Jan. 11, 1966 J. F. QUAAS ET AL 3,228,610

FLAME-SPRAYING TORCH

Filed June 21, 1963 2 Sheets-Sheet 1

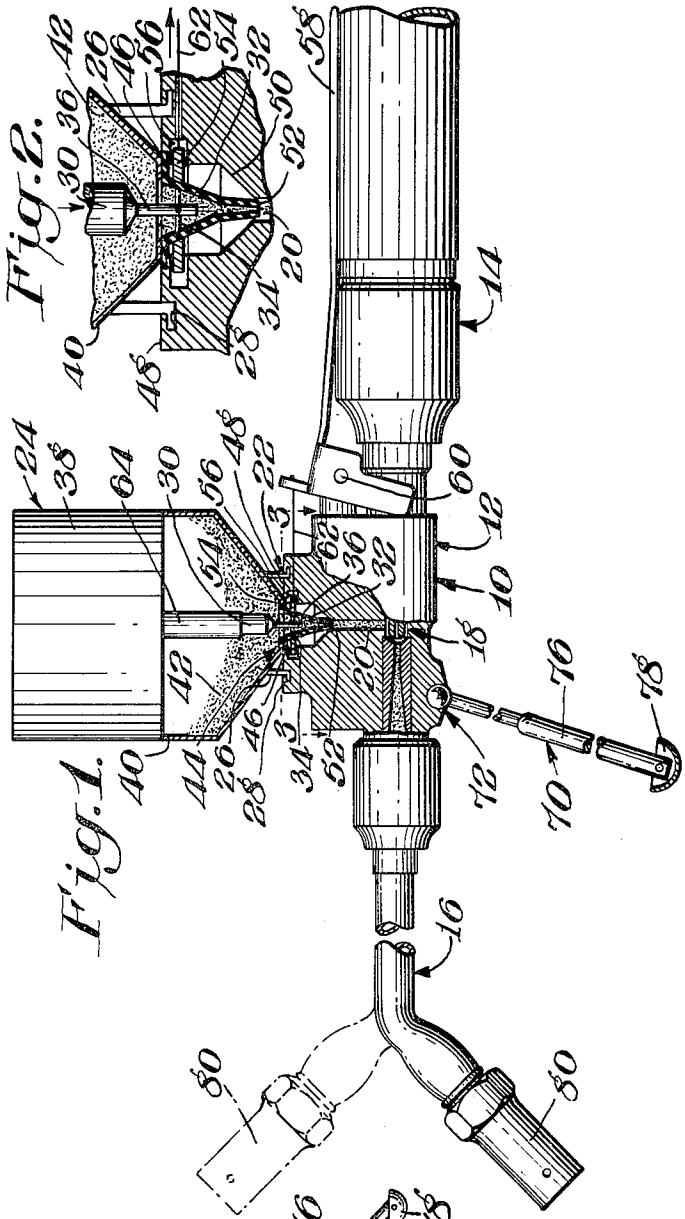


Fig. 1.

Fig. 2.

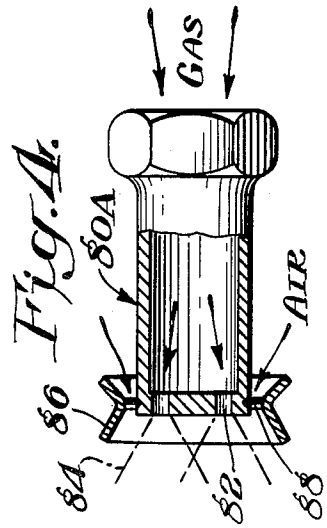


Fig. 4.

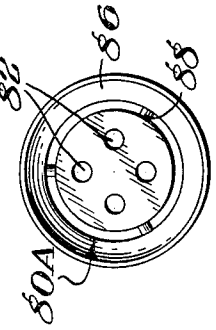


Fig. 5.

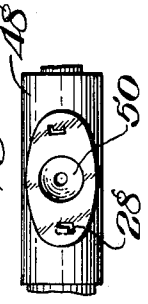


Fig. 3.

