Oct. 27, 1936. F. E. CLESI ET AL 2,059,089

SPRAY GUN

Filed Sept. 7, 1934 2 Sheets-Sheet 1

Fig. 1.

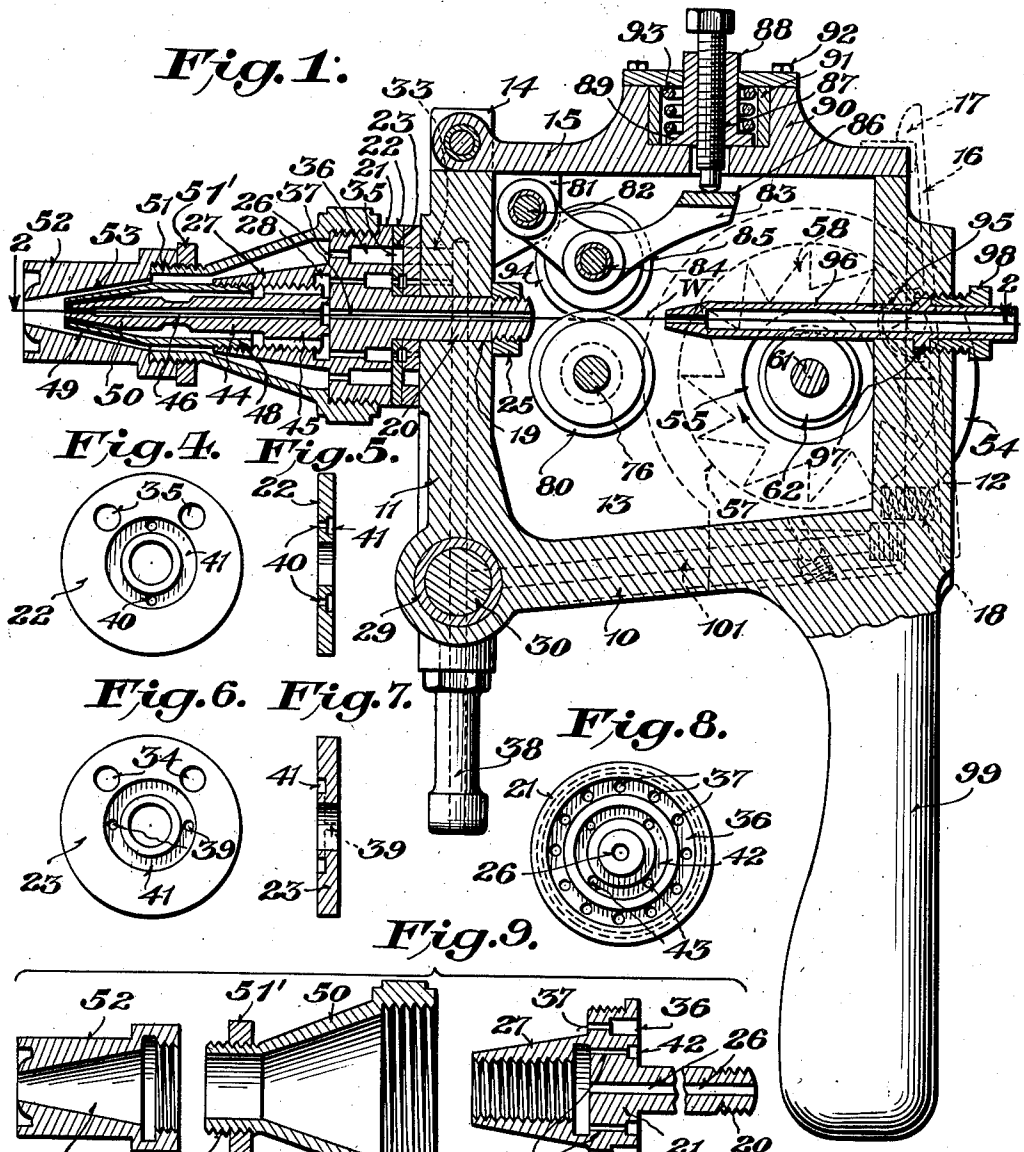

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

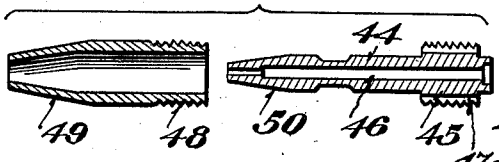

Fig. 11.

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Fig. 2.

