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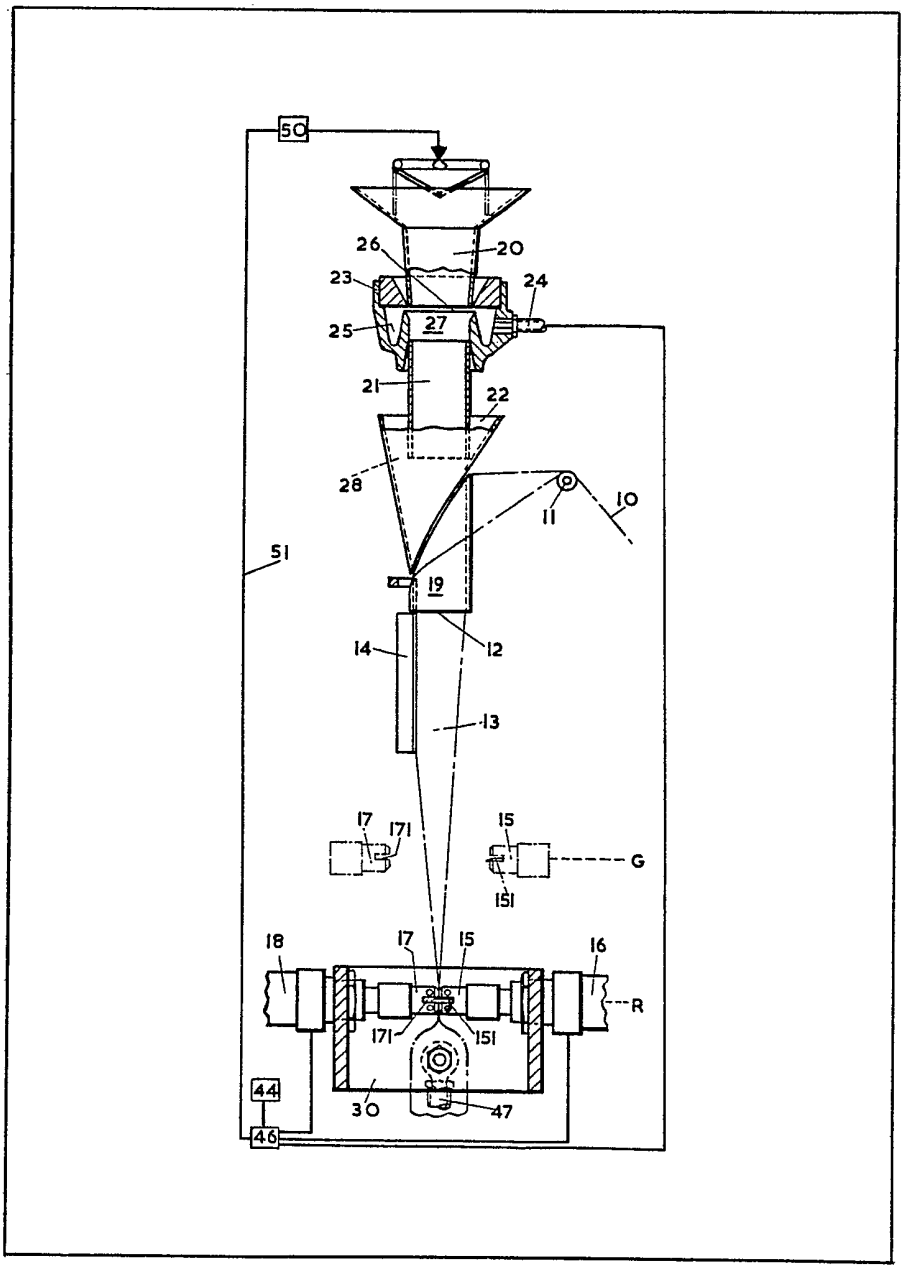
(54) **Apparatus for, and method of, charging of containers**

(57) In a vertical, form-fill-seal, wrapping machine, downward flow of charges of product, from a charge dispenser 50 to the wrapper tube 21, is assisted by utilizing the Coanda effect to establish a pulsed product-entraining flow of gas in a nozzle 23 in the pathway which leads from the weigher to the wrapper tube.