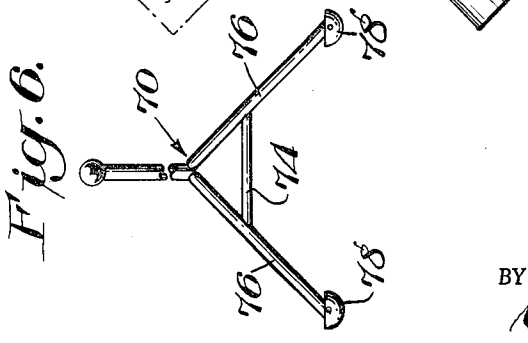


Fig. 6.

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FLAME-SPRAYING TORCH

Filed June 21, 1963 2 Sheets-Sheet 2

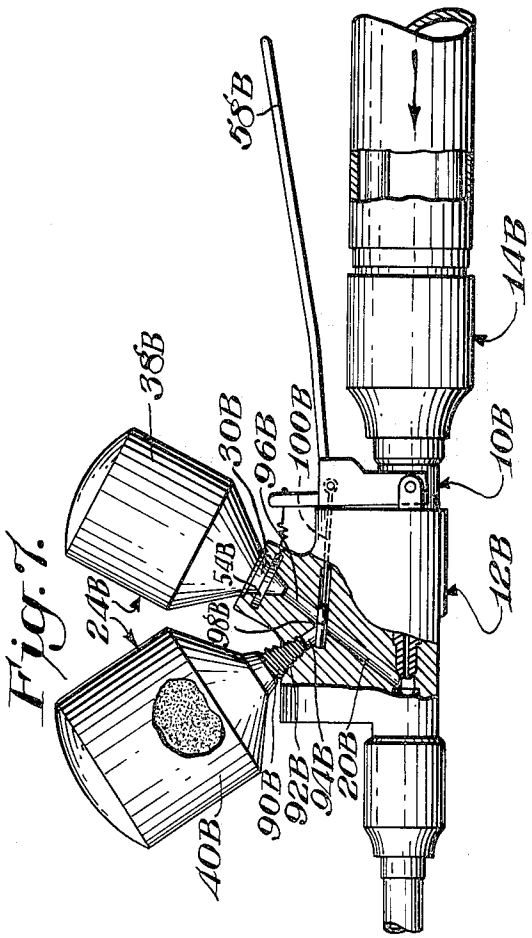


Fig. 7.

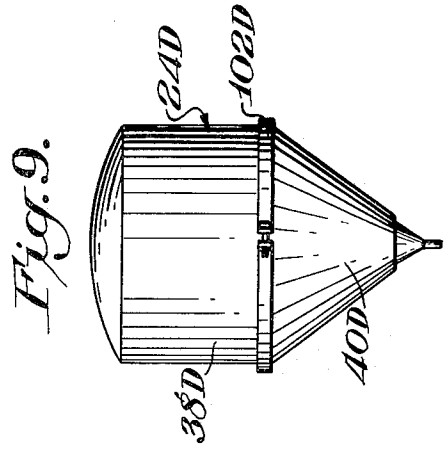


Fig. 9.

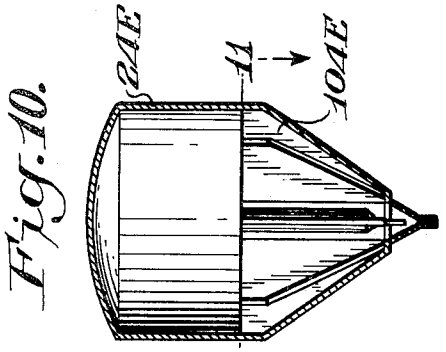


Fig. 10.

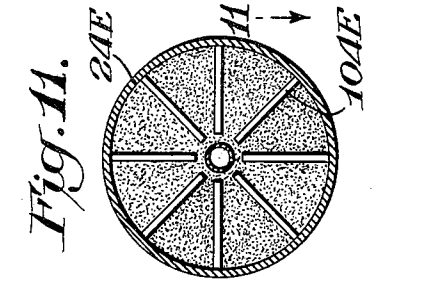


Fig. 11.

