United States Patent [19]

Fagniart

[11] **3,928,940**

[45] **Dec. 30, 1975**

[54] **PACKAGING MACHINE**

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[22] Filed: **Feb. 27, 1974**

[21] Appl. No.: **446,205**

[30] **Foreign Application Priority Data**

Mar. 2, 1973 France 73.07831

[52] **U.S. Cl.**...................... **53/112 B;** 53/86; 53/187; 53/385; 141/59

[51] **Int. Cl.**[2] **B65B 31/02**

[58] **Field of Search**.......... 53/7, 12, 22 R, 22 B, 86, 53/87, 95, 96, 112 R, 112 B; 141/7, 8, 59, 65

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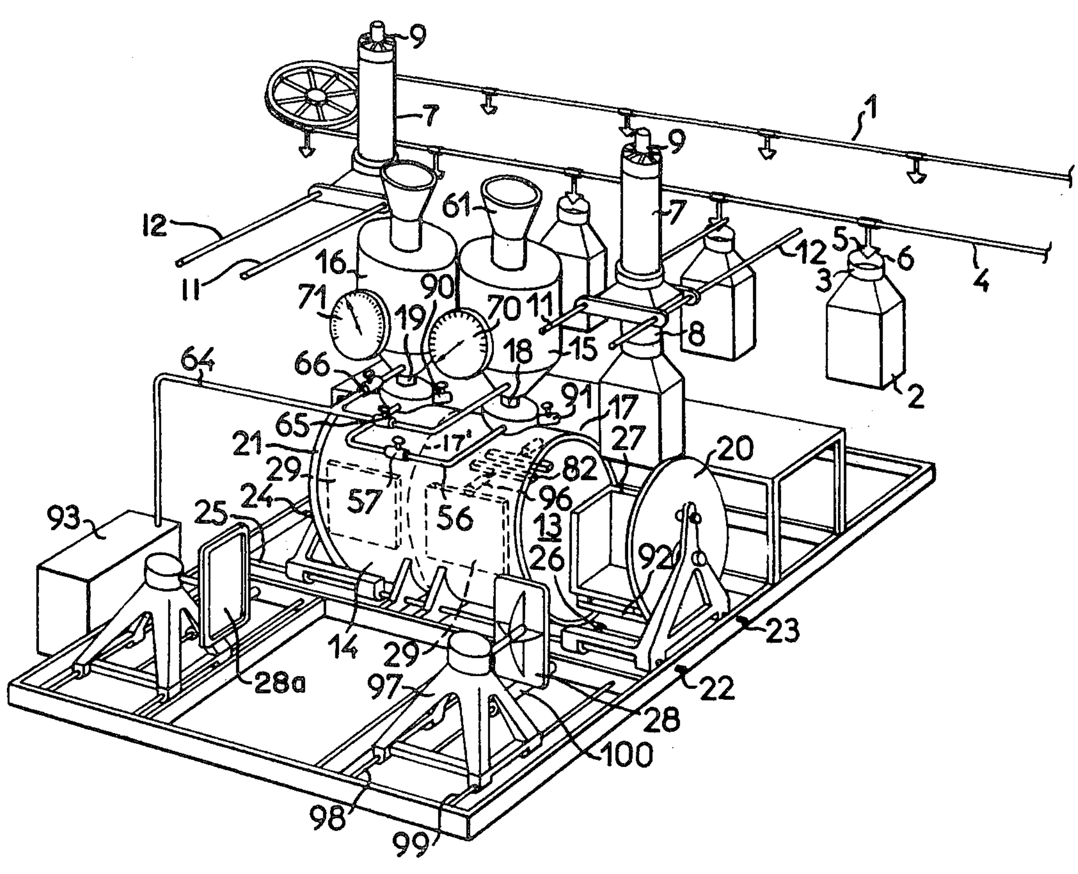
[57] **ABSTRACT**

Machine for packaging materials having a low mesh size, in cubic bags of flexible material. Each bag is supported in a rigid-walled cubic enclosure mounted on the door of an hermetically sealed filling chamber and a vacuum or controlled gaseous atmosphere is established and maintained in the filling chamber. The bag is vibrated and filled, under the controlled atmosphere, with the material to be packaged from which gas has been removed. The material falls under gravity from an hermetically sealed degassing and weighing chamber mounted above the filling chamber, passing through a tube into the bag. The neck of the filled bag is heat-sealed under vacuum in the filling chamber by two sealing heads. The sealed, filled bag is then removed from the filling chamber by opening the door and the bag is removed from the enclosure by a suction plate which grips one side of the bag. The bag can be inflated before insertion into the enclosure in order to produce its maximum volume.