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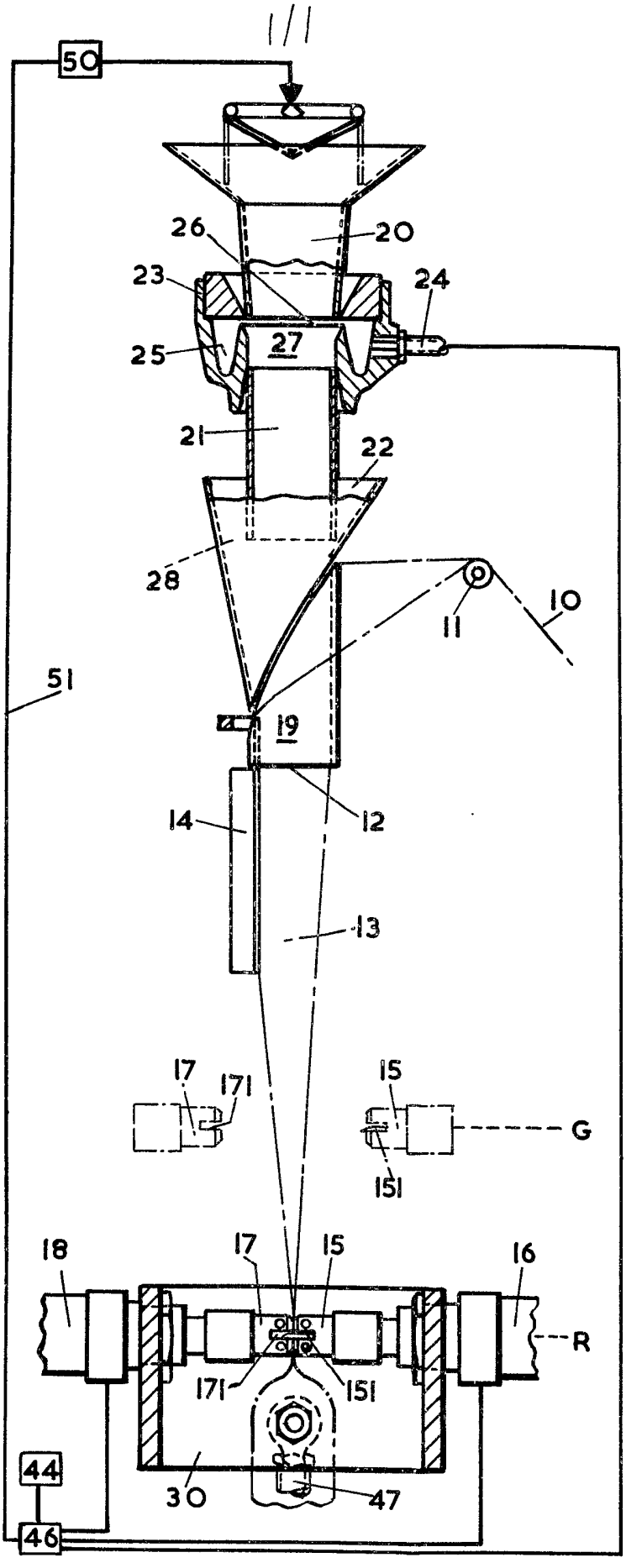
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SPECIFICATION

Apparatus for, and method of, charging of containers

This invention relates to apparatus for conveying charges of product to a succession of containers and, more particularly but not exclusively, it concerns bagging snack foods, in particular potato crisps (known as chips in U.S.A.) in a vertical, form-fill-seal, bagging machine.

Bagging equipment is known which receives weighed charges of crisps at a rate of from 40 to 45/min. In such equipment, a bag forming and filling machine produces pillow-type bags, each holding one of the charges, from a continuous tube of a wrapping material. Each bag exhibits cross seals at the top and bottom of the bag and a vertical seal between them.

The bulky nature of the charge of product in relation to its relatively low weight presents several problems in the feeding, weighing and bagging of the product in this way.

In particular, natural differences in potato size, density and water content, which are not all eliminated in the manufacture of crisps, make it difficult to weigh crisps both fast and accurately into the bags. For a typical target weight of the charge of 25 gms, it is not unusual in routine operation to find a charge weight which is 50% in excess of the target weight.

Further, the variable size of the crisps and their inconsistent weight leads to variation in the time it takes charge to fall under gravity down into its associated bag and therefore limits the rate of formation of bags to no more than approximately 40 to 45 bags per minute.

However, weighing machines are known which can provide bag-filling charges of crisps at faster rates. In one such machine, several fractional charges, each less than the target weight, are made simultaneously available. The weights of these charges are accurately recorded and a computer then selects the particular combination of available fractional charges which additively will provide most nearly the target weight. For example, the combination could be the sum of the contents of three or five weigh pans out of a total of ten loaded pans. It will be appreciated that use of such a machine can improve the weight consistency of bag charges over the consistency otherwise obtainable, as well as provide bag charges at an increased rate.

