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UNITED STATES PATENT OFFICE

2,505,049

ELECTRIC POWDER CONTROL

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11 Claims. (Cl. 302—17)

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This invention relates to the art of feeding powder, and more particularly to electrical means for controlling the flow of powder.

In feeding powder, especially iron powder, which is carried and propelled by a fluid, such as air flowing under substantially constant pressure through a conduit, the scoring and rapid erosion of mechanical valves present a serious problem. Such valves must be properly designed to prevent clogging, and they need to be replaced frequently. This is not only expensive, but requires entire systems to be shut down while the valves are being repaired or replaced.

The main objects of the invention are to provide an improved method and means for feeding powder, particularly powder containing or composed of particles responsive to an electric field; and to provide novel feed means for measuring powder in a feeding system.

According to the invention the feeding of ferrous powder, for example, is controlled by a magnetic field crossing the path of such powder. In one form of the invention a novel magnetic powder feed system is provided which includes a non-magnetic tube for conducting powder therethrough and an electromagnet for polarizing powder in such tube to control the powder fed through the tube. The powder may be paramagnetic or diamagnetic as well as ferromagnetic, such as powdered iron, nickel, or magnetic alloy. In any case the novel control is quite simple and avoids disadvantages and difficulties of the prior art.

In the drawings:

Fig. 1 is a diagrammatic view, partly in perspective, of a magnetic powder feed system exemplifying the invention.

Fig. 2 is an enlarged view mainly in side elevation of the magnetic powder valve, parts being broken away and shown in section.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a view in front elevation of a modification of the invention for supplying measured charges of magnetic powder.

Fig. 5 is an enlarged cross-sectional view taken on line 5—5 of Fig. 1.

Referring to Figs. 1 and 5, an oxy-acetylene cutting blowpipe B is fed with magnetic or paramagnetic or diamagnetic powder M from a dispenser comprising closed hopper P through a conduit L including a tube 8 provided with inlet and outlet couplings 10 and 12. The hopper P is in communication through a pipe A containing a valve 13 with a source of fluid such as air under substantially constant pressure, so that the powder normally flows from the hopper P, through the conduit L, to the blowpipe B.

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As shown in Fig. 5, the hopper P contains a supply of the powder M, air under pressure being supplied to the space N above the powder. A bleeder tube X having its upper end open to the space N, communicates with a chamber Y near the bottom of the hopper. An outlet tube Z in the bottom of the hopper has its upper end opening to the chamber Y above powder ports Q. The air stream passing through the chamber Y into the tube Z entrains powder entering the chamber Y through ports Q, and the powder-laden air then flows through the conduit L and the valve tube 8 thereof to the blowpipe B. The dispenser itself is fully disclosed and claimed in Patent 2,327,337.

The blowpipe B is mounted on a carriage C which travels on a track T so as to move the blowpipe across the top of a metal bar W, as the blowpipe nozzle 11 discharges a stream of cutting oxygen and an oxy-acetylene flame. Such stream of cutting oxygen thermochemically severs the bar W. The thermochemical reaction is materially assisted especially at the start by the magnetic powder, which burns readily in oxygen, and the oxy-acetylene preheating flame. Oxygen is supplied to the blowpipe through a hose O, and acetylene through a hose F. The blowpipe B is provided with a cutting oxygen valve 14 and preheating oxygen and acetylene valves 15 and 16.

The tube 8 is a part of a novel magnetic powder control or shutoff valve V. Such tube may be composed of non-ferrous, non-magnetic material such as brass, copper, glass, fiber or plastic. It is disposed in the gap 17 between pole pieces 18, 18, as shown in Fig. 3, of an otherwise closed magnetic circuit 20 of an electromagnet E including a coil 22. Thus, when the coil 22 is energized with direct current, the resulting magnetic lines of force polarize or magnetize powder particles suspended in the air flowing through the tube 8 and such particles are attracted or repelled by the

pole pieces 18 and cling to the inside surface of the tube 8. A powder dam is formed by the magnetic field which effectively stops or restricts the flow of powder and air through the tube 8.

The entire valve V is enclosed in a non-magnetic housing 24 which serves two purposes, i. e., the housing seals the unit against entrance of dust and preserves a minimum air gap 26 between the iron core 20 and any external iron or steel, thus insuring that practically all magnetic lines of force will flow across the powder tube 8. The coil 22 is electrically connected to a source DC in Fig. 1 of direct current by a suitable circuit 25 including a switch S and a rheostat R. The latter may be adjusted to regulate the rate of flow of powder through the tube 8 when the switch S is closed. Normally, however, when the switch S is closed, the powder flow ceases; and, when the switch is opened, the powder flow starts and continues until the switch is again closed.

