

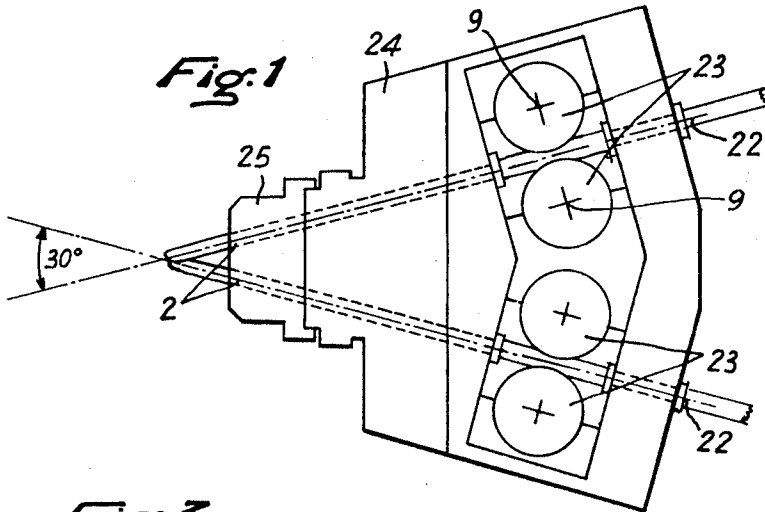
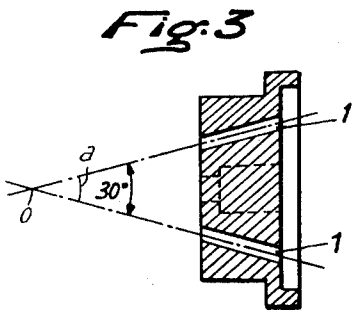
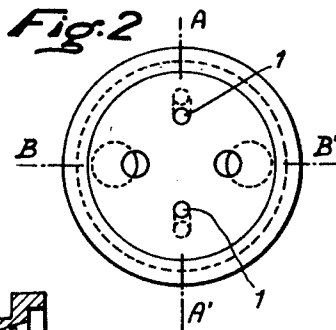
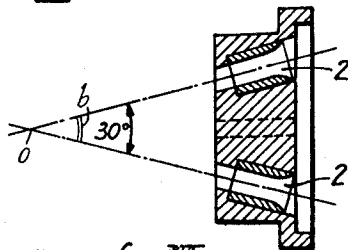
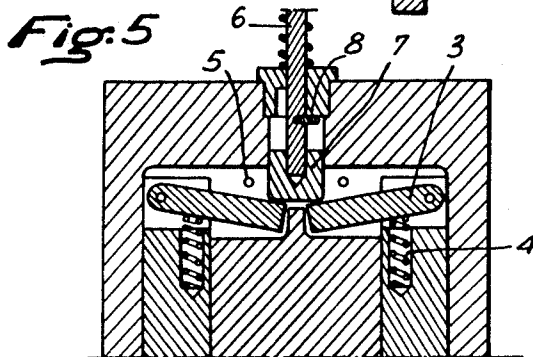
July 21, 1964

