

Translation :

Technical field

The invention relates to a method for the bagging of pre-determined bulk material fill weights into transport containers, more particularly bags, also to a bulk material bagging apparatus having a weigher and a control apparatus, which discharges predetermined bulk material contents quantities from a weighing receptacle into transport containers.

State of the art

Besides conventional transport containers, specialised filling and packaging apparatus for consumer containers are known in the so-called packaging industry. In such cases usually contents quantities of a few hundred grams, at the most a few kg, are produced. 5 - 10 kg weights are usually found to be the top limit. The size is suitable for easy handling for sales purposes and consumers, respectively from the selling shop or store to the final consumer, for example in the kitchen. Transport containers are used mainly for transporting from a processing works to the next in succession, in the classic case from a mill to a baker. The weight of transport containers, mostly adapted to male workers, is between 20 and 100 kg.

In actual practice three automation stages can be distinguished for the filling of transport bags, corresponding to the specific requirements :

- automatic batch preparation
 - suspending and closing the bag by hand
- automatic batch preparation
 - suspending the bags by hand
 - fully automatic closing of the bags

- automatic batch preparation

fully automatic bag suspending and bag closing.

It will be seen from this that in every case batch preparation is the basis for all the automation stages. The central problem resides in forming and precisely weighing bulk material batches in a small time span. One and the same bulk material can behave differently depending on whether the material during transport was able to mix with air and has acquired a more or less liquid-like behaviour, or whether troubles arise from extreme conditions such as heat or cold of machine parts also, and adhesion forces resulting therefrom between bulk material and wall parts.

As compared with the dimensions of storage bin installations, bag contents represent small portions or batches. Yet large dimensions are involved for filling apparatus, for example in intermediate stores. Assuming room heights of 3 to 4 m, the bagging apparatus require 1 - 2 storeys.

After the bulk material weigher generally a weigher pouring hopper is used, so that the full weigher contents upstream of the bag is collected in an intermediate storage means, which also requires height.

As against the practice of the past two decades of replacing bags by tank and large-vessel transport, there is now again a reverse tendency towards small transport containers, in other words the bag. In many countries trade associations require a reduction of bag weight from for example 50 kg to 25 kg which, given the same output tonnage, involves doubling the number of bags. Therefore, there is an increasing demand for bagging stations with a very high item number output. For especially fine industrial products such as cement, lime, synthetic plastic materials etc., so-called valve bags are most widely used. The product is introduced through a suitably small valve aperture of the bag via a beak-like filling nozzle. After

the attainment of the desired weight the bag aperture can be closed at once by prepared paper folds.

The huge advantage is that the product mixes with air to only a slight extent. The main disadvantage of this system lies in the limited adaptability. Grain, semolina, flour, bran and animal feedstuffs etc. have of course greatly varying bulk weights, so that with differing products different weights have to be bagged in the same bag size.

In the case of classic flour bags a small amount of empty space in the filled closed paper or plastic bag does not cause trouble, on the other hand, since the bag is tightly closed after the filling operation, either with a sewing machine or by means of glue.

The bag is suitable for simple transport of individual-items goods over relatively long distances, and is a convenient unit for optimum handling on site in many respects. Depending on the particular material concerned, special criteria stand out such as questions of hygiene, and dust-free tightly packed bag filling. In almost all cases the purchaser expects a precise fill weight for each individual bag. Only by a high degree of automation, however, is it possible to fill a large number of bags per hour to precise weights at advantageous costs. When using ^{usually} so-called net bagging weighers the laws ^{usually} require certain method rules to be observed through calibration regulations. For producing a predetermined contents quantity, the result is the following weighing procedure:

- 0-calibration of the weighing receptacle
- rough dosaging
- fine dosaging - standstill
- monitoring the contents quantity or desired weight
- possible correction of the rough flow and/or fine flow discontinuing point.

In the case of higher bagging outputs the 0-calibration and the monitoring of the contents quantity and, resulting therefrom, the correction of the fine flow discontinuing

point can only be carried out cyclically, that is to say, for example, at each 20th pouring operation. The following weighing parameters are to be taken into account :

- the impact pressure of the rough and fine flows
- the Doppler effect
- the after-flow of the rough and fine flows
- the differing height of fall with varying bag weights.

