

- (21) Application No **8300409**
(22) Date of filing **7 Jan 1983**
(30) Priority data
(31) **804/82**
(32) **24 Feb 1982**
(33) **Denmark (DK)**
(43) Application published
28 Sep 1983
(51) **INT CL³**
B07C 5/18
(52) Domestic classification
G1W P
(56) Documents cited
GB A 2094489
GB A 2084744
GB A 2079554
GB A 2039374
US 4206822
(58) Field of search
G1W
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(54) **Distributing bodies of different weight in units of predetermined weight**

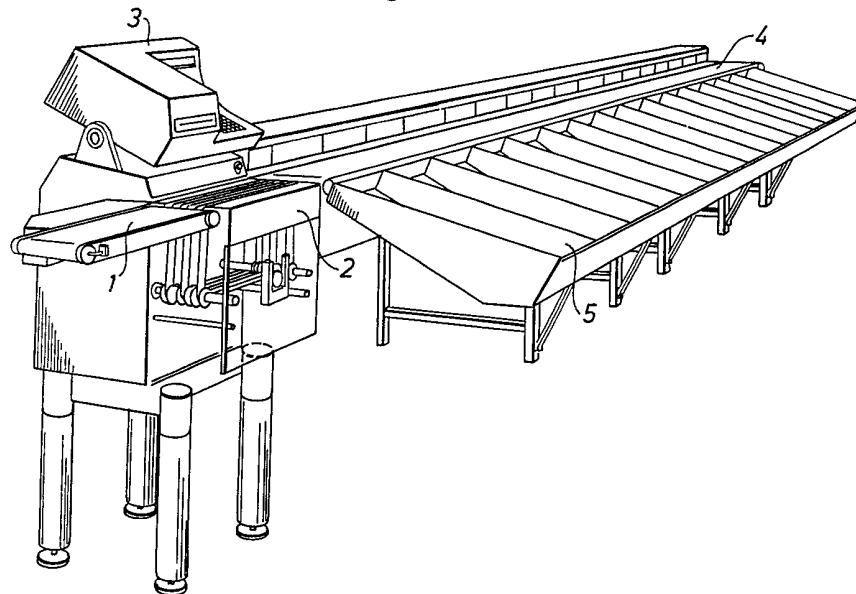
(57) A method of distributing a number of bodies of different weight in units of a predetermined weight consists of the

following steps:

- a) dynamic weighing of the individual bodies,
- b) registration of the weight of the body in a steering unit,
- c) conveyance of the weighed body to a collecting station wherein the weight registered of any bodies previously collected is less than or equal to the desired, predetermined weight of the finished unit minus the weight of the body,
- d) recirculation of bodies not yet placed,
- e) removal of the bodies, when the desired weight has been obtained, and packing.

The apparatus consists of a feeding belt conveyor (1), a dynamic weighing station (2), a steering unit (3) as well as a feed unit (4) adapted to convey the bodies from the weighing station (2) to either a collecting station (5) or back to the weighing station (2), dependent on signals from the steering unit (3).