While use of such a weighing machine can increase weighing speeds, it does not in itself solve the problem of variation in dropping time. The present Inventor has studied the behaviour of crisps during their fall and have found that variation in dropping time is effected by a tendency of the crisps to float and ricochet down through the product flowpath of the form-fill-seal machine. He considers that this tendency would limit the bagging rate to a maximum rate of around 60 bags/minute.

The above-mentioned weighing machines are readily capable of providing more bag-filling charges than 60/minute. One object of the present invention is to take advantage of this facility, that is to say, further to increase the bagging rate of crisps (and other snack foods such as extruded rice, and re-constituted and shaped maize or cereals) in a vertical, form-fill-seal, bagging machine.

According to the present invention there is provided apparatus for conveying successive charges of product from a charge dispenser to a succession of charge containers, and comprising: channel surfaces defining a pathway for flow of product away from the dispenser upstream of an entry end of the pathway and towards a location where containers are presented for reception of product downstream of an exit end of the pathway; annular means for introducing a flow of compressed gas into the pathway at the channel surfaces and inducing said gas to flow as a result of the Coanda effect along the pathway towards the exit end thereof, thereby to induce a product-entraining flow of gas into the entry end of the pathway; means defining a gap between the said exit end of the pathway and a container receiving said product from the pathway through which gap gas may pass out of the pathway; and means for cyclically modulating the said flow of compressed gas in such a way that a relatively high rate of flow is provided at times when a charge is to be accelerated along the pathway and a relatively low rate of flow (which may be zero) at other times.

It will be appreciated that the invention harnesses the Coanda effect to establish a gas flow which performs the useful task of speeding the passage of product charges from the dispenser, which may be a high speed weigher, to the charge containers.

For a better understanding of the invention, reference will now be made, by way of example, to the accompanying drawing which is an elevation, partly in section, of certain essential components of a vertical, form-fill-seal, bagging machine according to the invention.

With reference to the drawing, those skilled in the art will recognise certain basic machine parts and the underlying mode of operation of the machine.

Thus, a web 10 of bag-forming synthetic plastics material is fed from a reel (not shown) over a roller 11 and on to the exterior surface of a hollow former 12 which forms the web, inside the former 12, into a tube 13. Associated with the former 12 is a longitudinal seal former 14. A pair of sealing jaws comprising a first jaw 15 actuated by a cylinder 16 and a second jaw 17 actuated by a cylinder 18 are reciprocable in a horizontal plane both to pinch the bag material between them and so form in it a transverse seal, and also to sever the material at the seal. The severing means comprises a knife 151 in the jaw 15 which cuts into a gap 171 in the jaw 17. The knife 151 is actuated by means not shown.

The jaws also reciprocate in a vertical plane. They move through a cycle, moving when open to an upper position G shown chain dotted, then

closing to pinch the bag material at said upper position, then, still closed and holding the bag material, moving downwardly to a lower position R thereby drawing a fresh bag length on to the former 12. At the lower position R, the knife 151 is actuated to sever the bag material. The jaws then open to release downwardly a severed bag.

In synchronism with each downward jaw movement, a bag-filling charge of product is dispensed into the internal flow channel 19 of the former 12. It then falls freely under gravity downwardly into the tube 13 sufficiently far that it comes to rest between the upper G and lower R position of the jaws 15 and 17 so that it becomes sealed within a pillow-type bag generated by the cyclical operation of the jaws 15 and 17.

Turning now to a more particular description of the present invention, charges of product are delivered to the channel 19 from a high speed weighing machine 50 as mentioned above by passage down a pathway defined by a feed funnel 20, and a cylindrical tube 21, and thereafter through a shaped funnel 22. Between the funnel 20 and the tube 21 there is disposed an airmover 23, in this case a Brauer AM75—3 airmover obtainable from H.M.C. Brauer, Dawson Road, Mount Farm Estate, Bletchley, Milton Keynes, Buckinghamshire, MK1 1JP, England or an equivalent airmover from O.N. Beck & Co. Ltd., 104 Fox Lane, London, N13 4AX, England, there being a close fit between the airmover and the funnel 20 and the tube 21.

