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FEEDING OF POWDER OR OTHER FLUENT MATERIALS OF SUBSTANTIALLY EQUAL QUANTITIES

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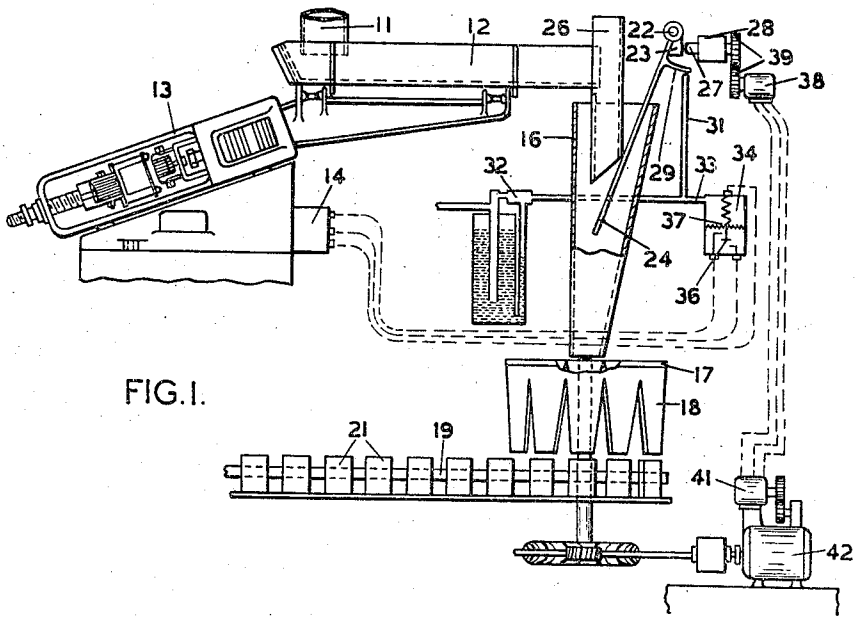


FIG. 1.

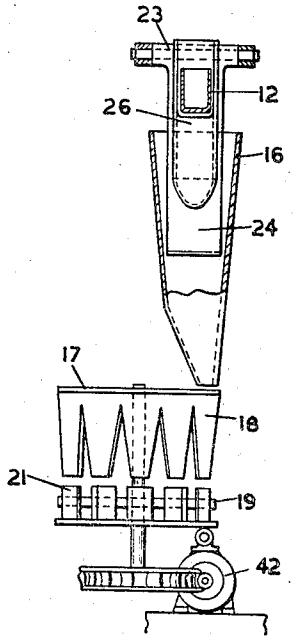


FIG. 2.

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FEEDING OF POWDER OR OTHER FLUENT MATERIALS OF SUBSTANTIALLY EQUAL QUANTITIES

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5 Claims. (Cl. 141—132)

This invention relates to the feeding of powder or other fluent material such as, for example, granulated, flaky or other comminuted materials, in substantially equal quantities. Such materials will be referred to herein simply as "powder." The invention is particularly concerned with the feeding of powder in a continuous substantially uniform stream towards a series of delivery funnels which are moved in succession through the stream in such a manner that each receives the stream for substantially the same pre-determined period, the powder then passing from each funnel into a container movable in register with each funnel while it passes through the stream. Provided that the stream of powder flows at a substantially constant rate, therefore, each container receives substantially the same pre-determined quantity of powder by volume.

It is sometimes found, however, that whilst the quantities received by the successive containers are substantially equal by volume, the weight of the volume changes from time to time for a variety of reasons depending to some extent on the kind of powder being fed. Thus, powder of a given kind may vary in density by reason of atmospheric changes or by variation in the size of the individual particles making up the powder; or again by the degree of aeration given to the powder by turbulence during the feeding operation.

An object of the invention is to vary the rate of flow of the stream of powder in accordance with variation in the density of the powder so that the quantities received by the containers will be substantially equal in weight.

According to the present invention, powder is continuously fed in a stream at a pre-determined rate towards the containers, the stream being arranged to impinge on a vane carried by a pivoted arm so as to cause that arm to tend to rotate about its pivot, the arm being yieldably pre-loaded against such rotation by an amount sufficient substantially to balance the load applied to the vane by the pre-determined rate of flow of the powder, and means responsive to any sensible movement of the pivoted arm from its normal position of balance are provided for varying the rate of flow of the stream to restore the balance.