18 Claims, 8 Drawing Figures



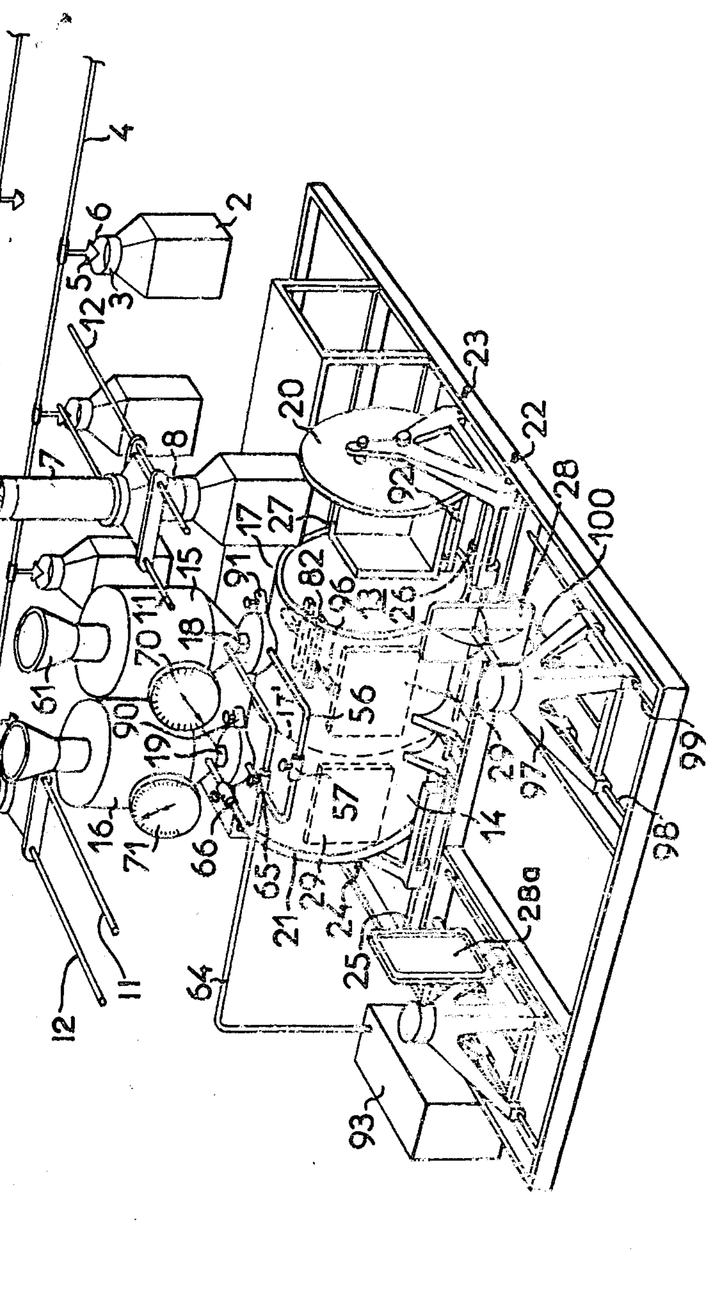

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Fig.1