J. CAUCHETIER
METAL SPRAYERS

3,141,616

Filed Aug. 6, 1962

2 Sheets-Sheet 1



Inventor
Jacques Cauchetier
by Michael S. Striker
RM

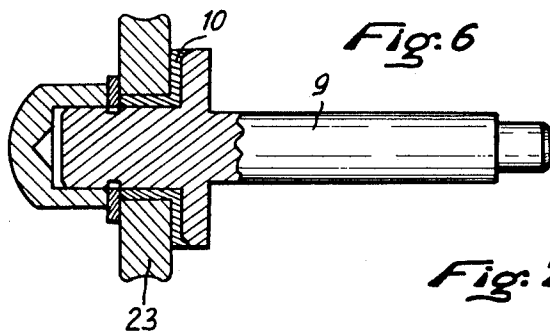
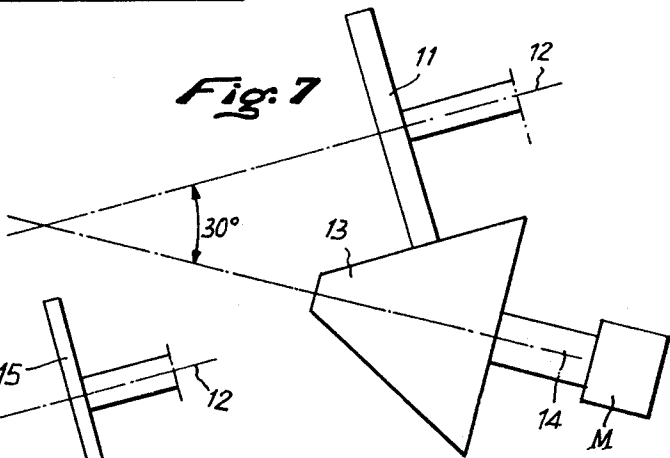
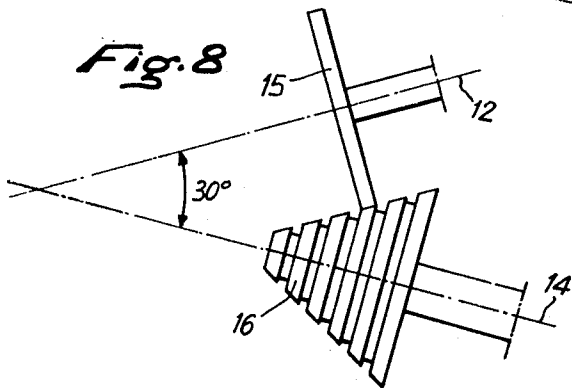
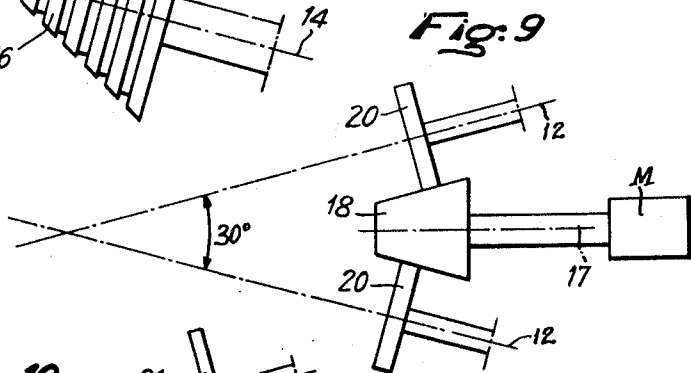
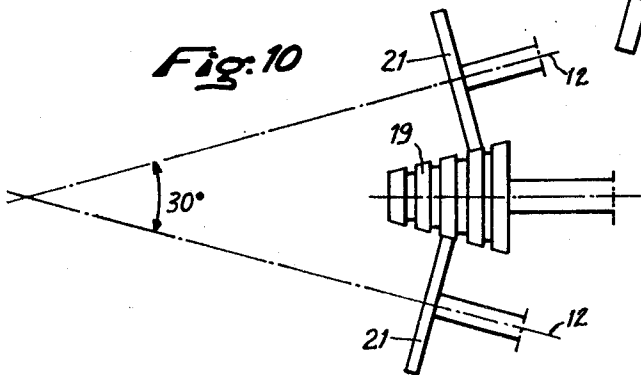
July 21, 1964

J. CAUCHETIER
METAL SPRAYERS

3,141,616

Filed Aug. 6, 1962

2 Sheets-Sheet 2



Inventor
Jacques Cauchetier
by
Michael S. Striker
R.H.

1

3,141,616

METAL SPRAYERS

Jacques Cauchetier, Paris, France, assignor to Societe Nouvelle de Metallisation, Paris, France, a company of France

Filed Aug. 6, 1962, Ser. No. 214,982

Claims priority, application France Aug. 11, 1961

6 Claims. (Cl. 239—81)

It is known to make metal sprayers intended for producing metal coatings by atomisation of molten metal, the source of heat for the melting being a flame or an electric arc and the molten metal being propelled by a gaseous fluid under pressure. In particular, it is known to effect the melting of the metal by the electric arc formed between two consumable electrodes constituted by two wires of the metal to be sprayed.

It is known that in order that the arc may be broken and re-struck, the two electrode wires must come into contact at a certain angle. In most devices, the wires pass in bent wire guides, which entails abnormal wear at the bends; in addition, in known devices the compressed fluid intended to atomise the molten metal covers the entire arrangement and has no or only poor guiding.

Moreover, the different known electric contact devices do not give entire satisfaction and produce either short-circuits or bad contact.

In addition, in the course of the operation of an arc metal sprayer having two consumable electrodes, it frequently happens that, depending on the nature of the current, one of the two wires melts more quickly than the other, which prevents the correct operation of the sprayer, either through the extinction of the arc or through the deflection of the jet of metal sprayed, or even through producing a short-circuit in the nozzle.