The coil 22 of Fig. 3 is wound between disks 27 on a cylinder 28 of insulating material which fits an iron core 30 having axial projections 32. The projections 32 fit and extend through holes 34 in iron yokes 36 to the top of which the iron pole pieces 18 are secured by screws 38. The pole pieces 18 extend toward each other and are separated by the powder tube 8 which fits therebetween. These parts are secured in such position by upper and lower plates 40 composed of non-magnetic material and screws 42. Openings 44 are provided in the pole pieces 18. Insulated conductors 46 and 48 of the direct current circuit 25 leading to the terminals of the coil 22, extend through one of such openings and a terminal bushing 50 mounted on the housing 24.

Side covers 52 and a bottom cover 54 of non-magnetic material are secured to the yokes 36 by screws 56, and the space around the coil within the resulting box 58 is filled with suitable cement 60. The box 58 is supported within the housing 24 by the projections 32 of the core 30, the projections filling and extending through holes 62 in end covers 64 of the housing 24. Nuts 66 and 68 are threaded on the projections and, with washers 70, secure the parts together.

Referring to Fig. 4, an upper magnetic powder valve V1 is fixedly mounted on a panel 72 above a lower magnetic powder valve V2 which is mounted on the panel for vertical adjustment. The valves V1 and V2 may be similar to the valve V. The tube 8, however, extends vertically through both valves, so that, when the valves are energized alternately, a measured charge of powder is delivered. The amount of powder in each charge is determined by the distance between the valves. Such distance or the volume of the charge is indicated by a vertical scale 74 mounted on the panel adjacent a pointer 76 which is, in turn, mounted on the lower valve V2. The panel 72 contains vertical slots 78 for bolts 80 which secure the lower valve V2 to the panel, so that vertical adjustment of the valve V2 is possible.

What is claimed is:

1. In a magnetic powder feed system, a conduit, gas under pressure urging magnetic powder to flow in a stream of gas through the conduit, and magnetic field producing means operatively associated with said conduit for controlling the quantity of powder flowing in such stream comprising adjustable means for varying the effective strength of such field with respect to such stream to control the quantity of powder fed through such conduit.

2. In a powder feed system comprising a conduit, a source of magnetic powder connected to said conduit, and a source of fluid under substantially constant pressure connected to said source of powder and normally acting to cause a stream of fluid and powder to flow through said conduit, a non-magnetic tube in said conduit, and magnetic field producing means acting to polarize powder in said tube so as to control the quantity of powder flowing therethrough.

3. Means for controlling the flow of magnetic powder in a conduit containing a fluid under pressure normally urging such powder to flow through the conduit, comprising an electro-magnet disposed adjacent the conduit for producing a magnetic field for regulating such flow of powder, and means for adjusting the strength of such field to control the amount of powder leaving the conduit.

4. A magnetic powder valve including an electro-magnet having a magnetic circuit comprising a core, yokes connected to said core and pole pieces connected to said yokes, said pole pieces being spaced to provide a gap, non-magnetic means for conducting powder through said gap so that the flow of powder is controlled by the magnetic field between said pole pieces, a coil mounted on said core between said yokes, means including said pole pieces and yokes providing a container for said coil, and cement filling the space within said container about said coil.

5. A magnetic valve as defined by claim 4 which also includes a housing of non-magnetic material within which the electro-magnet is supported so as to provide space on all sides between the electro-magnet and the housing, and means including projections of said core for supporting the electro-magnet within the housing.

6. In combination a powder tube of electrically non-conducting material and magnetic means for polarizing powder in said tube by magnetic fields traversing the tube at longitudinally spaced areas for stopping and starting the flow of magnetic powder in said tube.

7. Powder feeding apparatus comprising, in combination, powder supply means constructed and arranged to entrain and suspend material containing magnetizable particles in a flowing stream of fluid under pressure; a non-magnetic conduit for such particle-laden fluid stream, said conduit communicating with said means; and magnetic field producing means operable to subject said particle-laden stream to the force of a magnetic field for the purpose of regulating the amount of powder leaving the conduit.

8. A method of feeding powdered magnetizable material which comprises entraining and suspending magnetizable powder particles in a confined flowing stream of fluid under pressure, and controlling the rate of flow of said particles by subjecting such particle-laden stream to the force of a magnetic field of sufficient strength to retard the flow of powder and fluid.

9. The method of controlling the flow of powder which is responsive to a magnetic field, which comprises conducting such powder through a conduit of non-magnetic material, and establishing a magnetic field across said conduit of sufficient strength to retard the rate of flow of such powder.