Fig.1



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Fig.1

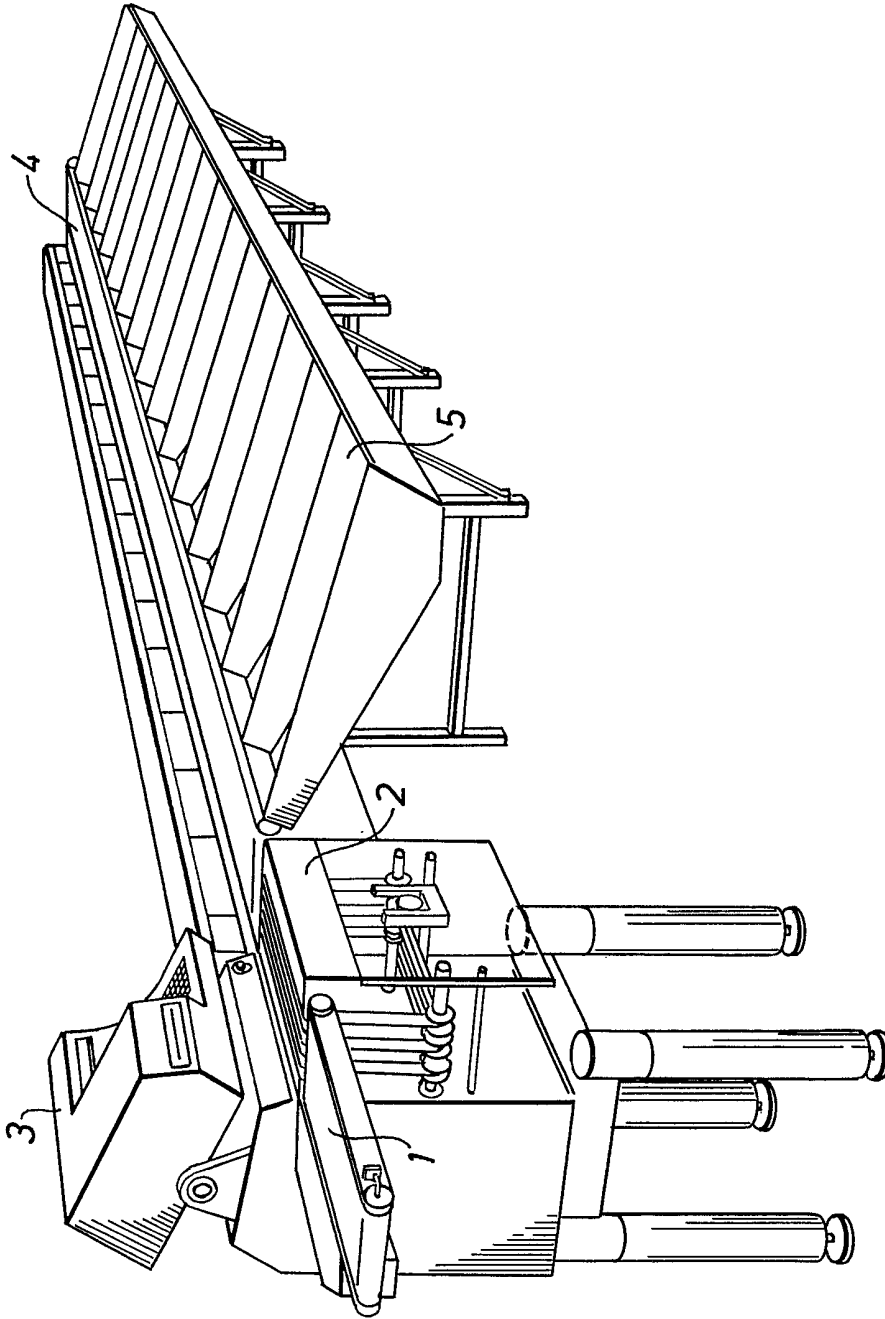
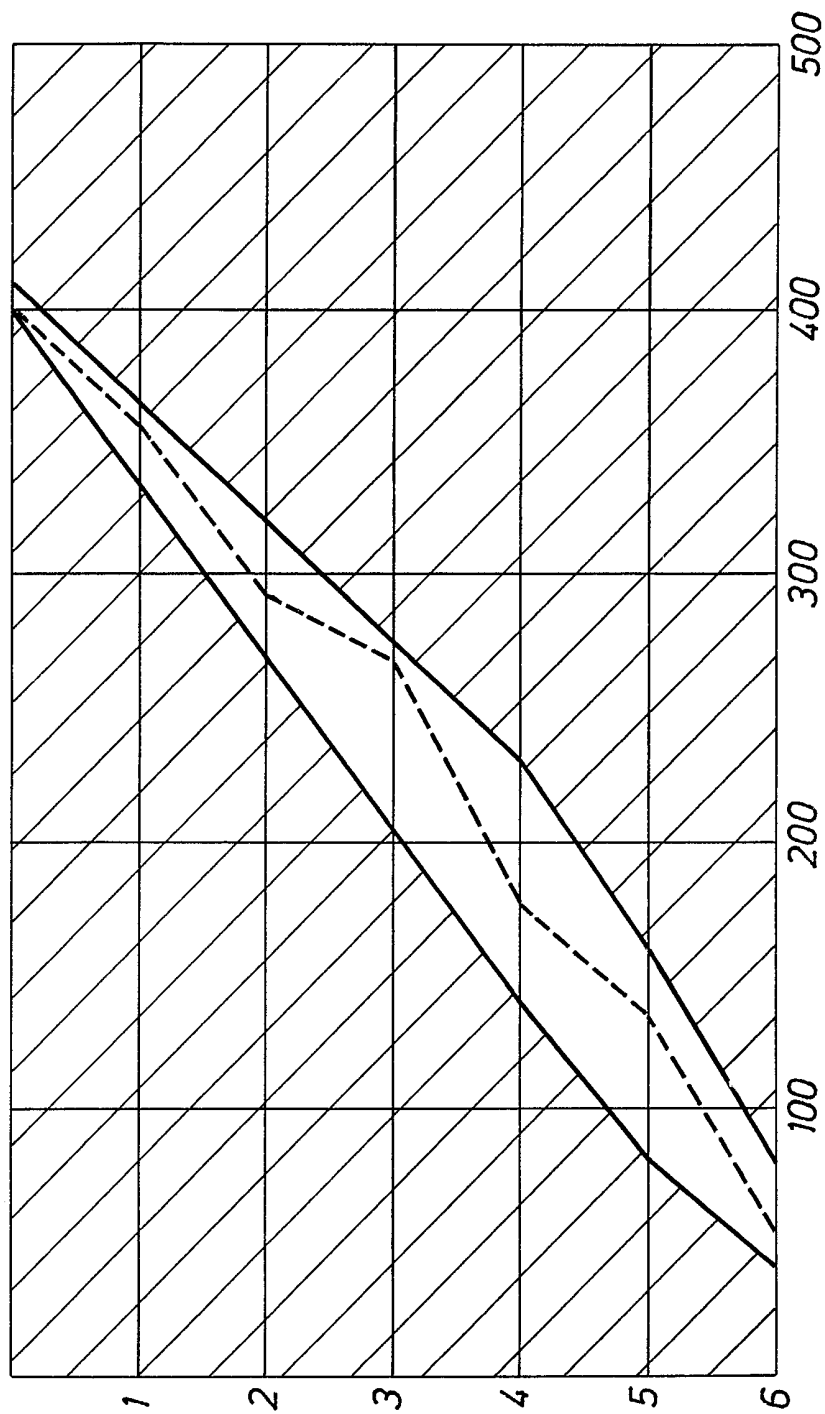


