May 19, 1953 H. A. GOLWYNNE 2,639,006

APPARATUS FOR COLLECTING AND DISCHARGING METAL POWDERS

Filed Sept. 29, 1949

Fig. 1.

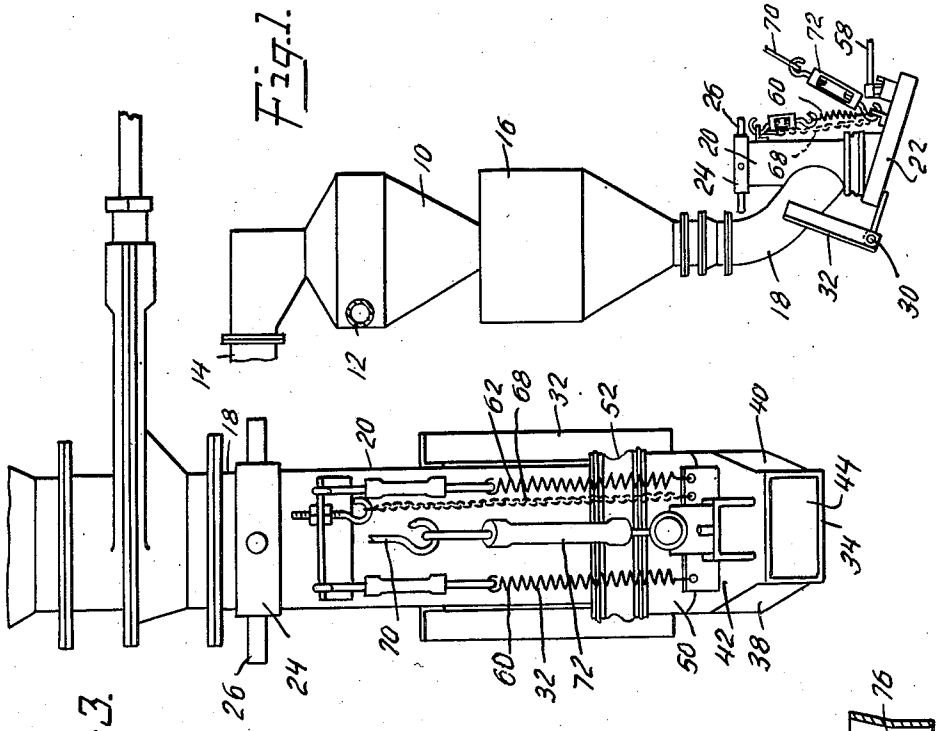

Fig. 3.

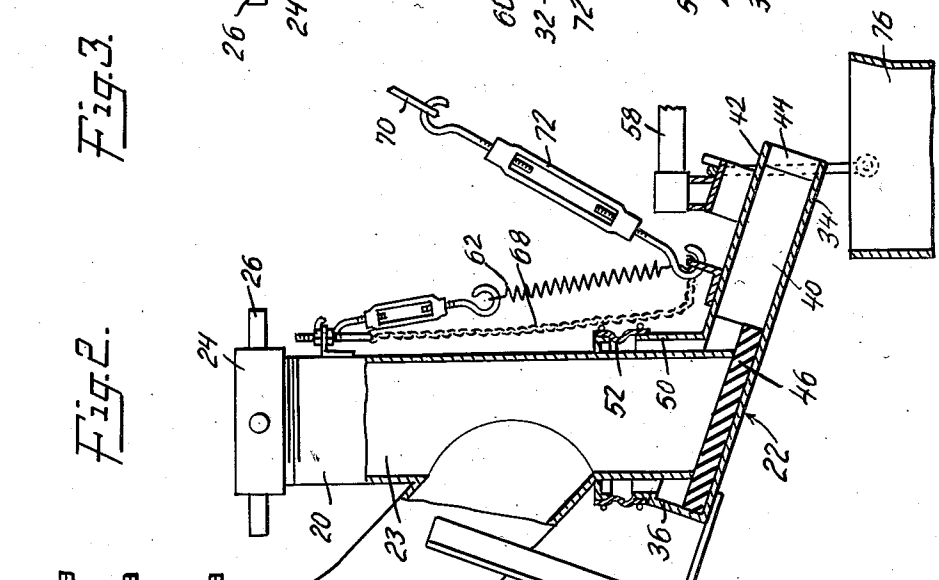

Fig. 2.