The object of the present invention is to obviate some of the faults found in the operation of metal sprayers based on fusion by an electric arc and the spraying of two consumable electrode wires.

The metal sprayer according to the present invention comprises a nozzle provided on the one hand with two or more oblique supply pipes for gaseous fluid and on the other hand with two rectilinear and oblique electrode wire guide passages, the axes of the wire guides converging with the axes of the supply pipes for gaseous fluid at a common point forming the apex of a pyramid.

This sprayer comprises in addition a current supply device enabling the wires to be placed simultaneously under tension or out of circuit, while effecting the opening or the closing of the atomisation device, while a device driving the wires enables the speed of one of the electrodes in relation to the other to be varied.

In order to facilitate the understanding of the description below, the invention is illustrated by way of example in the accompanying drawings, in which:

FIGURE 1 is a diagrammatic plan view of a sprayer according to the present invention,

FIGURE 2 is a front view of the nozzle of the sprayer illustrated in FIGURE 1,

FIGURE 3 is a section on the line A—A' in FIGURE 2,

FIGURE 4 is a section on the line B—B' in FIGURE 2,

FIGURE 5 is a detail view of the contactor device,

FIGURE 6 is a view in section of an electrode wire driving wheel,

FIGURE 7 is a diagrammatic view of a differential driving device for the electrode wires,

FIGURE 8 is a modified construction of the device illustrated in FIGURE 7,

FIGURE 9 is a diagrammatic view of another form

2

of construction of a differential driving device for the electrode wires, and

FIGURE 10 shows a modified form of construction of the device illustrated in FIGURE 9.

Referring to FIGURE 1, it is seen that the sprayer according to the present invention has a central body 24 on which are mounted the driving wheels 23 for the two electrode wires 22. A nozzle 25 is fitted to the said body. This nozzle 25, illustrated separately in FIGURES 2, 3 and 4, has on the one hand two or more oblique passages 1 for the supply of the gaseous atomisation fluid (FIGURE 3), these passages forming together an angle a , and on the other hand two rectilinear, oblique passages 2 constituting electrode wire guides and forming between them an angle b , the axes of the passages 1 and the axes of the wire guides 2 converging at a common point O forming the apex of a pyramid.

In the example illustrated, the angle a and the angle b are equal. The angle b is determined so that the arc may be broken and re-struck between the electrode wires, and the angle a must be equal to or slightly greater than the angle b ; if in fact the angle a is equal to or slightly greater than the angle b , there is obtained a better concentration of the jet of atomised metal, whereas if the angle a were smaller than the angle b , the current of gaseous fluid would tend to disperse the jet of metal.

The angle a must be equal to or slightly greater than the angle b , because if the angle a becomes too great and becomes close to 90° there is a risk of braking the speed of the jet of metal, producing a more dispersed jet and possibly extinguishing the arc, while if the angle a remains equal to the angle b , or greater than that angle within reasonable limits, the current of gaseous fluid thus sprayed contributes towards increasing the force of impact of the atomised jet, while in addition when the angle a coincides with the angle b , the current of gaseous fluid prevents the electrodes from heating and acts a little like a nozzle, concentrating the jet of metal and increasing its density and the speed of the particles.

It is moreover necessary for the axes of the passages 1 and the axes of the wire guides 2 to converge at the same common point O.

If in fact the apex of the angle a is situated between the nozzle 25 and the apex of the angle b , the current of gaseous fluid will tend to disperse the jet of metal; while if the apex of the angle a is situated beyond the apex of the angle b , the current of gaseous fluid will tend to brake the jet of atomised metal particles.

In the example illustrated, the nozzle 25 has two air supply passages 1, but it may obviously have more than two.

The wire driving mechanism is so disposed that the wires are introduced into the nozzle without undergoing any twisting or diversion. The arrangement of two groups of driving wheels is that indicated in French Patent No. 1,194,509, filed on the 4th of March 1958 and having the title: "Improvements in Metal Sprayers," which enables the driven wire to remain in the same axis whatever its diameter, because of the oscillating bearings.

Each electrode wire is fed with electric current through the medium of the device illustrated in FIGURE 5. Two bronze sliding contacts 3, each connected to one of the current supply wires, are held by respective springs 4 in contact with the respective electrode wires 5. A device for locking in the working position is constituted by a rod 6 ending in a piston 7 of insulating material which with the aid of a notch and a stud 8 can be locked in the lowered position in which the bronze contacts 3 are lowered and the current is cut off. By associating this rod 6, by means of a device not illustrated, with the control cock for the compressed fluid used for atomisation, the current may be cut off automatically when the sprayer

3

is put out of action, and the wires may be reconnected when the cock is re-opened in order to start operating again, thus avoiding all danger of a short-circuit when the sprayer is not in the working position.