Fig. 2



SPECIFICATION

A method of distributing a number of bodies of different weight in units of a predetermined weight and an apparatus for use when working the method

The invention relates to a method of distributing a number of bodies of different weight in units of a predetermined weight.

10 The packaging of e.g. articles of foods involves a need of being able to select bodies of different weights from a store in such a manner that the removed bodies form a unit of a predetermined weight $\pm$ the accepted deviation.

15 A number of more or less automatized methods of systematically selecting bodies in the manner described above is known. However, it is common to these methods that the aggregate store is stored by weight, whereupon an appropriate number of
20 bodies is selected from the individual weight groups in such a way that the bodies all together form a unit of the desired weight.

It is an essential disadvantage of these prior methods that a trained operator is required for
25 making the "legal" combinations of weight groups in such a way that all the time there is approximately the same number of bodies in the individual weight groups.

It is the purpose of the invention to simplify the
30 distribution or selection of a number of bodies of different weight to units of predetermined weight.

According to the invention, this purpose is achieved by a method of the type mentioned above and characterized by comprising the following steps

- 35 a) dynamic weighing of the individual bodies,
- b) registration of the weight of the body in a steering unit,
- c) conveyance of the weighed body to a collecting station wherein the weight, registered by the
40 steering unit, of any bodies previously collected is less than or equal to the desired, predetermined weight of the finished unit minus the weight of the body,
- d) recirculation of bodies not yet placed,
- 45 e) removal of the bodies, when the desired weight has been obtained, and packing.

Thus, by distributing the bodies dependent on the weight registered by means of dynamic weighing to the individual collecting stations, a direct selection is
50 obtained without use of an intervening sorting step, wherein the bodies are sorted by weight.