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APPARATUS FOR COLLECTING AND DISCHARGING METAL POWDERS

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9 Claims. (Cl. 183—85)

1

This invention relates to the production of metal powders and has for its object more particularly certain improvements in apparatus for collecting and discharging metal powders.

Certain metal powders tend easily to combine with oxygen even at comparatively low temperatures, sometimes to the extent of being subject to spontaneous combustion. This is true particularly of such metals as magnesium and of some finely divided non-metal particles. The production of metal powders such as magnesium is a definite hazard. Innumerable fires and explosions have occurred, often doing a great deal of damage. Workmen are often reluctant to work in metal powder producing plants and particularly in those sections of a plant where such fires and explosions are most apt to occur.

One of those sections is the place where the magnesium powder, for example, is collected and discharged into other containers. In the production of such powder by atomizing a fine stream of molten magnesium in an inert or non-reactive atmosphere, the powder-gas is subjected to a separation step resulting in the deposition of the powder. Such a procedure is disclosed in my copending applications, Serial Nos. 118,621 and 118,622, filed September 29, 1949, simultaneously herewith. The magnesium powder is generally permitted to accumulate at the bottom of the separator or a collector associated therewith, from which the powder is gradually withdrawn; but not in amounts sufficient to permit air to seep into the separator or collector. In other words, enough powder is retained at and above the discharge outlet to act as a seal against ingress of air. In spite of this precaution, however, magnesium powder flowing from the outlet sometimes catches on fire. This scares the operator, who is then apt to jump back or even run away. As he does so he lets go of the closure member at the outlet, thus exposing more powder to the fire which can promptly reach explosive proportions. Air also seeps into the collector and separator, thus converting the inert or non-reactive atmosphere of the system into a highly reactive one.

My investigations have led to the discovery that certain improvements in apparatus for collecting and discharging such finely divided materials make it possible to conduct the operation in comparative safety. Even if a fire should occure at the discharge outlet, the improvements are such that the apparatus may be readily operated to close itself, even to close itself automatically, and thus to prevent further amounts

2

of the powder from coming into contact with the fire and air and thereby to prevent the fire from spreading.

In accordance with the invention, the apparatus for collecting and discharging finely divided material, such as metal powder, includes a discharge conduit for the material communicating with a collector; a relief chamber connects the discharge conduit near its outlet; a closure member is provided at the outlet to open and close the same, the closure member being adapted to force adjacent material at the outlet into the relief chamber instead of back into the conduit and collector to facilitate closing of the discharge outlet. The closure member is preferably provided with self-closing means to cause it to move to its closed position automatically when not in use.

In a present practice the closure member is hinged to a fixed support so that the closure member may be raised and lowered angularly to close and open the discharge outlet. The hinged closure member is advantageously in the form of a chute to facilitate discharge of the powder into a container.

If an operator moves the closure member manually to its open position to discharge some of the collected magnesium powder, for example, and a fire should suddenly occur, he may promptly move the closure member back into its closed position. To facilitate this closing movement, magnesium powder directly adjacent or above the closure member is easily pushed into the relief chamber. In the absence of the relief chamber, enough pressure would have to be applied to the closure member to push not only that portion of the magnesium powder but all of the other powder behind it backwardly in the conduit and collector. This would only add to the operator's difficulties, because the closure member might not completely reach its closed position. A substantial amount of the magnesium powder would then remain exposed to the air and therefore subject to burning or combustion. The use of the relief chamber, however, greatly facilitates closing of the closure member since very little pressure or force is required to shove that portion of the metal powder into the chamber.

On the other hand, if the closure member is provided with the self-closing means, the operator may, as he sometimes does, instinctively let go of the closure member in his fright, the closure member nevertheless closes automatically without any intervention on his part.