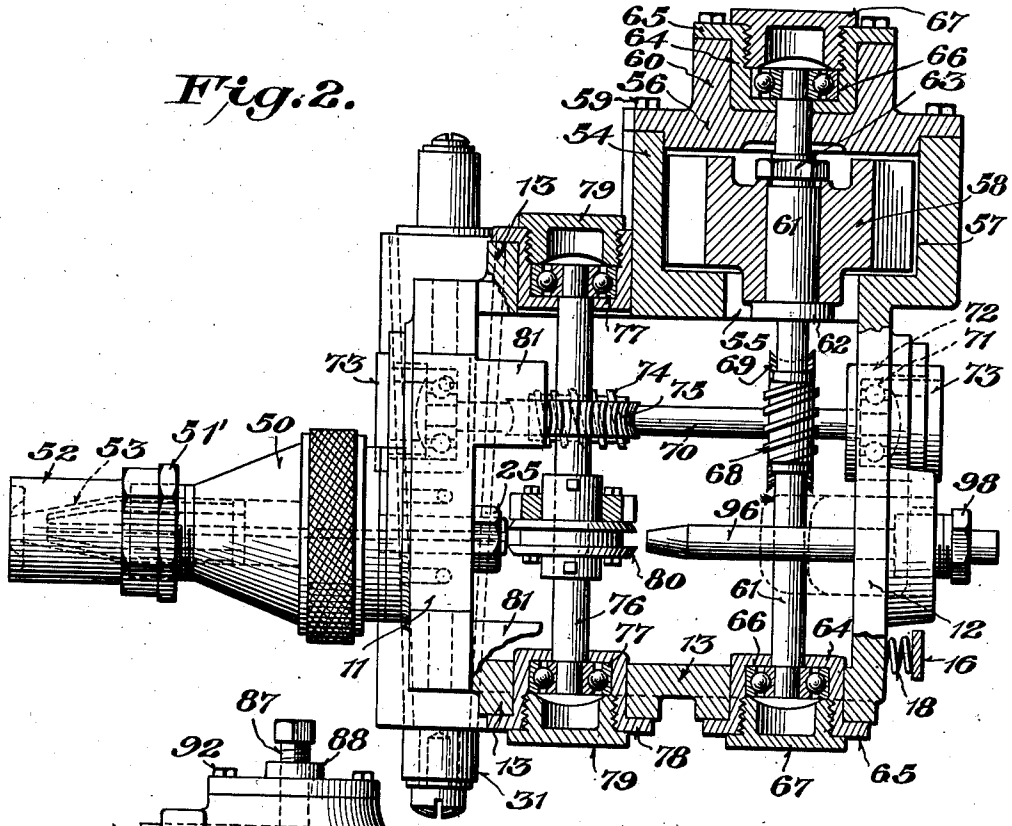
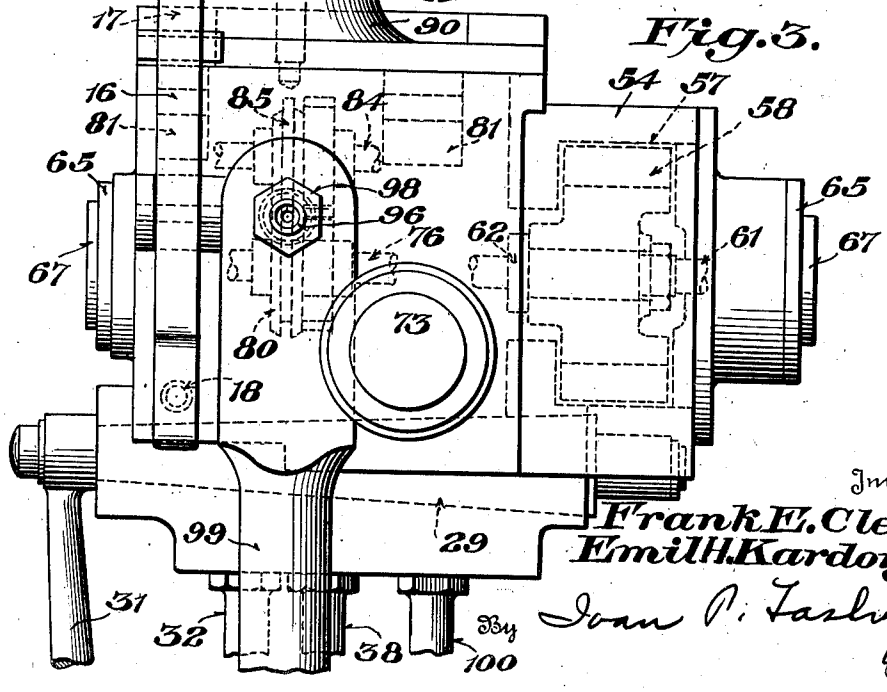


Fig. 3.