Over decades the so-called bagging weigher, most widely used in the form of the net bagging weigher, was developed for the special object in mind. In the bagging weigher itself the predetermined batch weight is prepared in precisely weighed manner, and is filled into the bag in the shortest possible time after the hanging of an empty bag on a bag nozzle. Several 100 to over 1,000 batches per hour are prepared in this way, and the product bagged in the corresponding numbers of bags. In many uses, nowadays substantially larger outputs are required, for example up to 2,000 batches per hour.

From EP 348 610 A2 a bagging plant is known which is suitable for the packaging of multi-substance mixtures, the individual components being weighed, dosaged and packaged. For the purpose, individual filling stations of the bagging plant are provided with combined discharge, weighing and transfer devices which deal with the individual components individually.

From EP 288 415 A2 a bagging apparatus is known for the gravimetric filling of bulk material quantities from a storage container via a rough dosaging system and a fine dosaging system.

In both known bagging apparatus (EP 348 610 A2 and EP 288 415 A2) the bulk material is filled into a separate weighing receptacle until the measured weight of bulk material in the receptacle corresponds exactly to a bag filling or contents. Then the entire receptacle contents are filled as one bag filling into a bag. During this time the discharge of the bulk material from the storage means into the weighing receptacle is stopped.

EP 348 077 A1 shows a bagging apparatus wherein the bulk material is filled directly into a bag and weighed there. Filling continues until the weight of the bulk material in the bag corresponds to the desired bag contents weight. Then the filling is stopped, the filled bag is unhooked, a new bag is suspended in place, and the complete operation is then repeated.

All the above bagging apparatus belong to the category of net bagging weighers, which have the disadvantages described hereinafter.

In the article "Gravimetric dosaging with band weigher or differential weigher" in the special-subject periodical "Wagen und Dosieren" No. 6, Nov. 1989, the manual "Handbuch des Wägens", Manfred Kochsiek, Friedr. Vieweg & Sohn, 1985, pp.335-339, and the firm's prospectuses "Continuous weighing and feeding equipment" F 9100 e and "Peser et doser en continu" F 9100 f of Messrs. Schenk, a differential dosaging weigher is described which discharges bulk material by means of a discharge device from a weighing receptacle. The discharge quantity is in accordance with the weight decrease in the bulk material quantity per unit of time in the weighing receptacle. This operation is known in the relevant literature under the term "differential dosaging weighing". The aim of such differential dosaging weighers is to produce continuously a predetermined bulk material quantity constant in time - a continuous bulk material flow. To produce this continuous flow the weighing receptacle must be re-loaded cyclically with bulk material. Since during the re-loading time no weight decrease of the bulk material in the weighing receptacle can be measured, the differential dosaging weigher switches to volumetric discharge. For this purpose the discharge device is continued by control means for a short time at the same speed as had been ascertained previously in the differential dosaging weighing operations.

WO 86 05875 shows an apparatus for the automatic monitoring of a continuous bulk material throughput by means of a continuous-flow weigher, comprising a weighing receptacle and an adjustable closure device for adjusting the outlet cross-section of the weighing receptacle. This apparatus monitors continuously the timewise varying quantity of bulk material flowing past or through.

Net bagging weighers empty the fill weight suddenly and at a very high rate. This gives rise to some serious problems. The bag inflates ^{considerably} owing to the air displacement caused by the filling, and loads the bag material additionally. Also, in the case of pulverulent products the bulk material takes up a considerable amount of air during the emptying, so that the venting of the bag nozzle represents a further known problem. The bag nozzle must also be chosen to be as large as possible for reasons of optimum venting and quick filling. To achieve high outputs a high degree of automation is a pre-requisite, and therefore an automatic bag attacher or suspending ^{device} is used. Large bag nozzles, however, prejudice considerably the functioning reliability of a mechanical bag suspending device. For products which can be reduced in their volume by compacting elements in order to reduce the size of the final pack or to economise in expensive bag material, the compacting time is prolonged because of the great fluidisation of the product, and reduces the bagging throughput.

A weigher pouring hopper is used to connect the weigher to the bagging nozzle. Sticking phenomena in this hopper have very negative influences on the one hand on the weight accuracy of the packing and on the other hand on hygiene. Especially in the case of products which have a strong tendency to stick, frequent cleaning especially of the pouring hopper is unavoidable.