Moreover, in order to avoid too rapid deterioration of the bronze sliding contacts by the formation of the arc, they may be metallised on the bearing surface with a metal having a very high melting point and in particular withstanding the arc, for example a molybdenum-tungsten alloy.

In order to prevent any possibility of current passing in the sprayer, the wheel carrier spindles 9 are covered with a plastic material 10 (for example super-polyamide which is sold under the name "Rilsan"), which may be deposited either by flame spraying or by fluidisation (FIGURE 6). In addition, the support handle of the apparatus is likewise covered with plastic.

During the operation of the arc metal sprayer having two consumable electrodes, it frequently occurs that one of the two wires melts more quickly than the other, which may cause either extinction of the arc or a deflection of the atomised jet, or else a short-circuit in the nozzle.

Referring to FIGURE 7, it is seen that the sprayer according to the present invention comprises a device making it possible, with the aid of a single driving motor M, to vary the ratio of the speeds of advance of the two wires, during the actual spraying.

A roller 11 which is keyed on the driving spindle 12 of the first pair of wheels 23, so as to drive the said spindle while being laterally slidable along the said spindle, slides on the surface of a cone 13, which in turn is solid with the spindle 14 driving the second pair of wheels 23. By varying the position of the roller 11 along the conical surface 13, it is possible to modify at will the ratio of the driving speeds of the two wires.

In order to prevent any risk of the roller 11 slipping on the surface of the cone 13, the roller 11 may be replaced by a gearwheel 15 and the cone 13 by a series of gearwheels 16 (FIGURE 8).

It is thus possible to obtain a whole series of precise speed ratios suitable for each type of metal used.

FIGURE 9 illustrates a second form of construction of the differential driving device for the electrode wires.

The driving shaft 17 carries a cone 18, along which two keyed rollers 20 are adapted to slide, each sliding along the driving spindle 12 of each pair of wheels.

As in the previous case, the roller 20 may be replaced by pinions 21 and the cone 18 by a series of gearwheels 19 (FIGURE 10). In a third form of construction (not illustrated), it is also possible to couple each pair of wheels to a driving motor.

The driving motor or motors preferably has or have a variator.

I claim:

1. In an arc metal spray gun, in combination, a spray nozzle formed with a first pair of rectilinear passage means therethrough adapted to be connected to a supply of gaseous fluid under pressure and having axes located in a first plane and inclined to each other for feeding a gaseous fluid under pressure through said nozzle, and with a second pair of rectilinear passage means therethrough having axes inclined to each other and located in a second plane extending transverse to said first plane for guiding a pair of consumable electrode wires through said nozzle, all of said axes intersecting at a single point located forwardly of said nozzle; feeding means for feeding a pair of electrode wires through said second passage means, respectively; and means for simultaneously supplying electric current to said pair of electrode wires when gaseous fluid is passed through said first passage means and for cutting off the current when the flow of fluid is interrupted.

2. In an arc metal spray gun, in combination, a spray nozzle formed with a first pair of rectilinear passage means therethrough adapted to be connected to a supply

4

of gaseous fluid under pressure and having axes located in a first plane and inclined to each other for feeding a gaseous fluid under pressure through said nozzle, and with a second pair of rectilinear passage means therethrough having axes inclined to each other and located in a second plane extending transverse to said first plane for guiding a pair of consumable electrode wires through said nozzle, all of said axes intersecting at a single point located forwardly of said nozzle; feeding means for feeding a pair of electrode wires through said second passage means, respectively; and speed varying means operatively connected to said feeding means for varying the speed of feed of one of said electrode wires with respect to that of the other while said electrode wires are fed through said second pair of rectilinear passage means.

3. In an arc metal spray gun, in combination, a spray nozzle formed with a first pair of rectilinear passage means therethrough adapted to be connected to a supply of gaseous fluid under pressure and having axes located in a first plane and inclined to each other for feeding a gaseous fluid under pressure through said nozzle, and with a second pair of rectilinear passage means therethrough having axes inclined to each other and located in a second plane extending transverse to said first plane for guiding a pair of consumable electrode wires through said nozzle, all of said axes intersecting at a single point located forwardly of said nozzle; feeding means for feeding a pair of electrode wires through said second passage means, respectively, and for varying the speed of feed of one of said wires with respect to that of the other and including a pair of feed rollers for each wire, a driving shaft operatively connected to one of said pair of feed rollers, a friction cone fixedly mounted on said driving shaft for rotation therewith, a driven shaft operatively connected to the other pair of feed rollers, and a friction wheel mounted on said driven shaft for rotation therewith, shiftable along the axis thereof and frictionally engaging said friction cone to be driven thereby so that by changing the position of said friction wheel on said driven shaft the speed of feeding of one of said wires may be changed with respect to that of the other of said wires.