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2,059,089

SPRAY GUN

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11 Claims. (Cl. 91—12.2)

This invention relates to spray guns of the type used for melting metal and spraying the molten metal on surfaces to coat the same.

In devices of this character, it is common to employ a wire formed of the metal or alloy to be melted and sprayed, this wire being fed by suitable means into a nozzle system wherein the forward end of the wire is subject to fusing heat and from which the molten material is blown under pressure. Ordinarily a fuel gas and air are introduced under pressure and burnt in the nozzle system to effect fusion of the wire and spraying of the molten metal, air being also used to drive an air motor or turbine operatively connected with the wire feeding device to actuate the latter.

In the nozzle systems of such devices leaks are apt to occur and if the wire is not fused in the proper zone, the nozzle is apt to clog. One important object of the present invention is to provide an improved nozzle system so designed as to eliminate leaks.

A second important object of the present invention is to provide an improved nozzle system which, in the event of accidental clogging, may be readily removed as a unit, the parts of the unit being easily separable after such removal to clear the system.

In devices of this character the turbine, in present construction, is accessible with difficulty and its bearings are not readily renewable when such renewal becomes necessary or advisable.

A third important object of the present invention is to so improve the turbine arrangement of such devices that the rotary element of the turbine, its shaft and the reducing worm carried thereon may be removed and replaced as a unit.

A fourth important object of the invention is to provide an improved manner of housing the anti-friction bearings used to support the ends of the turbine shaft in such a spray-gun.

A fifth important object of the invention is to provide an improved wire feeding device in such a spray-gun whereby to accommodate various diameters of wire under substantially uniform pressure.

With the above and other objects in view, the invention consists in general of certain novel details of construction and combinations of parts hereinafter fully described, illustrated in the accompanying drawings and specifically claimed.

In the accompanying drawings like characters of references indicate like parts in the several views; and:—

Figure 1 is a vertical median view on the longitudinal axis of the device.

Figure 2 is a section; partly in elevation on the line 2—2 of Figure 1.

Figure 3 is a rear end view of the device.

Figure 4 is a face view of a certain gas and air control plate or disk forming part of the nozzle system.

Figure 5 is a diametric section through the plate shown in Figure 4.

Figure 6 is a face view of a second air and gas control plate or disk cooperating with the first plate.

Figure 7 is a diametric view through Figure 6.

Figure 8 is a face view of a gas and air distributing member used in connection with the plates of Figures 4 and 6.

Figure 9 is an exploded view of the outer members of the nozzle system.

Figure 10 is an exploded view of the two inner members of the nozzle system.

Figure 11 is an end view of one of the inner members of the nozzle system.

The body of this invention consists of a main part or casing having a bottom wall 10, a front wall 11, a rear wall 12 and side walls 13, the casing being open at the top. At each side of the top of the front wall is a lug 14 to which is pivoted or hinged the forward end of a cover plate or closure 15. Pivoted to the rear wall 12 is a latch lever 16, this lever being pivoted intermediate its ends and having its upper end provided with a hook 17 to hold the rear end of the closure 15 in closed position. At the lower part of the rear wall there is provided a recess holding a compression spring 18 engaging the lower end of the lever 16 to force the said lower end rearwardly and thus to hold the hook 17 in engagement with the rear of the closure 15 and lock the latter down. By forcing the lower end of the lever 16 forwardly against the action of the spring 18, the hook 17 is released and the hinged closure is allowed to open.

In the front wall 11 there is provided an opening 19 wherethrough extends the shank or stem 20 of a main nozzle member having a cylindrical body 21. Between the body 21 and the front wall 11 there is provided a pair of disks 22 and 23 which serve, among other purposes, to space the body 21 from the front wall 11. A nut 25 is screwed on the rear end of the stem 20 and holds the main nozzle member or nozzle base in position. The stem 20 and body 21 are provided with an axial passage or bore 26 for the wire used herein. Extending forwardly from the

body 21 is an exteriorly frusto-conical wall or body tip 27 internally threaded at its forward part and having a circumferential channel 28 formed in its inner face adjacent the body 21 and constituting a gas chamber.