One of the objects of the invention was to reduce the

overall height needed by receptacle technology and more particularly to keep potential disturbing influences on the path of movement of the bulk material as low as possible.

Representation of the invention

The invention has as its object more particularly to obviate the known disadvantages as far as possible, to shorten the packaging operation, that is to say to increase the output.

The invention achieves this object by the subject matters of claims 1 and 4.

According to claim 1 a method is provided for the bagging of predetermined fill weights from a weighing receptacle into transport containers, more particularly into bags, wherein the bulk material quantities discharged respectively from the weighing receptacle into the transport containers are gravimetrically ascertained via a differential weight decrease of the weighing receptacle (also referred to as differential weighing hereinafter), and the bulk material quantity discharge is controlled to the predetermined bulk material fill weight.

The terms differential weighing and differential dosaging weighing are to be clearly distinguished between hereinafter.

In differential weighing only the weight decrease of a starting weight present at an initial point in time is pursued. For the purpose the weighing receptacle is filled with an approximately known quantity of bulk material, and the weight of weighing receptacle with the bulk material is determined. Then bulk material is discharged from the weighing receptacle until the difference between on the one hand the instantaneously present weight of weighing

receptacle and bulk material and on the other hand the starting weight corresponds precisely to a predetermined bulk material fill weight. Here it is not important what weight amount is discharged within a specific period of time. Thus for example initially a very large bulk material quantity can be discharged within a short time. Then subsequently discharge is slower in proportion as the differential weight approaches to the given bulk material fill weight.

In differential dosaging weighing on the other hand, per unit of time a specific weight of bulk material is continuously discharged, for example 10 kg of bulk material per second.

However, a substantial amount of the disturbance effects are quite simply no longer present with the new invention, for example :

- no impact pressure of the rough and fine flows
- no Doppler effect
- no after-flow of the rough and fine flows
- no varying height of fall
- no weigher pouring hopper and corresponding dust zone
- no change nozzle

It has been possible to reduce the influence of a further group of sources of trouble drastically :

- only minimum fluidisation now occurs
- the outlay for the compacting of the bulk material in the bag and the need for bag shaking is minimised
- substantial reduction in size of the bag nozzle

The invention allows a large number of especially advantageous developments.

It is proposed that the filling batches are prepared ^{cyclically} by controlling the discharge from a differential bagging weigher via the ascertaining of the differential weight and filled directly into bags via a bagging nozzle.

For the purpose the differential weighing system has a differential weighing receptacle with bulk material feed and a controlled product discharge, also computer means which from weight values of the weighing system control both the bag filling and the weighing receptacle filling operation.

Preferably a refilling of the differential weigher receptacle takes place cyclically alternately after each or after a plurality of filling operations. In the differential weigher 1.5 to at most 5 times, preferably 1.5 to 3 times a batch of material is prepared, from which transport bags of 10 to 100 kg weight can be filled.

According to claim 4 a bulk material bagging apparatus with a weigher and a control apparatus is provided, which discharges predetermined bulk material contents quantities from a weighing receptacle into transport containers, the weigher being designed as a controlled differential weigher which monitors gravimetrically via a differential weight decrease of the weighing receptacle the bulk material quantities which are discharged respectively from the weighing receptacle into the transport containers, and controls the bulk material quantity discharge to the given bulk material fill weight.

Thus not only can the whole filling apparatus be of simpler, lower and more hygienic construction, but also a huge advance in automation is permitted, so that the object of doubling the bagging output without involving disadvantages is also achievable.

Many further forms of embodiment are possible with the apparatus according to the invention. Thus in a preferred constructional form the product discharge of the differential bagging weigher (1) opens directly into a flow filling nozzle of a bag suspending device. The

weighing operation can be improved by arranging a controllable closing device at the end of the discharge region of the differential bagging weigher.

For products which have an unfavourable flow behaviour it is proposed that the apparatus has an upright weigher receptacle, a discharge worm which is rotational speed controllable and has a substantially horizontally directed discharge from the weigher receptacle, and also a transfer piece from the weigher receptacle to the discharge worm and differential weighing elements, the discharge opening directly with the use of gravitational force into the bagging nozzle. Preferably the differential bagging weigher has both rough and fine dosaging, and the rough and fine discharges are constructed as controlled forcible discharge elements, preferably discharge worms. On the other hand for free-flowable products it is proposed that the product discharge apparatus is constructed as a dosaging arrangement with controllable dosaging slide valves.