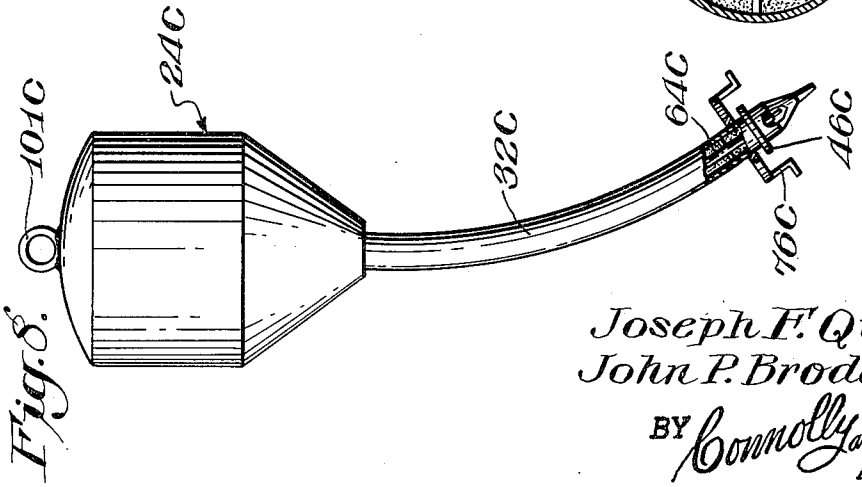


Fig. 8.

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FLAME-SPRAYING TORCH

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18 Claims. (Cl. 239—85)

This invention relates to a torch for spraying coatings upon surfaces from powders, and it more particularly relates to a gas type of such a torch.

Gas torches have been used for applying metal powders to surfaces by entraining them in the stream of burning gases issuing from them. Various means for mixing and entraining powders in the gases have been used. Where auxiliary propellants such as compressed air are utilized for entraining the powders, the complication and expense of an air compressor is incurred. When the mixed gases themselves are used for entraining the powder, the available power is limited thereby restricting the freedom of powder supply.

An object of this invention is to provide a relatively simple, economical and positive means of feeding and injecting powder into the stream of burning gases in a flame-spraying torch.

In accordance with this invention a sealed pressurized powder-containing and feeding means is mounted upon the powder-injecting section of the torch. A control valve is manually actuated to discharge pressurized gas mixed with powder into the gas stream as it is required. The sealed pressurized powder-containing and feeding means may comprise a divided container, a pair of pressurized and powder-containing units or the powder may be combined with the pressurized gas within an aerosol container incorporating a suitable propellant and vehicle that maintains the powder in suspension.

In the divided container form of this invention a discharge tube may extend from the pressurized section through the powder-containing section and terminate in a nozzle a short distance within the outlet from the powder container. A convenient laterally displaceable valve for the pressurized section may be connected to the tube which may be externally actuated by a ring disposed around the outside of the resilient outlet to the powder-containing section within which the tube is in contact. This ring may be moved laterally by a handle on the torch to actuate discharge from the pressurized container and its entrained powder. A circumferential seal on the end of the container resting upon the torch confines the discharged gas within the powder-injecting channel when the container is firmly coupled to the torch.

Novel features and advantages of the present invention will become apparent to one skilled in the art from a reading of the following description in conjunction with the accompanying drawings wherein similar reference characters refer to similar parts and in which:

FIG. 1 is a view in elevation partially broken away in cross-section of one embodiment of this invention with an alternative position of its tip illustrated in phantom;

FIG. 2 is an enlarged cross-sectional view of a portion of the embodiment shown in FIG. 1;

FIG. 3 is a cross sectional view taken through FIG. 1 along the line 3—3;

FIG. 4 is an enlarged side view in elevation partially broken away in cross-section of a modified form of the tip of the embodiment shown in FIG. 1;

FIG. 5 is a front view in elevation of the modification shown in FIG. 4;

FIG. 6 is a front view in elevation of the support shown in FIG. 1;

FIG. 7 is a side view in elevation partially broken away in cross section of another embodiment of this invention;

FIG. 8 is a view in elevation partially broken away in cross section of a modified remote form of dispenser portion of the embodiment shown in FIG. 1;

FIG. 9 is a view in elevation of another modification of the dispenser portion of the embodiment shown in FIG. 1;

FIG. 10 is a cross-sectional view in elevation of a further modification of the dispenser portion of the embodiment shown in FIG. 1; and

FIG. 11 is a cross-sectional view taken through FIG. 10 along the line 11—11.