Fig.2

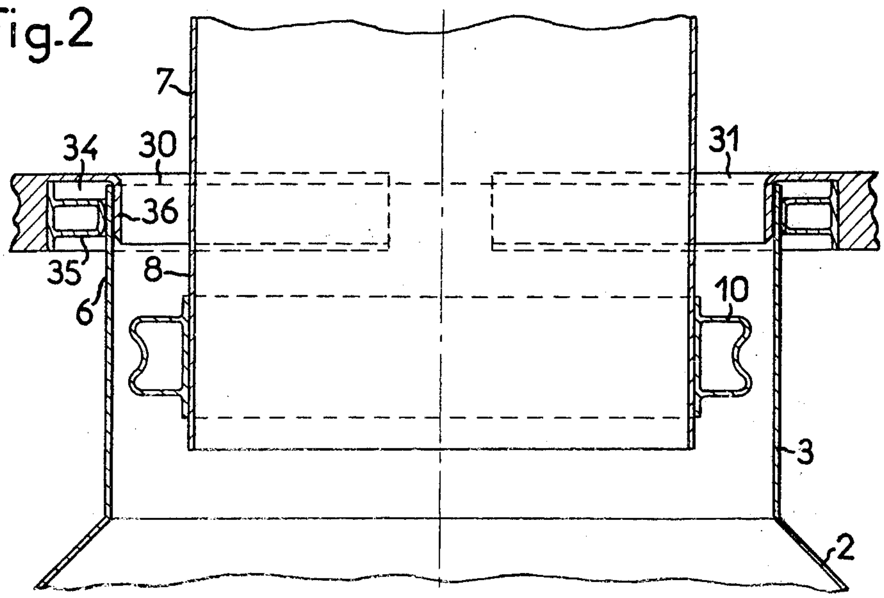


Fig.7

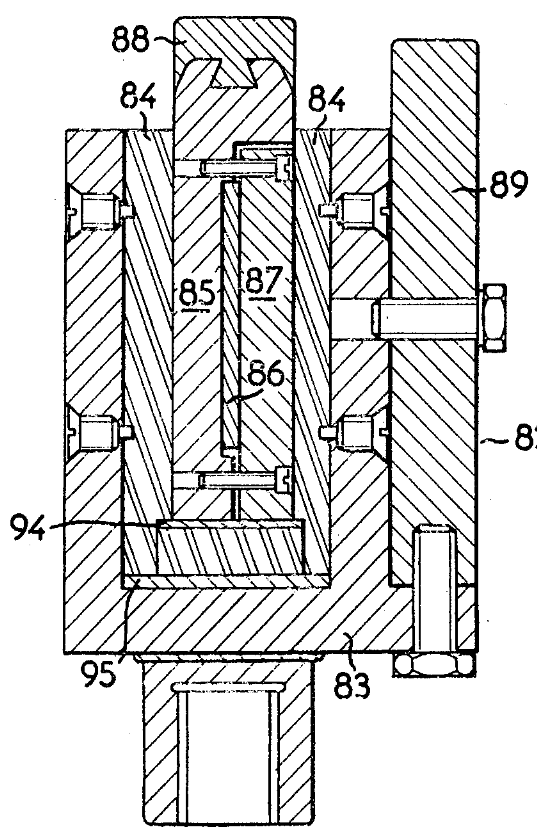
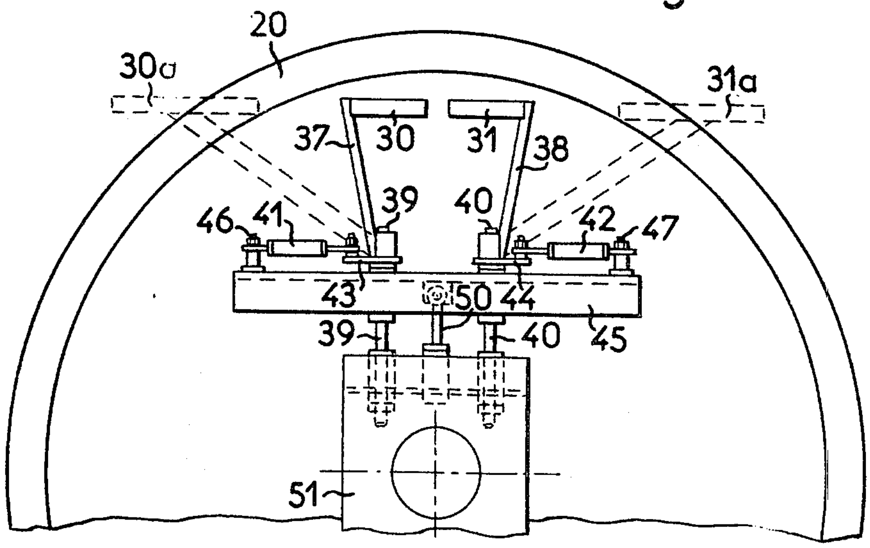