In the bottom of the front wall 11 at its junction with the bottom wall 10 there is provided a bore extending transversely of the casing and having a liner 29 wherein is fitted a valve 30 controlled by a handle 31. Screwed into the lower side of this valve chamber is a nipple 32 which, with the valve in operating position, supplies air to a pair of ports 33 communicating through ports 34 in the member 22 and registering ports 35 in the member 21 with an outer channel 36 in the body 21. By means of a series of ports 37 this channel opens through the forward face of the body around the exterior of the wall 27. Also, the valve 30 affords controlled communication between a nipple 38 and registering ports 39 and 40 in the disks 22 and 21 respectively, registering grooves 41 being provided in the confronting faces of these disks. The ports 40 open into a channel 42 in the rear face of the body 21 and this channel communicates by ports 43 with the channel 28.

The interior of the port 28 is screw-threaded and into this port is screwed the rear inner nozzle member 44, the same having an enlarged externally threaded rear portion 45 spaced somewhat from its rear face. This rear face fits tightly against the front face of the body 21 and the member 44 is provided with a bore 46 which, when the parts 44 and 21 are assembled, forms a continuation of the bore 26. The member 44 has a body of less external diameter than the internal diameter of the part 27. Grooves 47 cut longitudinally through the portion 45 so that gas may pass through these grooves from the chamber 28 to the forward end of the member 44. Secured into the forward end of the part is a front inner nozzle member 48, the internal diameter of which is larger than the external diameter of the forward end of the part 44 so that an annular passage is formed between these parts. The forward end of the part 48 is contracted forwardly to form a valve seat as at 49 and the forward end of the part 44 is similarly tapered as at 50. By this means the width of the annular passage between the outlet ends of these two parts may be regulated, it being merely necessary to adjust the part 48 relatively to the part 44 in the part 27. Obviously the part 48 is of tubular formation to permit forward passage of gas between this part and the front end of part 44.

Secured on the body 21 is the rear end of the frusto-conical shell or outer nozzle member 50 having a cylindrical forward end 51 surrounding the member 48 in spaced concentric relation thereto. On this forward end is screwed the tip 52 having a frusto-conical bore 53 which is concentrically spaced from the end 49 of the part 48. This tip projects forwardly of the part 49 so that the space in the forward end of the tip 52 forms a melting chamber.

The wire used projects through the members 44 and 48 into this chamber and is there melted due to the combustion of gas flowing into said chamber between the parts 50 and 49 and its combination with the oxygen of the air flowing into this chamber between the parts 49 and 52, the mixture having, of course, been ignited. The airblast, due to excess air, forcibly sprays the molten metal out of the tip. A nut 51' locks the tip in position on the member 50.

On one of the side walls 13, preferably the right side wall, there is provided a boss 54 internally hollowed and shouldered at its inner end to provide a comparatively small opening 55 communicating with the interior of the casing. The outer part of this boss constitutes a rotor casing and is open at its outer side. A cap or closure 56 is fitted on the outer end of this rotor casing to provide a cylindrical chamber 57. In this chamber is mounted a rotor 58 which substantially constitutes the rotary element of a prime mover such as a turbine. The cap or closure is secured on the boss by bolts 59. The cap or closure 56 is provided with a hollow boss 60 axially alined with the rotor 58. This rotor 58 is fixed on a shaft 61 between an internal collar 62 and a clamping nut 63 so as to be held in proper position between the cap or closure 56 and the side wall 13. Also, a bearing housing 64 is fitted into the cap 60 and is provided with a flange 65 whereby it is bolted to the outer end of the cap 60. This bearing housing is of substantially cup-shape so that it may receive the anti-friction bearing 66, the inner race of which is fitted on the right hand end of the shaft 61 while its outer race is force fitted into the interior of the member 64 and is clamped into position therein by the cap 67 screwed into the member 64 and forming a closure therefor, dust, moisture and air proof.

In the middle of the shaft 61 there is provided a worm 68 which meshes with a worm gear 69 fixed on a shaft 70 extending longitudinally of the casing between the walls 11 and 12. This shaft 70 has its ends mounted in antifriction bearings 71 mounted in pockets similar to the pockets 64 as shown at 72 and smilarly held by closures 73.

The shaft 70 carries a worm 74 fixed on this shaft and this worm meshes with a worm gear 75 fixed on a shaft 76 which extends transversely of the casing and has its ends mounted in antifriction bearings 77 mounted in housings 78 closed by caps 79. On the shaft 76 is mounted a roller 80 the upper periphery of which is axially alined with the bore 26.

