nature or due to the
desired weld deposit characteristics must be sprayed through the hotter portion of the flame. It will, therefore, be understood that the ability to variably control the placing of the powder in the flame is most important and expands the utility of the present flame spray torch.

In order to variably control the positioning of the powder fed into the flame, a second latching assembly 64 as shown in FIGS. 2 and 4 is provided, comprising control settings 66 on the base portion 16 and a holding pin 68 on the placing assembly 60 which fits in the control setting 66. The pin 68 can be moved to release on position and be moved to another position by depressing the rod 70 attached to the pin 68. The flame assembly 24 can be a standard gas torch nozzle end having two conduits which can be connected to a standard gas torch handle to be in turn connected to the gas sources such as oxygen and acetylene. The flame assembly 24 with the placing assembly 60 can be removed from the housing 12 and then can be used to fuse the sprayed deposit where this additional process is required.

It will, therefore, be understood by those skilled in the art that the objects of the present invention have been achieved by providing a simple, versatile flame spray torch with essential controls.

We claim:

1. A powder flame spray torch comprising:
   a. a housing;
   b. flame means for providing a flame carried by said housing;
   c. feed means for feeding powder to be flame sprayed carried by said housing;
   d. placing means operatively associated with said flame means for placing said powder in a predetermined area in said flame; and
   e. variable spray control means controlling said powder spray; said means comprising:
      1. a spray control housing, conduit means in said housing connected to said feed means, said conduit means having a powder discharge end; and
      2. latch means on said housing and on said spray control housing for maintaining said powder discharge end at a controlled predetermined positional relationship with said flame.

2. A powder flame spray torch comprising:
   a. a housing;
   b. flame means for providing a flame carried by said housing;
   c. feed means for feeding powder to be flame sprayed carried by said housing;
   d. placing means operatively associated with said flame means for placing said powder in a predetermined area in said flame; and
   e. variable spray control means controlling said powder spray said means comprising:
      1. a spray control housing;
      2. a first hollow cylinder disposed in part in said housing and communicating at one end with said feed means;
      3. a second hollow cylinder slidably disposed in part in said other end of said first cylinder; said other end of said second cylinder being a powder discharge end;
      4. control setting means disposed on said spray control housing;
      5. a recess in said housing;
      6. a holding pin disposed predeterminately in one of said control settings and in one of said recess;
      7. biasing means normally urging said holding pin in said control setting; and
   8. means for predeterminately moving said holding pin from one control setting and recess to any other control setting and recess and thereby predeterminately locating said discharge end with respect to said flame.

3. A powder flame spray torch comprising:
   a. a housing;
   b. flame means for providing a flame, said flame means being mounted on said housing so as to slide along a first line;
   c. feed means for feeding powder to be flame sprayed, said feed means being mounted on said housing so as to slide along a second line wherein said first line intersects said second line at an acute angle.

4. The powder flame spray torch of claim 3 further comprising:
   a. biasing means normally urging said holding pin in said control setting;
   b. flame means for providing a flame carried by said housing;
   c. feed means for feeding powder to be flame sprayed to a predetermined portion of said flame said feed means comprising:
      1. a first hollow cylinder carried by the housing and in communication with a powder source;
      2. a second hollow cylinder slidably mounted on the first hollow cylinder whereby the discharge end of the second hollow cylinder can be slidably positioned with respect to said flame.

5. A powder flame spray torch comprising:
   a. a housing;
   b. flame means for providing a flame carried by the housing;
   c. feed means for feeding powder to be flame sprayed to a predetermined portion of said flame said feed means comprising:
      1. a first hollow cylinder carried by the housing and in communication with a powder source;
      2. a second hollow cylinder slidably mounted on the first hollow cylinder whereby the discharge end of the second hollow cylinder can be slidably positioned with respect to said flame.

6. A powder flame spray torch said torch comprising:
   a. a housing adapted to carry a flame means and a flame sprayable powder supply means;
   b. flame means for providing a flame, said flame means being slidably and removably carried by said housing, said flame means being axially slidable and having means for holding said flame means in one of several discrete positions in order to position the flame with respect to the housing;
   c. feed means for feeding powder to be flame sprayed carried by said housing, said feed means comprising:
      1. a source of powder in communication with a first downwardly extending cylindrical tube fixedly held by said housing;
      2. a second cylindrical tube having an inside diameter substantially equal to the outside diameter of said first tube, said second tube being slidably mounted over the discharge end of said first tube, said second tube being provided with a series of depressions adapted to receive a spring loaded latch in order to position said second tube axially with respect to the housing, wherein the axis of said first tube and said second tube are at an acute angle to the axis of said flame means and wherein these axes intersect each other;
   d. valve means for controlling the rate of flow of powder from the powder supply, said valve means comprising a plate having rims-defining holes of varying diameters said plate being slidably mounted in said housing in order to selectively position one of the holes in the conduit between the powder supply means and the first tube in order to control the rate of flow of powder supply means to the tube.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,620,454 Dated November 16, 1971

Inventor(s) Broderick et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, Line 72, delete "rates flow" and insert
--rates of flow--.

Column 2, Line 58, delete "alloys" and insert --alleys--.

Column 2, Line 72, delete "on" and insert --an--.

Column 3, Line 64, delete "recess" and insert --recesses--.

Column 4, Line 59, delete "rims-defining" and insert
--rims defining--.

Signed and sealed this 23rd day of May 1972.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR. ROBERT GOTTSCHALK
Attesting Officer Commissioner of Patents