Fig.3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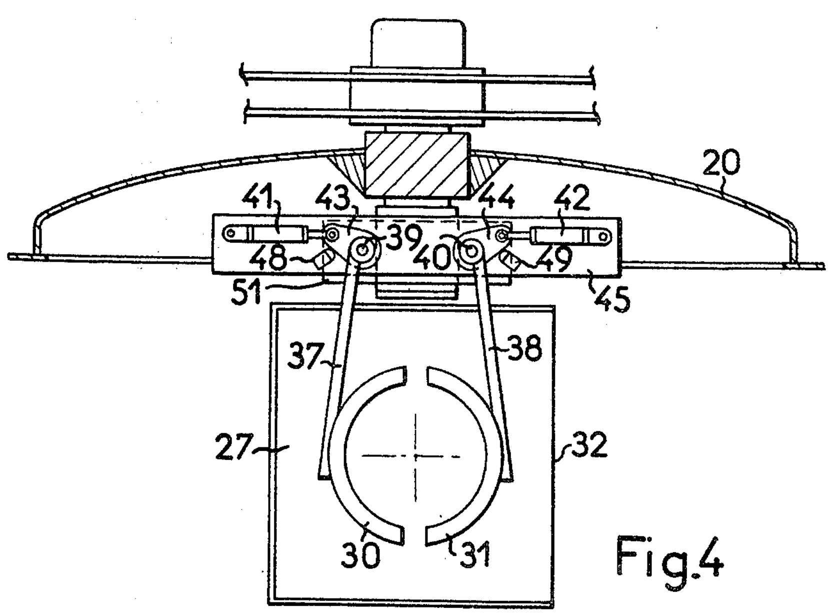
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Fig.4