In FIGS. 1 and 2 is shown a torch 10 having a powder-injecting section 12 inserted between a gas injecting handle assembly 14 and a tip assembly 16. A longitudinal gas conducting passageway 18 extends through powder-injecting section 12, and a powder supplying channel 20 extends from coupling section 22 at the top of powder-injecting assembly 12 to form gas conducting passageway 18.

A sealed pressurized powder container 24 is attached to powder injecting section 12 by coupling 22 which includes for example bayonet prongs 26 on container 24 and corresponding sockets 28 in the top of powder injecting section 12. A control valve assembly 30 which has a valve element in it of the aerosol dispensing type, such as that shown in U.S. Patent No. 3,067,784, which is opened by lateral deflection, is mounted upon container 24; and it is actuated by lateral pressure exerted on resilient tapered outlet section or snout 32. Radial prongs 34 bridge the space between nozzle 36 and resilient tapered outlet section 32.

As shown in FIG. 1, sealed pressurized powder container 24 is divided into a pressurized section 38, for example filled with a propellent such as nitrogen gas, and a powder containing section 40 containing a metallic powder 42. A mixer 44 is disposed at the outlet end of container 24, and it is constituted by nozzle 36 extending within resilient tapered outlet 32. The gas discharged from nozzle 36 entrains powder flowing downwardly into tapered outlet section 32. A sealing ring 46 of resilient material, such as rubber, is mounted on container 24 around outlet 32; and it engages the top surface 48 of powder injecting section 12 when pressurized powder container 24 is connected to it for confining the discharge of pressurized gas and powder from the container within channel 20. The inlet section 50 to channel 20 is funnel shaped for receiving outlet 32 with its tip 52 disposed within channel 20 for directing the pressurized powder containing gas into it.

Lateral pressure is exerted on outlet section 32 by actuating ring 54 mounted within an annular slot 56 in powder injecting section 12. Ring 54 is laterally displaced by rotation of operating lever 58 about pivot 60 to pull on cable 62 connecting lever 58 to ring 54. This lateral displacement is transmitted through nozzle 36 to valve 30 which is mounted upon the end of tube 64 extending from pressurized section 38 adjacent tapered outlet 32 of powder containing section 40.

The apertured tip 52 of resilient tapered outlet 32 is sealed by resilient lips which are opened when pressurized gas is discharged from nozzle 36 into the end of outlet 32. This discharge of gas entrains some of the fine metal powder 42 in outlet 32 and positively feeds it like an injector into the stream of gas flow through gas conducting passageway 18. The amount of powder injected into the gas stream of the torch is accordingly positively and accurately metered by its positive pressure injection even if the torch is substantially displaced from the illustrated optimum operating position, without incurring the expense and complication of provision of expensive auxiliary equipment, such as an air compressor.

The sealing of the powder within container **24** except when gas entrains and discharges it also protects it from atmospheric corrosion. A protective gas, such as nitrogen, stored within gas container **38** may also be initially injected within powder container **40** either from an outside source or from gas container **38**, and it is replenished each time the valve is actuated to discharge an amount of fine metal powder.

Plastic or ceramic powders as well as metal powders or mixtures thereof may be similarly dispensed. Fluxes of the methyl borate vapor or suspension type may also be incorporated in the pressurized container **38** for cooperating in deposition of fused coatings upon metal surfaces.

Physical manipulation of torch **10** is facilitated by a bipod support **70** mounted at the bottom of torch **10** by ball and socket coupling **72**. As shown in FIG. 6, a cross bar **74** joins legs **76** of support **70** to provide rigidity and a hanger for storing the torch. The curved feet **78** of support **70** help support the weight of the torch and may also be used to accurately distance it from surfaces being coated. The goose-neck tip section **16** of torch **10** may be swiveled as shown in phantom in FIG. 1 to facilitate the coating of overhead or lateral surfaces.

In FIGS. 4 and 5 is shown a modified tip **80A** to be used in conjunction with a torch such as torch **10**. Tip **80A** includes a multiplicity of apertures **82** arranged for example in a circular array of four. The jets of flame **84** shown diagrammatically in FIG. 4 flowing out from apertures **82** intersect each other to provide a broad band of flame which deposits a correspondingly broad band of fused coating upon a surface. This broad flame pattern drastically minimizes loss of powder through the sides of the flame and highly improves depositing efficiency which is quite critical when the powders being used are expensive, which is not unusual.