The stream of powder is conveniently produced by an electro-magnetic vibrating feed device of known kind, the speed of operation of the device (and thus the rate of flow of the powder) being controlled by an electrical control unit. With such construction, the means for varying the rate of flow may consist of an air-operated two way switch wired in the circuit of the control unit, the switch being under the control of an air-controller of the "Solex" type having an air jet impinging on an arcuate surface mounted on the vane-carrying arm, the surface being disposed eccentrically with respect to the pivotal axis of the arm so that pivotal movement of the arm varies the gap between the jet and the surface, thus producing the differential pressure for operating the switch.

The stream of powder conveniently falls down a chute

the discharge end of which is arranged above the path of movement of a series of delivery funnels carried by a rotatable drum, the discharge outlets from the delivery funnels, in turn being arranged above the path of movement of a series of cartons carried by a conveyor so arranged that each carton moves into register with a funnel before that funnel passes the chute.

To provide for variation in the speed of operation of the apparatus while maintaining the same quantity of powder in the cartons, means may be provided for automatically varying the amount of pre-loading of the vane-carrying arm in proportion to the variation in speed of the apparatus, so as to maintain the normal balance of the arm in spite of variation in the rate of flow of powder necessary for different speeds of operation of the apparatus.

By way of example, the invention will now be described in greater detail with reference to the accompanying drawings, as applied to an apparatus for packaging powder in cartons.

In the drawings:

Figure 1 represents diagrammatically such an apparatus, and

Figure 2 is an end view of the apparatus.

In general, powder is fed from a main feed pipe **11** into a tray **12** of channel section which is vibrated by an electro-magnetic vibratory feed device **13** of known construction, the rate of operation of the device being variable by an electrical control unit **14**. The tray **12** discharges a stream of powder into a chute **16** arranged above a rotatable carrier member **17** on the periphery of which is arranged a series of continuous discharge funnels **18** the upper edges of which are sufficiently sharp to avoid powder accumulating on the edges. The chute **16** is so arranged that each discharge funnel **18** passes in turn below the outlet of the chute.

Below the carrier member **17** is arranged a chain conveyor **19** carrying a spaced succession of cartons **21**, the conveyor **19** guiding the successive cartons **21** into register with successive funnels **18** and maintaining them in such registration over about 180° of the movement of the carrier member **17**. In this manner, each carton **21** receives the stream for substantially the same pre-determined period, and assuming uniformity of flow, therefore, each carton receives substantially the same pre-determined quantity of powder by volume.

Freely pivoted at **22** in anti-friction bearings is an arm **23** carrying a vane **24** passing into the chute **16** and extending transversely into the path of movement of the stream. The channel **12** discharges into a tube **26** of smaller diameter than the width of the vane **24**, and the adjacent edge of the tube **26** acts as a limit stop for the vane **24**, the latter being yieldably urged towards the stop by a plunger **27** slidably mounted in a housing **28** and urged into contact with the arm **23** by a spring contained within the housing **28**. The spring pre-loads the vane **24** against pivotal movement under the influence of the stream, the amount of pre-loading being sufficient substantially to balance the load applied to the vane **24** by the pre-determined rate of flow of the powder.

The arm **23** is provided with a curved surface **29** eccentric to the pivot **22**, and there is arranged adjacent the surface **29** a nozzle **31** from which an air jet is arranged to impinge on the surface. The nozzle **31** is provided with compressed air at a normally constant pressure by an air-controller **32** of the type well known under the name "Solex," air at the same pressure passing through a branch **33** to a chamber **34** housing a two-way control switch **36** operable by a spring loaded diaphragm **37**, the switch being connected in the circuit of the control unit **14**.

It will thus be seen that pivotal movement of the arm

23 causes a variation in the gap between the nozzle 31 and the surface 29 thus causing a variation in the pressure of the air entering the chamber 34, with the result that the switch is actuated by the diaphragm one way or the other to operate the control unit 14 to vary the rate of operation of the vibratory device 13.

With the vane arm 24 pre-loaded to suit the rate of flow of powder necessary to provide a given quantity in the cartons 21, therefore, it will be seen that any sensible change in the density of the powder will cause pivotal movement of the vane 24 in one direction or the other according as the powder is heavier or lighter than normal, such movement of the vane 24 varying the air gap mentioned above to operate the switch 34 one way or the other to decrease or increase the rate of feed of the powder by the feed device 13 as the case may be. In this manner, variation in the weight of the powder fed to successive cartons 21 can be maintained between tolerable limits.