In a method of the invention the weighed body is conveyed to a collecting station, wherein the weight of the bodies previously collected is equal to the
55 weight of the finished unit minus the weight of the weighed body.

Hereby a faster distribution of the bodies is obtained, as the collecting station which becomes a finished unit in this method is released to receive
60 bodies of arbitrary weight.

In a method of the invention wherein the weight of the bodies intended for distribution is statistically distributed, preferably statistically normal distributed, it is characterizing that the weighed body is
65 conveyed to a collecting station, wherein the weight

of any previously collected bodies plus the weighed body will be equal to the desired weight of the finished body minus a whole multiple of the average weight of the normal distributed bodies, including
70 nil times the average weight.

By placing the bodies just weighed according to this strategy it is achieved that the bodies having a weight corresponding to the average weight or only differing comparatively little herefrom will be easiest
75 to place. In case of normal distribution the greatest number of bodies will have a weight corresponding to the average weight, and the effectivity of the distribution will be substantially increased, consequently.

In a practically preferred embodiment of the method of the invention the body is conveyed to a collecting station, wherein the weight of the bodies previously collected plus the weighed body will be inside a weight range being equal to the desired
80 weight of the finished unit minus a whole number of times (the average weight $\pm$ the variance of the distribution) of the desired weight of the unit $\pm$ the variance of the distribution.

Hereby the number of bodies being recirculated
90 will be substantially decreased, as the bodies being closest to the average weight and constituting the greater part of the store will be of use to replenish the units in the process of formation in the individual collecting stations. Conversely, the bodies having a
95 weight differing substantially from the average weight, will admit of being placed as the first ones of a unit in a collecting station.

In a method of the invention, wherein a substantial number of collecting stations are used, it is characteristic that in case of several possible collecting
100 stations the steering unit selects the station to which a body has been conveyed latest.

Hereby a uniform distribution of units ready for packaging over the collecting stations is achieved,
105 which can be appropriate in the cases, where the packaging or packing is made by several operators.

Furthermore, the invention relates to an apparatus for use when working the method of the invention.

A practically preferred apparatus is characterized
110 by comprising a feeding belt conveyor, whereupon the bodies intended for distribution are fed separately to a dynamic weigh-in station adapted so as to weigh the bodies at great speed, preferably 100 - 150 bodies per minute, and to give a signal corresponding to the weighing to a steering unit, as well as a
115 feeding unit adapted so as to convey the bodies from the weighing station to either a collecting station or back to the weighing station, dependent on signals from the steering unit.

By means of this apparatus the method of the invention has been realized by means of simple apparatus components known *per se*.

The invention is further illustrated below with reference to the drawings, in which

125 *Figure 1* shows a perspective view of an apparatus designed according to the invention, and

Figure 2 shows an example of a practical distribution function executed by means of an apparatus of the invention.

130 The apparatus shown in *Figure 1* consists in all

essentials of a feeding belt conveyor 1 adapted in such a way that the fed bodies possibly overlapping are separated and fed separately to a dynamic weighing unit 2 located at the discharge end of the feeding belt conveyor 1. The dynamic weighing unit is known *per se* and will consequently not be described in further detail.

From the dynamic weighing unit 2 electric signals are given to a steering unit 3, wherein the signals are stored.

From the dynamic weighing unit 2 the weighed bodies are conveyed on to a feeding belt 4, wherefrom they are supplied to collecting stations 5 located by the side of the belt, which collecting stations in the embodiment shown in the drawing are in the form of so-called discharge compartments, i.e. trough-like boxes with a bottom adapted to be swung away. By the side of the feeding belt 4 turning away from the discharge compartments 5 a preferably pneumatically activatable arm is located, which, dependent on a signal from the steering unit, can be made to block the travelling path of the bodies on the belt 4 and thereby conduct the bodies down into the discharge compartment selected by the steering unit.

No return belt is shown in the drawing, but it goes without saying that by means of a conventional conveyor belt plant it will be possible to establish a returning of the bodies not supplied to a discharge compartment so that they are once more carried into the dynamic weighing unit via the feeding belt conveyor 1. Moreover, under the discharge compartments 5 part conveyors may be located adapted so as to convey the units of the desired weight on to a further station wherein the packing is performed.