These and other features of the invention will be better understood by referring to the accompanying drawing, taken in conjunction with the following description, in which:

Fig. 1 is a diagrammatic side elevation of an apparatus illustrative of a practice of the invention;

Fig. 2 is an enlarged similar view, partly in section, of the lower end of the apparatus; and

Fig. 3 is a front elevation of the same.

Referring first to Fig. 1, the apparatus shown is in the form of a combination powder-gas separator and collector, being specifically a conventional cyclone 10, with an inlet 12 for powder-gas and an outlet 14 for gas, and a hopper 16 integrally secured to and depending from the cyclone. The lower end of the hopper terminates in a laterally extending discharge conduit 18. The lower end of the discharge conduit enters the side of the container 20 at a substantial distance below the top thereof. The upper portion of the container 20 forms an upright relief chamber 23 while the lower portion thereof forms a continuation of the discharge conduit. The bottom of the container 20 is open or is provided with an opening to form an outlet for material discharged from the hopper 16 through the discharge conduit. A closure member 22 is pivotally supported and swings upwardly against the finely-divided material being discharged to close the outlet.

Referring next to Fig. 2, it will be seen that relief chamber 23 provides a substantial amount of free space which extends a suitable distance above the place where the discharge conduit enters the container 20. The top of the container is fitted with a screw cap 24 provided with a plurality of circumferentially spaced handles 26.

In the specific construction shown the discharge outlet is at a convenient angle to cooperate with closure member 22, which is in the form of an enclosed chute pivotally or hingedly connected at 30 to a fixed support 32. The chute has a bottom 34, back 36, side walls 38 and 40, a top 42 and a discharge opening 44. A piece of resilient gasket material 46, such as rubber, is integrally secured to the bottom of the chute so that it may be brought into sealing contact with the discharge outlet.

The container 20 is in the form of a pipe welded at its side to the main part of the discharge conduit, the upper end of the pipe being an extension which forms the relief chamber. The chute is integrally secured at its top 42 to an outer collar 50 fitting loosely around the lower end of the container or pipe 20. The upper end of the collar is integrally secured to the lower end of a flexible sleeve 52 fitting loosely around the lower portion of the container or pipe 20. This sleeve may be of rubber and is adapted to act like a bellows. The upper end of the flexible sleeve is in turn integrally secured to the container or pipe 20. When the chute is moved upwardly and downwardly, the flexible sleeve yields sufficiently to permit the discharge outlet to be closed and opened.

A handle 58 is secured to the top of the chute at its discharge end so that the operator may readily lower the chute to open the discharge outlet and raise the chute to close the outlet. This is a manual operation which may remain wholly in control of the operator.

If the operator, however, should instinctively let go of the handle in case of fire, or for any other reason, or should leave the scene, self-closing means associated with the chute at once take care of such a contingency. The particular self-closing means disclosed include a pair of spring tensioning devices 60 and 62 secured at their lower ends to the chute and at their upper ends to a fixed support, in the instant construction at the upper portion of the container 20. A turn-buckle is attached to each spring so that the springs may be placed under the proper amount of tension. When downward pressure is applied to the chute, such as by bearing down on handle 58, the springs yield sufficiently to permit the chute to drop away angularly from the discharge outlet. To make certain that the chute is not lowered unduly, for example, by the operator when excited, a chain 68 of predetermined length is fastened at its lower end to the chute and at its upper end to a fixed support. The chain fixes and limits the amount of drop for the chute. As a further precaution, a holding device 70 with a turn-buckle 72 is hooked at its lower end to the chute and at its upper end to a fixed support (not shown). When the chute is in its closed position, the turn-buckle is tightened. Pressure on handle 58 will, therefore, not open the chute. This feature is particularly desirable if children or non-trained operators have access to the apparatus.

When, therefore, it is desired to discharge magnesium powder from the apparatus, the operator must deliberately loosen turn-buckle 72 in order to release holding device 70. He then applies downward pressure on handle 58, which causes chute 22 to move or open downwardly. Magnesium metal powder then moves by gravity from hopper 16 through conduit 18 and the discharge outlet into the chute, and downwardly through the chute out of its discharge opening 44 into a receptacle 76.