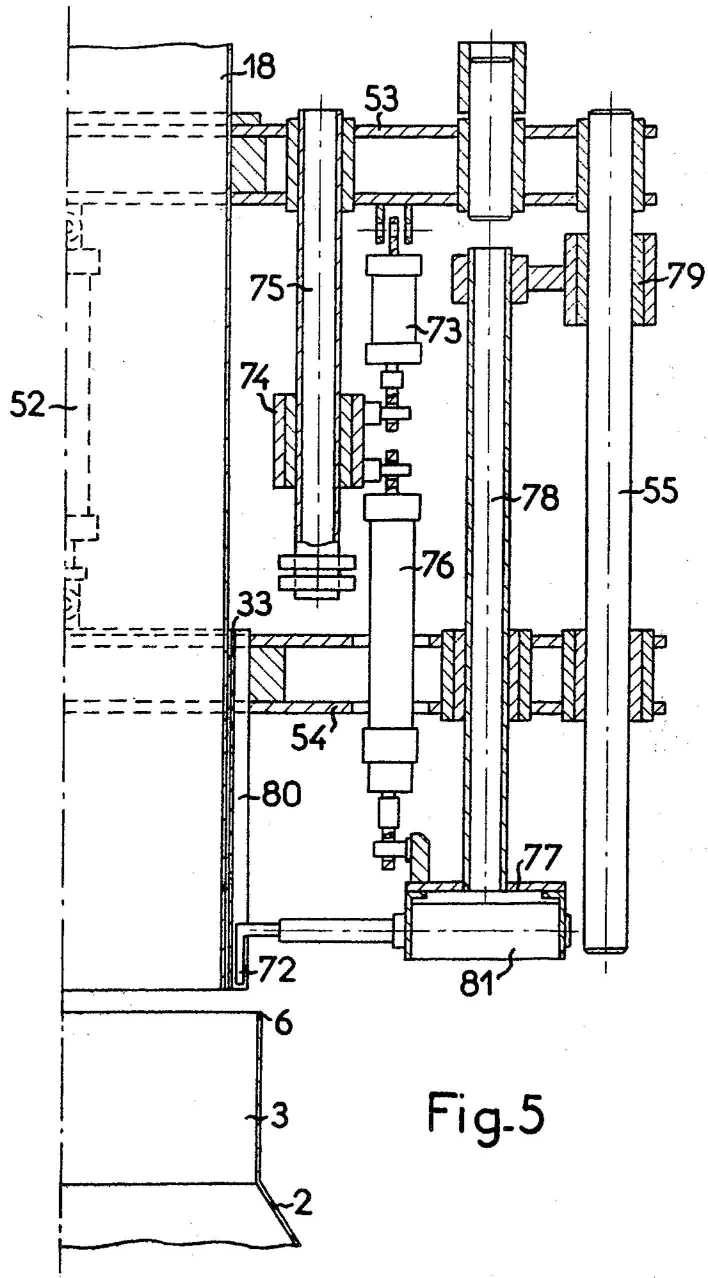


Fig.5

Fig.6

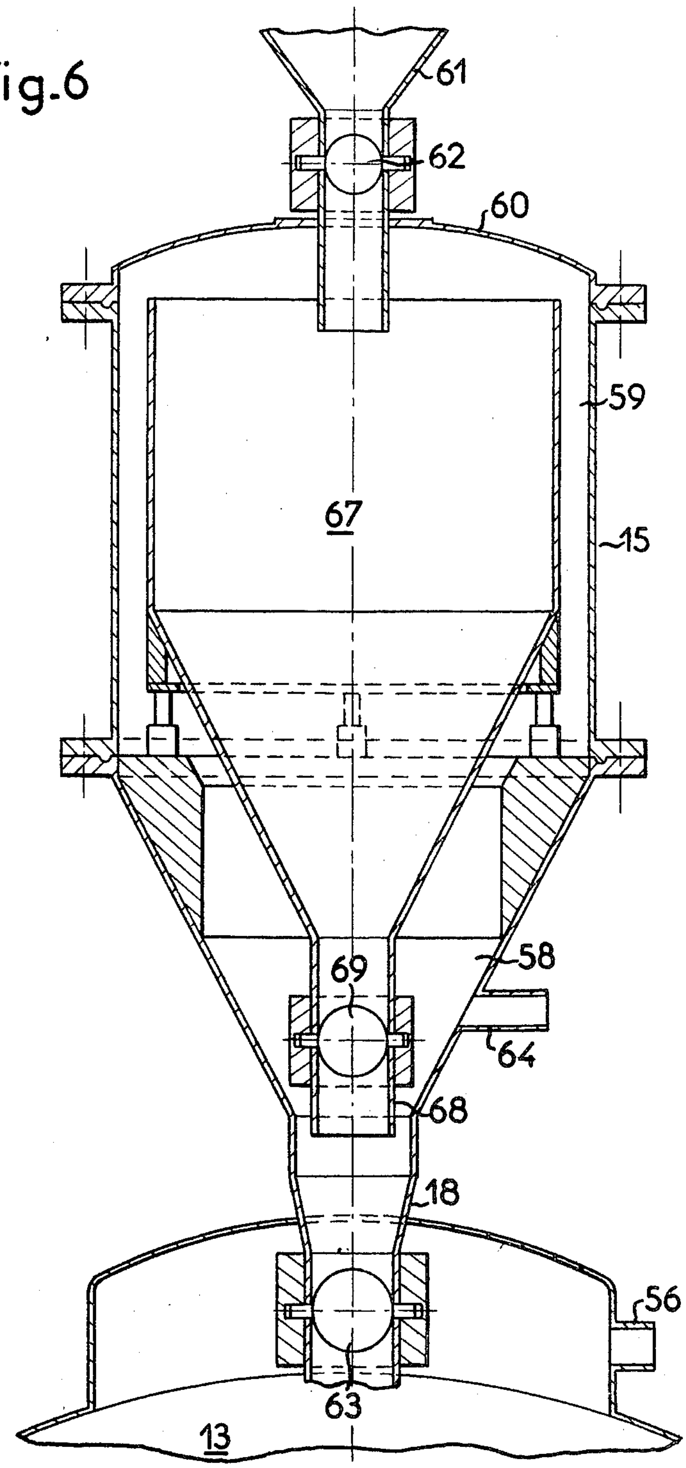
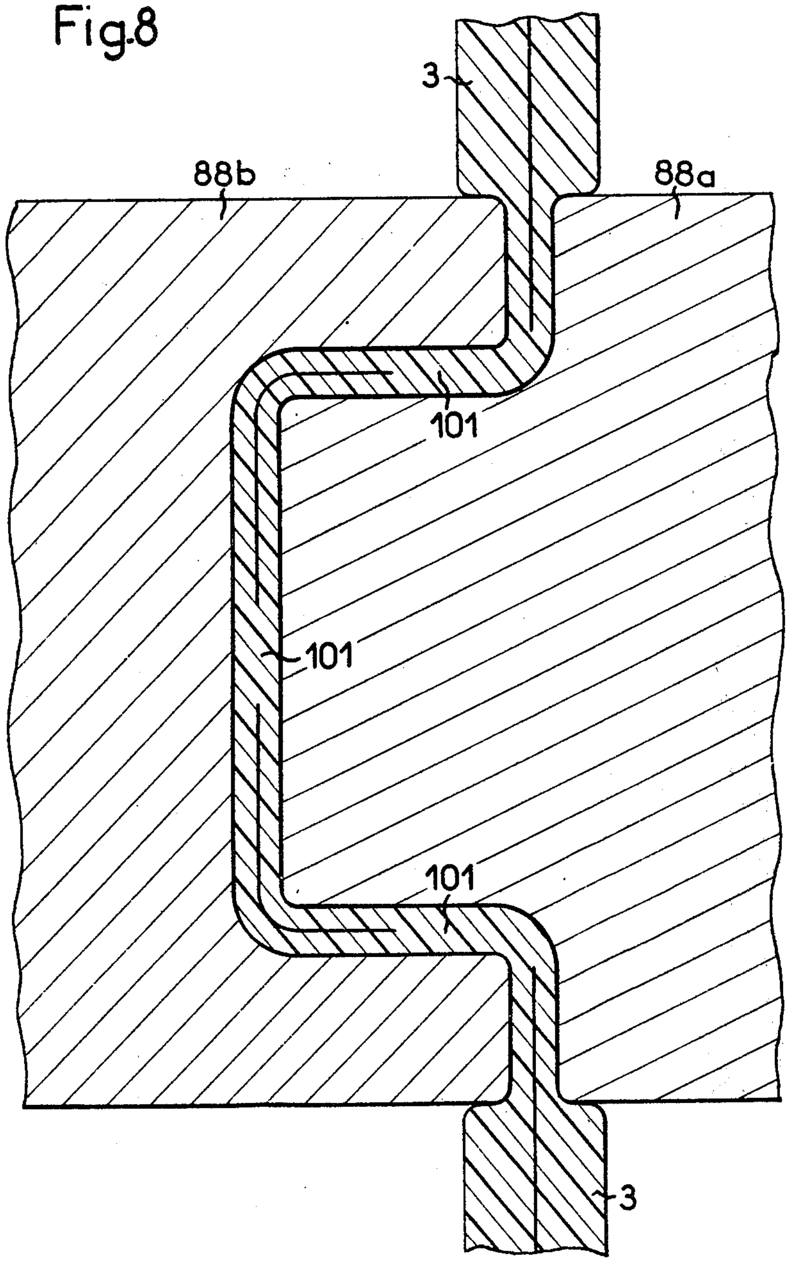


Fig.8



PACKAGING MACHINE

BACKGROUND OF THE INVENTION

This invention relates to packaging materials of low mesh size in bags of flexible material. It relates to a machine for such packaging.

Pulverulent or granulated products, such as cements, lime, sugar, flour and granulated plastics material are normally packaged either in paper, plastics or plasticized jute bags etc. in the case of small amounts (less than 100kg.), or in vessels made of metal, reinforced plastics or reinforced concrete, such as containers or silos, in the case of greater amounts.

Likewise, the transportation of these finely divided products takes place either in bags for small amounts or finely divided amounts or in vessels made of metal or possibly reinforced plastics for larger amounts. In the latter case, whether they are conveyed by road, rail, waterway or sea, the vessels are generally permanently mounted on specialized transportation appliances.