Within the casing there is provided a pair of lugs 81 wherein is mounted a shaft 82 to which is pivoted one end of each of a pair of levers 83 which carry intermediate their ends a shaft 84 whereon is mounted a feed roller 85 cooperating with the roller 80. The levers 83 are connected by a transverse member 86 which is forced downwardly by a screw 87, screwed through a sleeve 88 having a collar 89 on its lower end. This screw passes through the hollow boss 90 on the upper side of closure 15 of the casing, this closure being provided with a lining 91 and a cap 92 holding the closure in place. The spring 93 engages the collar 89 on the sleeve 88 and forces the sleeve 88 downwardly without respect to the position of the screw 87. By this means, adjustment of the screw 87 serves to grip the wire W between the roller 94, fixed on the shaft 84 and the roller 80.

Alined with the opening 19 in the rear wall 12 is an opening 95 wherethrough passes a tubular guide 96 having a collar 97 whereby it is held in position by the member 98. The handle 99 is provided for manipulating the device.

A nipple 100 admits air pressure to the valve chamber and the passage of air therethrough is controlled by the position of the valve so that

when the parts are in operative position, air under pressure is admitted through the passage 101 and passes into the chamber 57 to actuate the rotor 58.

In operation, the wire W is fed through the member 96 and through the nozzle system by means of members 94 and 80. When the valve is opened to feed the wire forwardly, combined gas and air in their ignited state melt the forward end of the wire, which is then sprayed out from the member 52 on to the surface to be coated.

It will be observed that the rings 22 and 23 are independently rotatable on the stem 20 so that the ports 34 and 35 may be moved into and out of registry and thereby control the flow of air to the nozzle. At the same time, due to the channel arrangement at 41, the gas flow is not in any way restricted, being uniform, in accordance with the open or closed position of the valve 30. Thereby, the proper proportion of air and gas is assured to produce substantially perfect combustion with the attendant rate of heat and melting of the wire.

There has thus been provided a highly efficient device of the kind described and for the purpose specified.

It is obvious that minor changes may be made in the form and construction of the invention, without departing from the material principles involved. It is not, therefore, desired to confine the invention to the exact form herein shown and described, but it is desired to include all such changes as properly come within the scope of the appended claims.

What is claimed as new is:

1. In a device of the kind described, a nozzle system including a base member having a forwardly projecting portion and provided with outer and inner channels opening respectively on the outer and inner sides of said forwardly projecting portion, a wire conduit screwed into the rear part of said forwardly projecting portion, an outer shell mounted externally of said forwardly projecting portion, a discharge tip on the end of said outer shell, and a gas feed flow control located between said tip and conduit and screwed into the forward part of the forwardly projecting portion of the base member.

2. In a metal spraying device, a casing having a front wall provided with air and gas passages opening through the outer face of said front, a nozzle system including a base member having a body provided with a stem removably fitted in said front wall, said base member having rearwardly opening inner and outer channels and perforations extending from said channels through its forward face, means to secure the nozzle system to said front wall, rotary valve means on said stem between the body of the base member and said front wall and controlling the flow or air to one of said channels, said valve means including a pair of independently rotatable rings.

3. In a metal spraying device, a casing having a front wall provided with air and gas passages opening through the outer face of said front, a nozzle system including a base member having a body provided with a stem removably fitted in said front wall, said base member having rearwardly opening inner and outer channels and perforations extending from said channels through its forward face, means to secure the nozzle system to said front wall, rotary valve means on said stem between the body of the base member and said front wall and controlling the flow of air to one of said channels, said valve means including a pair of independently rotatable rings, the confronting faces of said rings being each provided with an annular channel, said channels registering with each other and being provided with ports in their bottoms, the ports on the front ring opening into the inner channel of the base.

4. In a metal spraying device, a casing having a front wall provided with air and gas passages opening through the outer face of said front, a nozzle system including a base member having a body provided with a stem removably fitted in said front wall, said base member having rearwardly opening inner and outer channels and perforations extending from said channels through its forward face, means to secure the nozzle system to said front wall, rotary valve means on said stem between the body of the base member and said front wall and controlling the flow of air to one of said channels, said valve means including a pair of independently rotatable rings, the confronting faces of said rings being each provided with an annular channel, said channels registering with each other and being provided with ports in their bottoms, the ports on the front ring opening into the inner channel of the base, said rings being further provided with ports movable into and out of registry by relative rotation of the rings, the last mentioned ports of the front ring opening into the outer channel of the base.