An annular shield **86** mounted about the end of tip **80A** by radial pins **88** directs air smoothly about diverging jet flame patterns **84** to help confine the powder within the flame pattern and direct it upon a surface. This further improves the efficiency of powder deposition.

In FIG. 7 is shown a torch **10B**, which is substantially similar to torch **10** with the exception that sealed pressurized powder dispenser **24B** is divided into two separate sections **38B** for gas and **40B** for powder. Gas section **38B** is connected to powder injecting section **12B** by an arrangement similar to that of FIG. 1 with the exception of the elimination of the tapered outlet section. Actuating ring **54B** accordingly acts directly upon valve **30B**.

Powder containing section **40B** has its snout **90B** screwed into a threaded socket **92B** and directed into a branch channel **94B** which joins powder conducting channel **20B** together with a similar branch channel **96B** from gas container **38B**. A gate valve **98B** actuated by a second cable **100B** from operating lever **58B** permits powder from container **40B** to be entrained into stream of gas discharged into channel **20B**.

In FIG. 8 is shown a remote form of sealed pressurized dispenser **24C** in which tapered outlet **32C** is elongated in length and made together with the tube **64C** within it flexible to permit container **24C** to be hung remote from a torch by ring **101C** while bayonet prongs **26C** and sealing ring **46C** are engaged with the powder injecting section **12C** (not shown) of a torch in the same manner described in FIG. 1. A large amount of powder of considerable weight may therefore be drawn from dispenser **24C** without imposing its weight directly on the torch. The torch may also be freely operated in different orientations without interfering with the efficiency and precision of metering of the flow of powder.

In FIG. 9 is shown another form of powder dispenser **24D** which is similar to that shown in FIG. 1 with the exception that the two sections **28B** and **40B** may be separated from each other by releasing a coupling band **102D** joining them together. This permits the addition of powder into section **40B** or the combination of different powder and gas containing sections at will.

In FIGS. 10 and 11 is shown another form of pressurized dispenser **24E** similar to that shown in FIGS. 1 and 2 with the insertion of a series of radial ribs **104E** for segregating portions of powder thereby preventing the components of a mixture from completely separating from each other during storage.

What is claimed is:

1. A flame-spraying torch comprising a gas injecting assembly having connecting means for attachment to a combustible gas source, a tip section disposed at the front of said torch, a powder-injecting section connected between said tip section and said gas injecting assembly for entraining powder within the burning gases discharged from said torch, a longitudinal gas-conducting passageway through said powder-injecting section, a coupling means upon said powder-injecting section, a powder-supplying channel in said injecting section extending from said coupling means to said longitudinal gas-conducting passageway, a sealed pressurized powder containing means connected to said coupling means, a control valve within said pressurized powder containing means, manually-operable means connected to said control valve for actuating it to discharge powder under pressure through said channel into said gas-conducting passageway, said sealed pressurized powder containing means comprising a container divided into a gas pressurized section and a powder-containing section, mixing means between said sections for combining said said gas issuing through said valve from said pressurized section with powder from said powder-containing section, said mixing means comprising a tube from said pressurized section extending through said powder-containing section, a tapered outlet from said powder containing section, said tube terminating in a nozzle disposed within said tapered outlet, and a pressure responsive seal mounted upon the end of said tapered outlet which is opened by discharge of the gas from said nozzle for emitting a stream of gas mixed with powder from said container.

2. A torch as set forth in claim **1** wherein a sealing ring is mounted upon said container adjacent said coupling means, and said coupling means forcefully engages said sealing ring with said powdered injecting section for confining the discharge of pressurized gases from said container within said channel.

3. A torch as set forth in claim **2** wherein said coupling means comprises bayonet prongs and sockets.

4. A torch as set forth in claim **1** wherein said control valve is mounted upon said tube adjacent said nozzle and actuable by lateral displacement of said nozzle, valve actuating means mounted upon said powder injecting section adjacent said coupling, said tapered outlet being made of a resilient material, bridging means within said tapered outlet connecting it with said nozzle, said valve actuating means engaging said resilient tapered outlet, and said manually-operable means being connected to said valve actuating means for laterally displacing it to actuate said valve.

5. A torch as set forth in claim **4** wherein said pressure responsive seal comprises resilient lip means at the end of said resilient tapered outlet which seals said powder within said outlet section in the absence of discharge of pressure.