10. The method of controlling the flow of powder fed from a source of supply to point of consumption, which comprises forcing iron powder through a non-magnetic conduit by a stream of gas of sufficient velocity and under sufficient pressure to convey the powder through such conduit, and traversing such conduit with a magnetic field

of sufficient intensity to control the quantity of iron powder forced through the conduit by such gas stream.

11. The method of valving iron powder laden gas, which comprises conducting the powder laden gas through a conduit and retarding the flow of iron powder in such conduit with a magnetic field which can be turned on and off to effectively open or close the conduit as desired.

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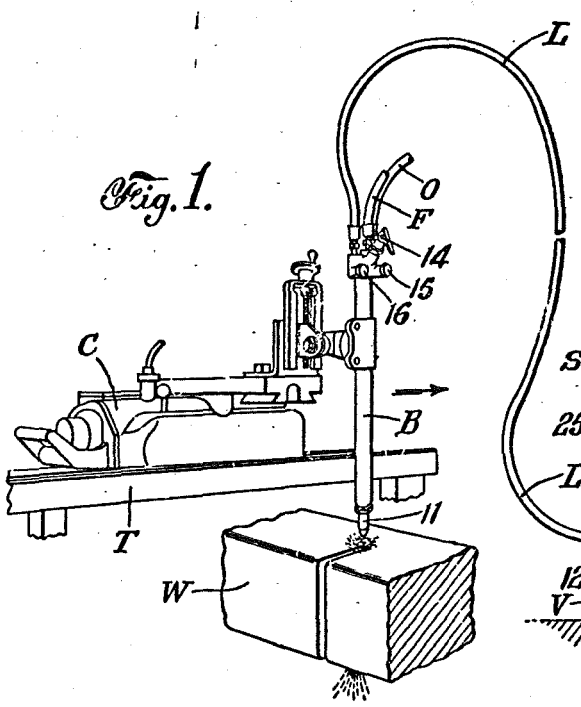
Fig. 1.



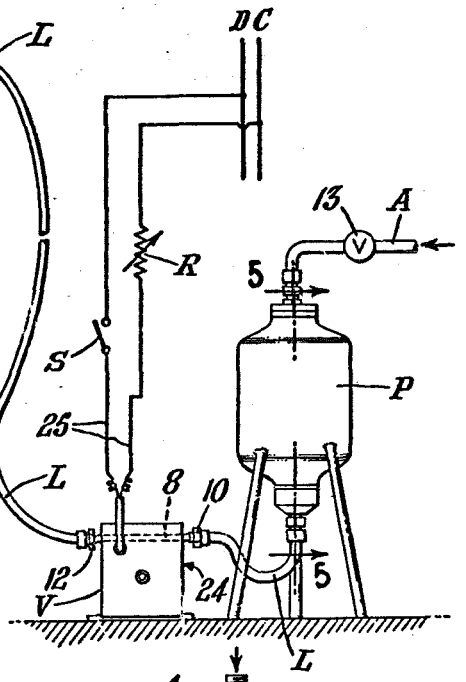
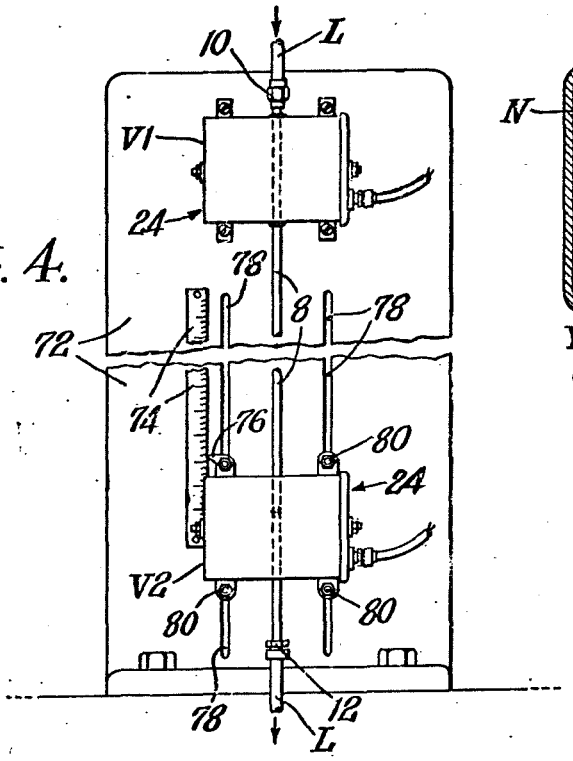


Fig. 4.