4. In an arc metal spray gun, in combination, a spray nozzle formed with a first pair of rectilinear passage means therethrough adapted to be connected to a supply of gaseous fluid under pressure and having axes located in a first plane and inclined to each other for feeding a gaseous fluid under pressure through said nozzle, and with a second pair of rectilinear passage means therethrough having axes inclined to each other and located in a second plane extending transverse to said first plane for guiding a pair of consumable electrode wires through said nozzle, all of said axes intersecting at a single point located forwardly of said nozzle; feeding means for feeding a pair of electrode wires through said second passage means, respectively, and for varying the speed of feed of one of said wires with respect to that of the other and including a pair of feed rollers for each wire, a driving shaft operatively connected to one of said pair of feed rollers, a plurality of truncated gear wheels having outer gear faces located along a common cone surface and being fixedly mounted on said driving shaft for rotation therewith, a driven shaft operatively connected to the other pair of feed rollers, and a gear mounted on said driven shaft for rotation therewith and shiftable along the axis thereof between a plurality of positions in which said gear meshes with one of said plurality of truncated gear wheels, respectively, to be driven thereby so that by changing the position of said gear on said driven shaft the speed of feeding of one of said wires may be changed with respect to that of the other of said wires.

5. In an arc metal spray gun, in combination, a spray nozzle formed with a first pair of rectilinear passage means therethrough adapted to be connected to a supply of gaseous fluid under pressure and having axes located in a first plane and inclined to each other for feeding a gas-

5

eous fluid under pressure through said nozzle, and with a second pair of rectilinear passage means therethrough having axes inclined to each other and located in a second plane extending transverse to said first plane for guiding a pair of consumable electrode wires through said nozzle, all of said axes intersecting at a single point located forwardly of said nozzle; feeding means for feeding a pair of electrode wires through said second passage means, respectively, and for varying the speed of feed of one of said wires with respect to that of the other and including a pair of feed rollers for each wire, a driving shaft, a friction cone fixedly mounted on said driving shaft for rotation therewith, a driven shaft for each pair of feed rollers and operatively connected thereto, and a friction wheel mounted on each of said driven shafts for rotation therewith, shiftable along the axis thereof and frictionally engaging said friction cone to be driven thereby so that by changing the positions of said friction wheels on said driven shafts the speed of feeding of said wires may be changed with respect to each other.

6. In an arc metal spray gun, in combination, a spray nozzle formed with a first pair of rectilinear passage means therethrough adapted to be connected to a supply of gaseous fluid under pressure and having axes located in a first plane and inclined to each other for feeding a gaseous fluid under pressure through said nozzle, and with a second pair of rectilinear passage means therethrough having axes inclined to each other and located in a second plane extending transverse to said first plane for guiding a pair of consumable electrode wires through said nozzle, all of said axes intersecting at a single point located

6

forwardly of said nozzle; feeding means for feeding a pair of electrode wires through said second passage means, respectively, and for varying the speed of feed of one of said wires with respect to that of the other and including a pair of feed rollers for each wire, a driving shaft, a plurality of truncated gear wheels having outer gear faces located along a common cone surfaces and being fixedly mounted on said driving shaft for rotation therewith, a driven shaft for each pair of feed rollers and operatively connected thereto, and a gear mounted on each of said driven shafts for rotation therewith and shiftable along the axis thereof between a plurality of positions in which said gear meshes with one of said plurality of truncated gear wheels, respectively, to be driven thereby so that by changing the positions of said gears on said driven shafts the speed of feeding of said wires may be changed with respect to each other.

References Cited in the file of this patent

UNITED STATES PATENTS

2,011,873	Rava	Aug. 20, 1935
2,130,698	Preston	Sept. 30, 1938
2,196,647	Snyder et al.	Apr. 9, 1940
2,423,490	Erhardt	July 8, 1947
2,903,559	Wempe	Sept. 8, 1959

FOREIGN PATENTS

685,422	Great Britain	Jan. 7, 1953
790,700	Great Britain	Feb. 12, 1958
1,194,509	France	May 11, 1959