In another quite especially preferred form of the invention the differential bagging weigher is associated with a bagging turntable and, with the turntable cycle, transfers the respectively given batches through a bagging nozzle or flow filling nozzle for bagging.

For obtaining maximum bagging outputs, preferably two or more differential bagging weighers are associated with a flow filling nozzle of a bagging turntable. The batches can be prepared either in tandem operation or briefly with double hourly output.

It has been found especially advantageous if the flow filling nozzle has a free through passage cross-section smaller than or substantially corresponding to the cross-section of product discharge from the weigher receptacle. This arrangement also allows increased automation, since

a small bagging nozzle is simpler for carrying out the rapid mechanical movements of the bag suspending device.

Furthermore the same bagging nozzle can be used for a large ^{range} of bags, for example 20 to 100 kg bags.

The high-output bagging stations have ^{preferably} two rough dosaging weighers and also a fine dosaging weigher with associated computer means, and the bagging turntable has 3 - 6 flow filling nozzles.

These arrangements make it possible to set up programmes for accurate control of product movement, so that for example after a specific quantity of product which has to be bagged no product residues remain. Product changing can also be prepared and carried out more quickly with the same bagging apparatus.

The invention is described in more detail hereinafter with reference to some examples of embodiment.

Brief description of the invention

In the drawings:

Fig. 1 shows diagrammatically a simple bagging station with a differential bagging weigher;

Fig. 2 shows differential weighing in conjunction with a bagging turntable;

Fig. 2a shows the pattern of operation of the main bagging movement;

Figs. 3, 3a show the weighing principle of a net bagging weigher;

Fig. 4 shows a weight-time diagram of a net bagging weigher in the state of the art;

Fig. 5 shows a weight-time diagram of the novel differential bagging weigher;

Fig. 6 shows a layout for a high-output bagging system for example for 1200 bags per hour;

Fig. 6a shows the movement pattern for Fig. 6, similarly to Fig. 2a;

Fig. 7 shows a solution similarly to Fig. 1 but with bag packing machine;

Fig. 8 shows a 4-nozzle bagging turntable for bulk materials which are capable of trickling movement;

Fig. 9 shows a differential bagging weigher for materials which have difficult flow properties, on a larger scale.

Ways of carrying out the invention

Reference will now be made to Fig. 1. A differential weigher 1 is supported by means of columns 2, a platform 3 and weight-detecting elements 4 and respectively on the roof 5.

The differential weigher 1 comprises substantially a weighing receptacle 6, a transfer piece 7, and a forcible-discharge worm 8 which is driven by a drive motor 9 via a transmission 10 and is controlled from a computer 11. Rough and fine flow dosaging can be effected with a dosaging worm with two revolution speeds, or fine dosaging can be effected by means of a separately driven fine-flow worm not shown here.

So that there will be ^{uncontrollable} no ~~after-flow~~ from the feed means 8, the outlet aperture 16 is opened and closed controllably by means of the computer via a valve 15. A bagging head 17, which is supported on the ground 18 independently of the differential weigher 1, has a bagging nozzle 19 and also a bag holder 20, which in Fig. 1 holds clamped fast a bag 21. The air displaced in the bag 21 by the product can escape through suction means 22. By means of a rubber diaphragm 22 a product feed head 24 is connected in dust-tight manner to the weighing receptacle 6. A product feed conveyor 25 which is controlled through the agency of a drive motor 6 cyclically from the computer 11, or in accordance with the weigher signal, opens into the feed head 24.

In Fig. 2 a differential weigher 1 is shown directly above a bagging carrousel or turntable 31, on which bagging nozzles 32, 32', 32'' are visible. It is also important that the bag, especially in the case of gusseted bags, is filled uniformly with the product upwardly from below. A

compacting system, for example a side packer 33, compacts the product in the bag by shaking and oscillating movements with uniform intensity upwards from below very efficiently during rough and fine dosaging. Depending on particular problems, a second side packer 33 may also come into use, this behind a bagging nozzle 32' or 32''. After the conclusion of bag filling and bag shaking the bag is deposited in a conveyor belt 34 and conducted through a closing station 35 and prepared for transporting away.