In Figure 2 of the drawing a practical use of an apparatus according to Figure 1 is diagrammatically shown.

In the diagram shown in Figure 2 the desired weight in grams of the unit intended for packaging has been plotted as the abscissa, whereas the number of bodies used for the unit has been plotted as the ordinate, it being stated more specifically how many bodies are missing before the unit is ready for packaging (the "end"-position).

The line marked with dash lines illustrates a possible development of the total weight in a collecting station as a function of the number of units placed. Thus, in the Example shown the first unit weighs about 55 grams, the next unit about 80 grams, and so on.

The full drawn-lines illustrate the range within which the weight accumulation will take place in case of removal of bodies from a store with normal distribution of the weight. In the Example illustrated in Figure 2 the weight of the finished unit is about 400 grams and with an acceptable deviation of about 10 grams.

The invention is not restricted to the features shown and described above, and, thus, it will be possible to a person skilled in the art to make a great number of modifications within the scope of the invention. It will e.g. be possible to design the steering unit in such a manner that the bodies having a weight differing more than a certain

measure from the average weight are automatically sorted out. Moreover, it will be possible to use an apparatus of the invention for a traditional sorting by weight, as it is possible to readjust the apparatus by a simple amendment of the steering unit.

CLAIMS

1. A method of distributing a number of bodies of different weight in units of a predetermined weight, *characterized* by comprising the following steps:

- a) dynamic weighing of the individual bodies,
- b) registration of the weight of the body in a steering unit,
- c) conveyance of the weighed body to a collecting station wherein the weight, registered by the steering unit, of any bodies previously collected is less than or equal to the desired, predetermined weight of the finished unit minus the weight of the body,
- d) recirculation of bodies not yet placed,
- e) removal of the bodies, when the desired weight has been obtained, and packing.

2. A method according to claim 1, *characterized* by the fact that the weighed body is conveyed to a collecting station, wherein the weight of the bodies previously collected is equal to the weight of the finished unit minus the weight of the weighed body.

3. A method according to claim 1, wherein the weight of the bodies intended for distribution is statistically distributed, preferably statistically normal distributed, *characterized* by the fact that the weighed body is conveyed to a collecting station, wherein the weight of any bodies previously collected plus the weighed body will be equal to the desired weight of the finished unit minus a whole multiple of the average weight of the normal distributed bodies, including nil times the average weight.

4. A method according to claim 3, *characterized* by the fact that the body is conveyed to a collecting station, wherein the weight of the bodies previously collected plus the weighed body will be in a weight range equal to the desired weight of the finished unit minus a whole number of times (the average weight $\pm$ the variance of the distribution), or the desired weight of the unit $\pm$ the variance of the distribution.

5. A method according to one of the claims 1-4, wherein a substantial number of collecting stations is used, *characterized* by the fact that the steering unit, in case of several possible collecting stations, selects the station to which a body has been conveyed latest.

6. An apparatus for use when working a method according to one of the preceding claims, *characterized* by comprising a feeding belt conveyor (1), whereupon the bodies intended for distribution are fed separately to a dynamic weighing station (2) adapted so as to weigh the bodies at great speed, preferably 100 - 150 bodies per minute, and to give a signal corresponding to the weighing to a steering unit (3), as well as a feeding unit (4) adapted so as to convey the bodies from the weighing station (2) to either a collecting station (5) or back to the weighing station (2), dependent on signals from the steering

unit (3).

7. A method of distributing a number of bodies
of different weight in units of a predetermined
weight, substantially as hereinbefore described with
5 reference to the accompanying drawings.

8. An apparatus, substantially as hereinbefore
described with reference to, and as shown in, the
accompanying drawings.

9. Any novel feature or combination of features
10 described herein.

Printed for Her Majesty's Stationery Office, by Croydon Printing Company
Limited, Croydon, Surrey, 1983.
Published by The Patent Office, 25 Southampton Buildings, London,
WC2A 1AY, from which copies may be obtained.