If all goes well the handle is kept down until the desired amount of powder runs into the receptacle. The handle is then lifted by the operator to close the discharge outlet and the holding device is again replaced. With the self-closing means in use, however, the operator need merely release the handle and spring-tensioning devices 60 and 62 will lift the chute into its closed position. As already indicated this feature is particularly desirable in case of fire and the operator should let go of the handle or leave the scene in fright. In case of fire this is precisely what he should do for safety.

It will be clear to those skilled in this art that the particular apparatus described is only by way of illustration and that various useful modifications may be employed in the practice of the invention. In the case of the self-closing means for the closure member, for example, it is obvious that other types of means may be used to effect the same purpose. One or more counterweights, one or more compression springs, etc., could be substituted readily for the spring-tensioning devices. Other closure members, other collecting and discharging devices could be used. The invention disclosed solves some problems that have greatly troubled those working in this dangerous art.

I claim:

1. In an apparatus for collecting and discharging finely-divided material subject to spontaneous combustion, the improvement comprising a separator for separating the finely-divided material, a hopper for the separated finely-divided material so connected to the separator as to receive finely-divided material therefrom, a container closed at its upper end, a discharge conduit

connected to the hopper for the discharge of finely-divided material therefrom, said discharge conduit having its lower portion connected to said container a substantial distance below the closed end thereof for the feeding of material discharged from the hopper laterally into said container, the upper portion of said container forming a relief chamber and the lower portion thereof forming a continuation of the discharge conduit, the bottom of the chamber having an opening forming an outlet for material discharged from the hopper through said discharge conduit, and a closure member for said outlet, the closure member being so mounted that on moving to its closed position it moves in an upward direction against the finely-divided material being discharged from the outlet, whereby the lifting effect exerted on the finely-divided material by the closure member when moving to its closed position will force finely-divided material adjacent the outlet upwardly into said relief chamber rather than backwardly through the discharge conduit towards the hopper.

2. In apparatus for collecting and discharging finely-divided material as set forth in claim 1, the further improvement in which the closure member is provided with self-closing means to cause it to move to its closed position when not in use.

3. In apparatus for collecting and discharging finely-divided material as set forth in claim 1, the further improvement in which the closure member is in the form of a hinged chute.

4. In apparatus for collecting and discharging finely-divided material as set forth in claim 3, the further improvement in which the chute has an outer collar at its top fitting longitudinally around the lower end of the container, the upper end of the collar is secured to the lower end of a flexible sleeve loosely surrounding the container, and the upper end of the flexible sleeve is secured to the container, so that when the chute is moved upwardly and downwardly the flexible sleeve yields sufficiently to permit the discharge outlet to be closed and opened.

5. In apparatus for collecting and discharging finely-divided material as set forth in claim 4, the further improvement in which the closure member is provided with self-closing means to cause it to move to its closed position automatically when not in use.

6. In apparatus for collecting and discharging finely-divided material as set forth in claim 5, the further improvement in which the means for closing the discharge outlet when the chute is not in use includes a spring-tensioning device secured at its lower end to the chute and at its upper end to a fixed support.

7. Apparatus for discharging material subject to spontaneous combustion which comprises a container closed at its upper end, a discharge conduit for discharged material, said discharge conduit having its lower portion connected to said container a substantial distance below the closed end thereof for feeding discharged material laterally into said container, the upper portion of said container forming a relief chamber and the lower portion thereof forming a continuation of the discharge conduit, the bottom of the chamber having an opening forming an outlet for material discharged through said discharge conduit, and a closure member for said outlet, the closure member being so mounted that on moving to its closed position it moves in an upward direction against the material being discharged from said outlet.

8. Apparatus for receiving and discharging material as set forth in claim 7 in which the closure member is in the form of a hinged chute.

9. Apparatus for receiving and discharging material as set forth in claim 8 in which the chute has an outer collar at its top fitting longitudinally around the lower end of the container, the upper end of the collar is secured to the lower end of a flexible sleeve loosely surrounding the container, and the upper end of the flexible sleeve is secured to the container, so that when the chute is moved upwardly and downwardly the flexible sleeve yields sufficiently to permit the discharge outlet to be closed and opened.

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