Fig. 2 shows a pattern of operation with respect to time for for example a bagging turntable according to Fig. 2 provided with four bagging nozzles. The curve 36 shows the pattern of product replenishment N in the differential weigher 1 with respect to time. The curve 37 represents the pattern of product discharge from the differential weigher 1, G being the rough flow, F the fine flow, and B the quietening time for the weigher. The line 38 represents the pattern over time of the stepping movement of the turntable; S signifies the time for a stepping movement of a bagging nozzle through 90°. In the curve 39 R is the shaking time during which the side packer 33 compacts the product.

Figs. 3, 3a and 4 serve to explain the technical expressions. In the Figures, G = product in the weighing receptacle, P = impact pressure, D = Doppler effect, N = afterflow, FH = height of fall.

Figs. 3 and 3a show that the amount of the afterflow (dotted) is dependent on the height of fall. In Fig. 3a the afterflow is smaller than in Fig. 3. The speed of fall of the bulk material increases with increase in height of fall. The narrower the cross-section of the weighing receptacle, the more quickly does the level of bulk material rise in the weighing receptacle. Because of the column of bulk material in the weigher growing upwards in opposition to the falling flow of product a phenomenon is produced similar to what happens when two cars collide with one another. In both cases the impact force is greater

than in the case of impact against a stationary body. In the weighing art this is called the Doppler effect. The effective final weight can be determined only after the afterflow has deposited and the weigher has quietened. These and other disturbance factors have to be taken into account at each bulk material receptacle weigher, for example by appropriate time delays. A weight-time diagram according to Fig. 4 is known in the weighing art.

A weight-time diagram in the differential bulk weigher according to the novel solution is shown in Fig. 5. Weigher filling - bag filling interplay is shown in the illustrated example.

For the replenishment of the differential bulk material weigher approx. 1 - 2 seconds are required until a weight of approx. 25 kg is reached. It is quite important here that, for the replenishment, replenishment to a precise predefined weight is not needed except for the last bag contents quantities, since after the replenishment the exact weight in the differential bulk weigher is determined via the standstill ascertaining means and passed to a computer. Thereafter the filling weight with the system of differential weighing is discharged controlled to a predefined weight (FA), at first as a rough flow and then as a fine flow. The filling weight is reached within approx. 4 seconds. It is especially interesting that with the closing of the discharge dosaging elements of the differential bulk weigher, or the moment of the last crumb of bulk material leaving the weighing part, the exact ^{at once} actual weight measurement in the weigher ^{applies}. The afterflow has already been weighed. Doppler effects, impact pressure etc. have recognisably no influence on establishing the filling weight, since these occur outside of or after the weighing. All the disturbance factors mentioned

further hereinbefore are banned from the stage of the filling phase and shifted into the replenishment phase, and are thus made harmless to bag filling and establishing weight.

A complete bagging plant is shown diagrammatically in Fig. 6. Here the bags are suspended by an automatic suspending device 40 on the flow filling nozzle 32 of the bagging turntable 31. Bag filling is carried out alternately by the bulk weigher 1 or 1' respectively, replenishing and filling alternating. Fine dosaging is controlled by means of a computer 41, and an appropriate dosaging command is given to a fine dosaging weigher, which is also constructed as a differential dosaging weigher. By means of the computer 41 bulk material dosaging can also be carried out via dosaging worms 43, 43', 43'' respectively, from a distributor 44. The bagging turntable is constructed as a 6-nozzle turntable, the sixth, 32', being provided for suspending bags manually.

The co-ordinated functioning pattern of the bagging apparatus shown in Fig. 6 is shown in Fig. 6a in a manner similar to Fig. 2a. Here K = turntable; MWBC-GI = differential bagging weigher, rough flow I; MWBC-GII = differential bagging weigher, rough flow II; MWBC-F = differential bagging weigher, fine flow; R = shaker.