To provide for variation in the speed of operation of the apparatus while maintaining the same quantity of powder in the cartons, the amount of pre-loading of the arm 23 is automatically varied in proportion to the variation in speed of the apparatus. This is brought about in the present example by the provision of a pilot motor 38 connected by gearing 39 to a screw device within the housing 28 for increasing or decreasing the tension on the spring urging the plunger 27 into engagement with the arm 23. The motor 38 is identical with and connected in the circuit of the pilot motor 41 operating a variable speed main motor 42 for driving the apparatus. Any change in the desired speed of operation of the apparatus, therefore, immediately produces a corresponding change in the pre-loading of the vane 24 so as to maintain the normal balance of the vane in spite of the necessary change in the rate of flow of the powder.

I claim:

1. Packaging apparatus for feeding successive predetermined quantities of powder to successive containers in which the powder is fed in a continuous stream at a controlled rate towards a delivery station through which the containers pass in succession, said apparatus comprising a vane carried by a pivoted arm and so arranged that the stream will impinge on the vane so as to cause that arm to tend to rotate about its pivot, means for yieldably pre-loading the arm against such rotation by an amount sufficient substantially to balance the load applied to the vane by the predetermined rate of flow of the powder, means responsive to any sensible movement of the pivoted arm from its normal position of balance for varying the rate of flow of the stream to restore the balance, forwarding means for moving the containers through the stream, and means responsive to variation in the speed of the forwarding means for varying the pre-loading of the vane-carrying arm in the direction and in the amount so that the quantity of powder fed to the successive containers is substantially constant.

2. Packaging apparatus for feeding successive predetermined quantities of powder to successive containers in which the powder is fed in a continuous stream at a controlled rate towards a delivery station through which the containers pass in succession, said apparatus comprising an electro-magnetic vibratory feed device provided with control means for varying its rate of operation, a vane carried by a pivoted arm and so arranged that the stream will impinge on the vane so as to cause that arm to tend to rotate about its pivot, means for yieldably pre-loading the arm against such rotation by an amount sufficient substantially to balance the load applied to the vane by the pre-determined rate of flow of the powder, means responsive to any sensible movement of the pivoted arm from its normal position of balance for operating the control means to vary the rate of operation of the feed device, and thus the rate of flow of the stream, to restore the balance, forwarding means for moving the containers through the stream, and means responsive to variation in the speed of the forwarding means for varying the pre-loading of the vane-carrying arm in the direction and in the amount so that the quantity of powder fed to the successive containers is substantially constant.

3. Apparatus as in claim 2, comprising an air-operated two way switch wired in the circuit of the control means, an arcuate surface disposed on the pivoted arm eccentrically with respect to its pivotal axis, a nozzle disposed adjacent said surface and adapted to cause a jet of compressed air to impinge on the surface, an air connection between the nozzle and the switch, pivotal movement of the arm thus varying the gap between the nozzle and the surface to vary the pressure of the air communicated to the switch.

4. Apparatus as in claim 1, comprising a chute into which the stream is directed, a series of delivery funnels carried by a rotatable drum, the discharge outlet of the chute being arranged above the path of movement of the delivery funnels, and a conveyor adapted to forward a series of cartons in such a manner that each carton moves into register with a funnel before that funnel passes the chute.

5. Packaging apparatus for feeding successive predetermined quantities of powder to successive containers in which the powder is fed in a continuous stream at a controlled rate towards a delivery station through which the containers pass in succession, said apparatus comprising a vane carried by a pivoted arm and so arranged that the stream will impinge on the vane so as to cause that arm to tend to rotate about its pivot, means for yieldably pre-loading that arm against such rotation by an amount sufficient substantially to balance the load applied to the vane by the predetermined rate of flow of the powder, means responsive to any sensible movement of the pivoted arm from its normal position of balance for varying the rate of flow of the stream to restore the balance, forwarding means for moving the containers through the stream, spring means responsive to variation in the speed of the forwarding means for varying the pre-loading of the vane-carrying arm, a screw device for varying the tension in the spring means, a pilot motor connected by gearing to the screw device, an identical motor wired in the circuit of the pilot motor and adapted to operate a vairable speed main motor for driving the machine.

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