6. A torch as set forth in claim **5** wherein said bridging means comprises prongs spaced about the periphery of said nozzle.

7. A torch as set forth in claim **1** wherein said tapered outlet and said tube are extended in length and flexible to permit said sealed pressurized powder containing means to be mounted remote from said torch.

8. A torch as set forth in claim **7** wherein a sealing ring is mounted upon the end of said extended outlet, and said coupling means comprises attaching prongs upon the end of said extended outlet and engaging sockets upon said powder injecting section.

9. A dispenser as set forth in claim 1 wherein bridging means is within said tapered outlet connecting it with said nozzle said bridging means comprising spaced prongs about the periphery of said nozzle.

10. A sealed pressurized powder dispenser comprising a container divided into a gas pressurized section, and a powder-containing section, outlets from said sections, a control valve upon said gas pressurized outlet, a pressure responsive outlet upon said powder-containing section, mixing means connected between said outlets for combining said gas issuing from said pressurized section with powder from said powder-containing section, said mixing means comprises a tube from said pressurized section extending through said powder-containing section, the outlet from said powder-containing section being tapered, said tube terminating in a nozzle disposed adjacent said tapered outlet, and said pressure responsive outlet being opened by discharge of the gas from said nozzle for emitting a stream of gas mixed with powder from said container.

11. A dispenser as set forth in claim 10 wherein a sealing ring is mounted upon said dispenser adjacent said tapered outlet, for confining the discharge of pressurized gases from said container within said channel.

12. A dispenser as set forth in claim 11 wherein said control valve is connected upon said tube adjacent said nozzle and actuable by lateral displacement of said nozzle, said tapered outlet of said container being made of a resilient material, and bridging means connecting said nozzle within said tapered outlet to permit external lateral movement of said tapered outlet to actuate said valve.

13. A dispenser as set forth in claim 12 wherein said pressure responsive outlet comprises resilient lip means on said resilient outlet which seals said powder within said outlet in the absence of pressure discharge within them.

14. A dispenser as set forth in claim 12 wherein said tapered outlet and said tube are extended in length and flexible to permit said container to be mounted remote from a torch to which it can be connected.

15. A dispenser as set forth in claim 14 wherein a sealing ring is mounted upon the end of said extended tube, and a coupling means also being mounted upon the end of said tube for connecting said tube to said torch with said sealing ring engaged with it for confining gas discharged from said dispenser within said torch.

16. A flame-spraying torch comprising a gas injecting assembly having connecting means for attachment to a combustible gas source, a tip section disposed at the front of said torch, a powder-injecting section connected between said tip section and said gas injecting assembly for entraining powder within the burning gases discharged from said torch, a longitudinal gas-conducting passageway through said powder-injecting section, a coupling means upon said powder-injecting section, a powder supplying

channel in said injecting section extending from said coupling means to said longitudinal gas-conducting passageway, a sealed pressurized powder containing means connected to said coupling means, a propellant means including a control valve within said pressurized powder containing means, and manually-operable means for controlling said propellant means and control valve for actuating the control valve in a lateral direction to discharge powder under pressure through said channel into said gas-conducting passageway.

17. A torch as set forth in claim 16 wherein said sealed pressurized powder containing means comprises a container divided into a propellant gas pressurized section and a powder-containing section, and mixing means between said sections for combining said gas issuing through said valve from said pressurized section with powder from said powder-containing section.

18. A flame spraying torch comprising a gas injecting assembly having connecting means for attachment to a combustible gas source, a tip section disposed at the front of said torch, a powder injecting section connected between said tip section and said gas injecting assembly for entraining powder within the burning gases discharged from said torch, a longitudinal gas-conducting passageway through said powder injecting section, a sealed powder containing means connected to said powder injecting section, a powder supplying channel extending from said powder containing means to said longitudinal gas conducting passageway, means for opening said sealed powder containing means, a separate sealed propellant containing means including a control valve connected to and mounted on said powder injecting section, a propellant passageway extending from said propellant containing means and communicating with said powder supplying channel in aspirating relationship thereto, and manually operable means for controlling said propellant means and control valve for actuating the control valve in a lateral direction whereby the propellant flow entrains powder from said powder containing means and discharges it into said longitudinal gas conducting passageway.

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