Fig. 7 shows a further, somewhat more convenient form of embodiment of a so-called bag packing machine, it being a question of an individual bagging nozzle. An individual bag²¹ is attached similarly to Fig. 1, a telescopic bagging nozzle carrying out a vertical movement V, with which any dust production in the bag 21 can be avoided. Filling here is carried out by means of a driven filling worm 50. The vertical movement is effected by means of a pneumatic cylinder 51. This bagging apparatus, known as a bag packing machine, is supported here by means of a support member 53 on the ground, similarly to Fig. 1. The operator presets the desired data for the movement

patterns by means of an inputting unit. A bagging cycle then proceeds through the agency of a control unit 54, or the corresponding weigher control 55.

Instead of the differential weigher 1 of Fig. 1 with forced discharge, Fig. 8 shows a differential weigher 60 for freely flowable materials with an adjustable discharge dosaging slide valve 61, 61'. By means of pneumatic cylinders 62 and the weigher control 63 various dosaging positions can be selected for obtaining rapid and yet optimum filling of the bags. Some very interesting combination effects are then possible. A collecting hopper 64 is constructed as integral with the bagging nozzle 32. The two parts and also the feed head 65 are securely supported on the floor 18 by means of a support member 66. Above and below in the region of rubber sleeves 67, 68 respectively the weighing receptacle 6 has cross-section identity with the fixed transition parts also. By means of an air compensation pipe 69 all air displaced below in the bag is then conducted over a large cross-section upwards, so that here neither dust nor differential pressure problems between top and bottom arise.

In the feed head 65 there is arranged below a hopper 70 a controllable slide valve 71 which is operated via a pneumatic cylinder 72. The weigher's electronic system is connected directly to a control box 73 from which the main working commands are issued, including to a partly automatic bag clamping device 74.

Fig. 9 will now be referred to. The production flow P1 enters vertically into a differential weigher 1 for difficultly flowable materials, at the top, and exits therefrom again at the bottom as P2. The throughflow measuring device comprises a feed head 102 which is securely connected to a platform 103 by brackets 104 and is supported thus on the

floor 105. An inlet tube 106 and an outlet tube 107 are stationary. The weighing part 108 is connected in dust-tight manner relatively to the feed head 102 and also the outlet tube 107 by a flexible rubber sleeve 109 in each case. The weighing part comprises an upright weigher receptacle 110 which in its lower portion has a slightly conical narrowing 110'. The weigher receptacle 110 and the conical narrowing are given a round tubular shape. A transition piece 112 is arranged between the weigher receptacle 110 and a discharge worm 111 and ensures in an optimum way the transition from the upright tubular form of the weigher receptacle 110 into a horizontal tubular form at the discharge worm 111 from the product flow point of view. As in Fig. 1 the transition piece 112 has a substantially constant cross-section from top to bottom, and in the example of embodiment has a round to rectangular shape. The weighing part 108 is suspended in the peripheral direction on for example three weight measurement value pickups 113 on the platform 103. The suspending of the entire weighing part 108 with the inclusion of a drive motor 114 is very interesting, so that the drive motor 114 and the discharge worm 111 project each in an opposite direction beyond the weighing part 108, and to some extent maintain an equilibrium with one another in relation to a central axis 115. Immediately at the inlet tube 106 ^{there is} situated a preliminary bin 116 which is controllable in accordance with a selectable programme by a pneumatic cylinder 117 and a bottom valve 118 via an electronic control means 119 or a pneumatic signal converter 120, desired values for product discharge being obtained from an external computer 121 and the actual-value weight signals from the weight measurement value pickup 113.

The preliminary bin has less than 50 % of the maximum

holding capacity of the weigher receptacle 110, preferably about 30 % to 90 %. But here again there is thus a deliberate departure from the conventional use of a differential weigher, since for the filling of the weigher receptacle only a proportion is pre-storable, so that the inflow is also monitorable in the weighing art sense, which is important for the monitoring of a production flow unless additional control units for the inflow can also be accepted.

The weigher receptacle has a height approximately double its diameter, and the diameter can amount to 0.3 to 0.6 m. Here the tube worm has a diameter of 1.100 to 0.250 m, so that a mean ratio of weigher receptacle cross-section to tube worm cross-section of about 1 : 10 results.

Fig. 9 shows also a further especially interesting development idea in that the drive motor 114 with or without flanged-on discharge worm shaft 122 is adapted to be pulled out by means of a pull-out part 123 like a sliding drawer in the direction of the axis 124 of the discharge worm 111. This makes it possible to maintain particularly high standards as regards keeping the path of travel of the product clean.