Pulses of air, delivered under line pressures up to 80 p.s.i. (5.44 atmospheres) to the airmover 23 along an air line 24, pass from an annular chamber 25 through an annular shaped nozzle 26 into the central passage 27 of the air mover 23 and by virtue of the shape of the nozzle 26 and the Coanda effect adhere to the walls of the passage 27 and flow downwardly into the tube 21 entraining relatively large quantities of air across the whole cross-section of the passage 27 to flow downwardly too. Because of the close fit of the funnel 20, a downward flow of air is induced in the funnel 20, air being drawn into the entry end of the funnel 20 at the top edge thereof. This downward flow accelerates product charges entering the funnel 20 and delivers them more swiftly and in a more controlled manner to the channel 19.

An annular gap 28 is provided between the exit end of the tube 21 and the shaped funnel 22, the dimensions of which are such that the air passing out of the airmover 23 and tube 21 can escape upwardly at a velocity which is lower than that of the air when passing down the airmover. Consequently the escaping air does not carry product items away with it out of the product stream, not even lightweight product items such as potato crisps.

The pulsed air supply is actuated at the moment when each product charge falls into the mouth of the airmover 23 and is switched off when the charge has passed through. This action is found to speed the fall rate of the charge of crisps and maintain them in a compact mass all the way down the bag-forming tube 12 thereby enabling bagging speeds to be increased up to at least 70 bags/minute and, in most circumstances, to over 100 bags/minute.

A source 44 of compressed air drives the cylinders 16 and 18 through pneumatic control means 46 which also controls pulsed flow of air to the airmover 23. The control means 46 operates in synchronism with the weigher 50, being connected to it by a control link 51. The movement of the jaws and the associated carriage between stations G and R is actuated by a mechanical link 47 driven by a crank.

It will be appreciated that it will generally be undesirable to maintain the air flow continuously, as this would add to the risk of the product being blown out of the feed tunnel gap 28.

The pulsed, downward flow of air has the additional, useful effect of helping to secure that, when it is most needed, the cross-section of the tube of wrapper into which the product is falling is maintained at its maximum.

The jaws 15 and 17 need not include means for severing bag lengths. For some applications, such severance is not required and, for others, severing means could be provided downstream of the jaws.

The present invention and another, which is the subject of our copending Patent Application No. 8122123 filed 30th July 1982 and entitled "Manipulation of Bags", are related, in that, in general, greater speed and efficiency in bagging snack foods is obtainable using the two inventions together than is obtainable with either invention by itself.

CLAIMS

1. Apparatus for conveying successive charges of product from a charge dispenser to a succession of charge containers, comprising channel surfaces defining a pathway for flow of product away from the dispenser upstream of an entry end of the pathway and towards a location where containers are presented for reception of product downstream of an exit end of the pathway, and further comprising annular means for introducing a flow of compressed gas into the pathway at the channel surfaces and inducing the gas to flow as a result of the Coanda effect along the pathway towards the exit end thereof thereby to induce a product-entraining flow of gas into the entry end of the pathway, means defining a gap between the said exit end of the pathway and a container receiving said product from the pathway, through which gap gas may pass out of the pathway, and means for cyclically modulating the said flow of compressed gas in such a way that a relatively high rate of flow is provided at times when a charge is to be accelerated along the pathway and a relatively low rate of flow (which may be zero) at other times.

2. Apparatus as claimed in claim 1 wherein the flow introducing means is located between an upstream channel surface defining an upstream portion of the pathway and a downstream channel

surface defining a downstream portion of the pathway.

3. Apparatus as claimed in claim 2, wherein the upstream channel surface cross-section tapers to become progressively smaller in a downstream direction.

4. Apparatus as claimed in any one of the preceding claims wherein the channel surfaces define the pathway to be of circular cross-section.

5. Apparatus as claimed in any one of the preceding claims for insertion between a weigher and a wrapper tube-forming component in a vertical, form-fill-seal, wrapping machine.

6. Vertical, form-fill-seal, wrapping apparatus comprising apparatus as claimed in any one of the preceding claims.

7. Wrapping apparatus as claimed in claim 6, having an ability to wrap product charges at a rate of at least 100 per minute.

8. A method of conveying successive charges of product along a pathway from a charge dispenser to a wrapper tube in a vertical, form-fill-seal wrapping machine comprising the step of utilizing the Coanda effect to establish in the pathway a flow of gas which, by entrainment of the product therein, assists flow of the charges along the pathway.

9. Apparatus for conveying charges substantially as hereinbefore described with reference to, and as shown in, the accompanying drawing.

10. A method of conveying charges substantially as described with reference to the accompanying drawing.

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