5. In a metal spraying device, a casing having a front wall provided with air and gas passages opening through the outer face of said front, a nozzle system including a base member having a body provided with a stem removably fitted in said front wall, said base member having rearwardly opening inner and outer channels, and perforations extending from said channels through its forward face, means to secure the nozzle system to said front wall, rotary valve means on said stem between the body of the base member and said front wall and controlling the flow of air to one of said channels, said base member having an annular forward extension between the perforations of the inner and outer channels of the base member, said extension being internally threaded and having an internal channel at its rear end, and a wire guide having an enlarged and threaded rear end screwed into said extension and having longitudinal channels extending through the threads on said rear end.

6. In a metal spraying device, a casing having a front wall provided with air and gas passages opening through the outer face of said front, a nozzle system including a base member having a body provided with a stem removably fitted in said front wall, said base member having rearwardly opening inner and outer channels and perforations extending from said channels through its forward face, means to secure the nozzle system to said front wall, rotary valve means on said stem between the body of the base member and said front wall and controlling the flow of air to one of said channels, said valve means including a pair of independently rotatable rings.

7. In a metal spraying device, a casing having a front wall provided with air and gas passages opening through the outer face of said front, a nozzle system including a base member having a body provided with a stem removably fitted in said front wall, said base member having rear-

wardly opening inner and outer channels and perforations extending from said channels through its forward face, means to secure the nozzle system to said front wall, rotary valve means on said stem between the body of the base member and said front wall and controlling the flow of air to one of said channels, said valve means including a pair of independently rotatable rings, the confronting faces of said rings being each provided with an annular channel, said channels registering with each other and being provided with ports in their bottoms, the ports on the front ring opening into the inner channel of the base, said base member having an annular forward extension between the perforations of the inner and outer channels of the base member, said extension being internally threaded and having an internal channel at its rear end, and a wire guide having an enlarged and threaded rear end screwed into said extension and having longitudinal channels extending through the threads on said rear end.

8. In a metal spraying device, a casing having a front wall provided with air and gas passages opening through the outer face of said front, a nozzle system including a base member having a body provided with a stem removably fitted in said front wall, said base member having rearwardly opening inner and outer channels and perforations extending from said channels through its forward face, means to secure the nozzle system to said front wall, rotary valve means on said stem between the body of the base member and said front wall and controlling the flow of air to one of said channels. said valve means including a pair of independently rotatable rings, the confronting faces of said rings being each provided with an annular channel, said channels registering with each other and being provided with ports in their bottoms, the port on the front ring opening into the inner channel of the base, said rings being further provided with ports movable into and out of registry by relative rotation of the rings, the last mentioned ports of the front ring opening into the outer channel of the base, said base member having an annular forward extension between the perforations of the inner and outer channels of the base member, said extension being internally threaded and having an internal channel at its rear end, and a wire guide having an enlarged and threaded rear end screwed into said extension and having longitudinal channels extending through the threads on said rear end.

9. In a device of the kind described, a casing, a rotor chamber in said casing, a cap on said rotor chamber closing the outer end thereof, a boss on said cap having a cup-shaped formation, a cup-shaped housing mounted in said boss, an anti-friction bearing mounted in said housing, a cap closing the outer end of said housing and closing the same, said last cap serving to hold the anti-friction gear in position, a shaft having one end supported in said anti-friction gear, a rotor in said chamber fixed on said shaft, and means to support the other end of said shaft.

10. In a device of the kind described, a casing, a rotor chamber in said casing, a cap on said rotor chamber closing the outer end thereof, a boss on said cap having a cup-shaped formation, a cup shaped housing mounted in said boss, an anti-friction bearing mounted in said carrier, a cap closing the outer end of said carrier and closing the same, said last cap serving to hold the antifriction bearing in position, a shaft having one end supported in said anti-friction bearing, a rotor in said chamber fixed on said shaft, said boss having an opening at its inner end, a worm on said shaft of less diameter than said opening, and means on the opposite side wall supporting the remaining end of said shaft.

11. In a metal spraying device, a casing, a boss on said casing forming a turbine chamber, a shaft extending through said chamber, anti-friction bearings supporting said shaft and accessible from the exterior of the casing a collar on said shaft, a turbine wheel detachably fitted on the shaft and resting against the collar, a nut screwed on said shaft and bearing against the wheel to force it against the collar, a worm removably mounted on said shaft, and a wire feeding device operated by said worm.

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