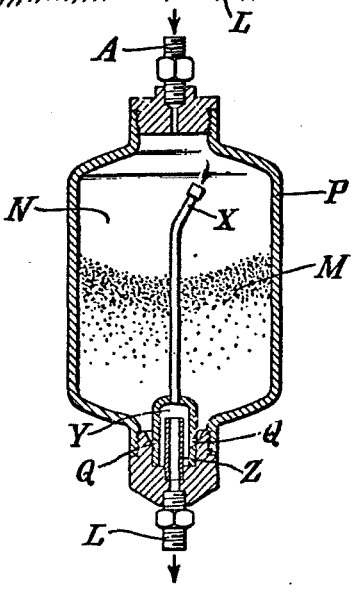


Fig. 5.

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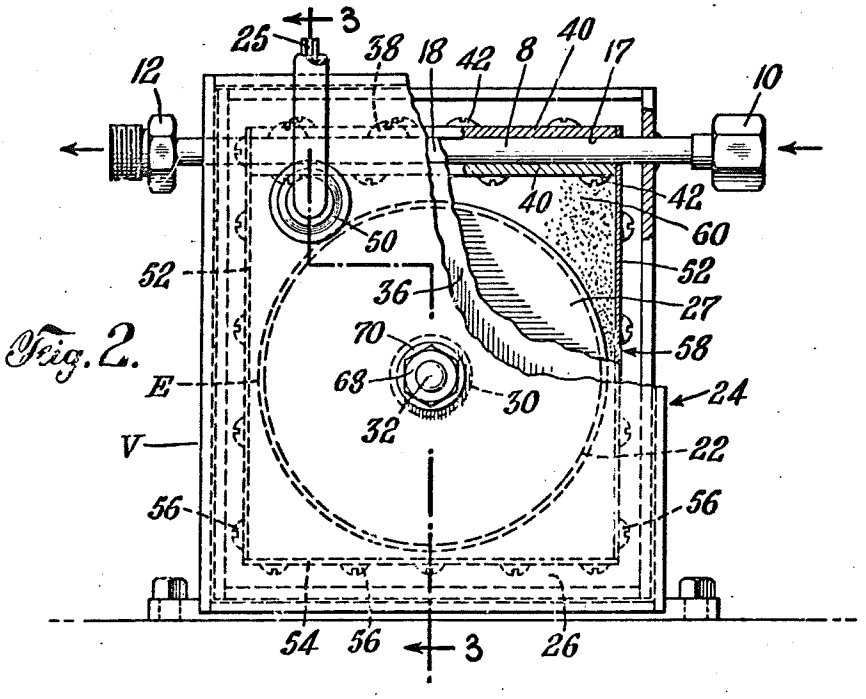

Fig. 2.

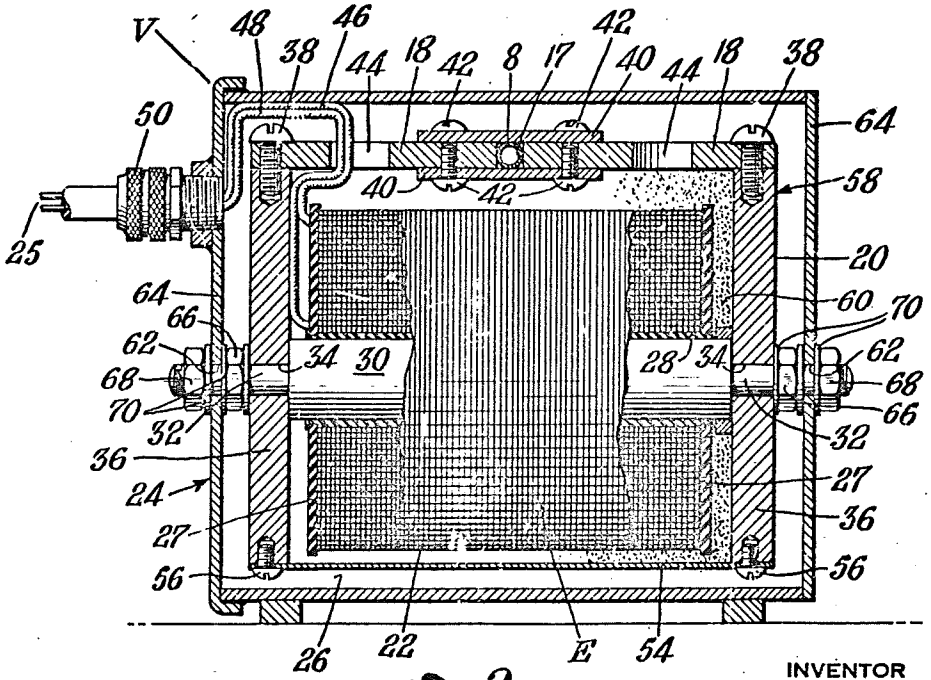

Fig. 3.

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