In the upright weigher receptacle 110 the product steadily sinks down vertically, is conducted with the transition piece 112 directly into the entrance of the discharge worm shaft 122, discharged horizontally from the weigher receptacle 110, and continually discharged again in a vertical direction through the outlet tube 7, monitored anew by measuring means.



C l a i m s

1. Method for the bagging of predetermined bulk material fill weights from a weighing receptacle (6, 110) into transport containers (21), more particularly into bags (21), characterised in that the bulk material quantities discharged respectively from the weighing receptacle (6, 110) into the transport containers (21) are gravimetrically ascertained via a differential weight decrease of the weighing receptacle (6, 110), and the bulk material quantity discharge is controlled to the predetermined bulk material fill weight.
2. Method according to claim 1, characterised in that the weighing receptacle (6, 110) is replenished after each or after a plurality of bagging operations, more particularly with 1.5 to 5 bag contents quantities.
3. Method according to one of the preceding claims, characterised in that the discharged bulk material is bagged as a dense phase flow.
4. Bulk material bagging apparatus with a weigher (1, 1', 108) and with a control apparatus which discharges predetermined bulk material fill quantities from a weighing receptacle (6, 110) into transport containers (21), characterised in that the weigher (1, 1', 108) is arranged as a controlled differential weigher (1, 1', 108) which gravimetrically monitors via a differential weight decrease of the weighing receptacle ^(6, 110) the bulk material quantities which are respectively discharged from the weighing receptacle (6, 110) into the transport containers (21), and also controls the bulk material quantity discharge to the given bulk material fill weight (8, 11; 61, 111, 121).



5. Bagging apparatus according to claim 4, characterised in that it is constructed as a bagging turntable (31).

6. Bagging apparatus according to claim 5, characterised in that the differential weigher (1, 108) is designed for transferring predetermined batches via a bagging nozzle or flow filling nozzle (32, 32', 32'') at the cycle of the bagging turntable (31).

7. Bagging apparatus according to claim 6, characterised in that two differential weighers (1, 1') are associated with a flow filling nozzle station.

8. Bagging apparatus according to one of claims 5 to 7, characterised in that a further controlled differential weigher (1) is associated with a further flow filling nozzle station.

9. Bagging apparatus according to claim 8, characterised in that the at least two differential weighers (1, 1') are so adjusted to one another that they discharge into the transport container (21) two batches which add up to make the predetermined bulk material fill weight, the first batch being discharged as a rough flow (GI, GII) and the second as a fine flow (GF).

10. Bagging apparatus according to one of claims 4 to 9, characterised in that the control apparatus (8, 11, 61, 111, 121) has at least one controllable slide valve (61, 61'),

11. Bagging apparatus according to one of claims 4 to 9, characterised in that the control apparatus (8, 11, 61, 111, 121) comprises forced-discharge elements (8), more particularly discharge worms (8).



12. Bagging apparatus according to one of claims 4 to 11, characterised in that the outlet (16) of the control apparatus (8, 11, 61, 111, 121) opens into the bagging nozzle (32, 32', 32'') of a bag attaching or suspending device (20, 40, 74), said nozzle being constructed as a flow filling nozzle.

13. Bagging apparatus according to claim 12, characterised in that the flow filling nozzle (32, 32', 32'') has a free throughflow cross-section which is smaller than or corresponds approximately to the cross-section of the outlet (16) of the control apparatus (8, 11, 61, 111, 121).

14. Bagging apparatus according to one of claims 11 to 13, characterised in that a closing device (11, 15) is arranged at the outlet (16) of the control apparatus (8, 11, 61, 111, 121).

15. Bagging apparatus according to one of claims 4 to 14, characterised in that it is designed for the filling of products which have disadvantageous flow properties,

a) the differential weigher (1, 108) comprising an upright weighing receptacle (6, 110) with differential weighing elements (4, 113);

b) the control apparatus (8, 11, 61) comprising a substantially horizontally disposed, rotational-speed-controllable discharge worm (8, 111) with an outlet (16) opening into the bagging nozzle (17, 19, 32, 32', 32'');
and

c) a transition piece (112) being arranged between weighing receptacle (6, 110) and discharge worm (8, 111).