Finally, as concerns handling, the latter is tedious and expensive in the case of small amounts (trans-shipping bags) and generally takes place for products which are packaged or conveyed in bulk, in vessels or silos, either by gravity or by pneumatic means such as compressed air.

The traditional manner of dealing with these products produces numerous drawbacks. Within the field of packaging, these drawbacks are the very expensive necessity of putting the products into bags, or storage and ensilage installations, as well as the very reduced possibility of storage, or even preserving certain products such as quicklime. In the field of transportation, traditional methods require considerable investment in containers as well as a specialization of the transportation equipment. Finally, in the field of handling, one is frequently forced to handle large finely divided quantities, which is clearly more logical.

To obviate these drawbacks, it has been proposed to place the product to be packaged in an enclosure of plastics material in which a vacuum has been created and to displace the load formed in this way by means of a nozzle placed on the upper side of the load and connected to a vacuum-pump.

This known method which has numerous advantages with respect to previous methods, particularly as regards simplification of handling and improving conditions for preserving oxidizable products, nevertheless has drawbacks when it is carried out.

Whereas it is relatively easy to create a partial vacuum in a plastics enclosure containing a material with a large mesh size, for example gravel, by means of a pump directly connected to this enclosure, it is indispensable to interpose a filter when the material packaged has a low mesh size.

Moreover, in this case, the time required for creating the vacuum does not make it possible to envisage an economical industrial exploitation. Indeed, the duration of the operation depends on the volume to be packaged and on the pressure drop undergone by the evacuated air, this pressure drop being particularly dependent on the dimensions of the inter-granular spaces. In the case of a material having a low mesh size, these dimensions are very reduced and even tend to decrease as the value of the vacuum increases, under the action of atmospheric pressure exerted on the walls of the enclosure.

In addition, it is difficult to obtain with this known method, enclosures having sides which are sufficiently large and sufficiently flat for gripping by means of a nozzle under good conditions. When this known method is applied, it is indispensible to use a sheet of very flexible plastics material as the enclosure, in order that this enclosure may deform when the vacuum is established in the material which it contains, causing a decrease in volume occupied by the latter; the enclosures obtained have numerous surface irregularities which are all the more troublesome since the gripping nozzle must bear against a large surface when the load to be handled is considerable.

It is a general object of the invention to remedy these drawbacks by new means for packaging materials of low mesh size under vacuum.

SUMMARY OF THE INVENTION

According to the invention there are provided means for packaging materials having a low mesh size, and particularly packaging them in large quantities, in bags of flexible material, by:

a. pressing at least one part of the periphery of each bag against flat rigid walls;
b. establishing and maintaining a vacuum inside the bag;
c. subjecting the bag to vibrations;
d. filling the bag under vacuum with the material to be packaged, from which gas has been previously removed; and
d. sealing the full bag under vacuum.

The new machine comprises:

— flat rigid walls defining an enclosure open at at least its upper part, intended to serve as a support for the bag and for retaining at least one part of the periphery of the latter;
— means for imparting a vibratory movement to said enclosure;
— a first chamber able to be closed hermetically, containing the material to be packaged;
— a pipe for discharging the material contained in the first chamber;
— a second chamber able to be closed hermetically, into which the discharge pipe opens;
— means for maintaining a high vacuum solely in said first chamber or in both the two chambers;
— at least one door for opening the second chamber, allowing introduction of the bag therein and to bring the neck of the latter under the discharge pipe; and
— means for sealing the neck of the bag, provided in the second chamber.

Preferably each bag is inflated before filling to produce its maximum internal volume.

Packaging may also take place with a controlled gaseous atmosphere.

Since, according to the invention, gas is removed from the material to be packaged before the material is introduced into the packaging enclosure, the drawbacks caused by the removing gas from the material already placed in this enclosure are eliminated.

The packaging time itself is shorter, since the volume of gas to be eliminated is less.

In addition, the volume of material does not vary during its packaging and it is possible to give the packaging enclosure a well defined shape before filling, so that it has at least one flat face for gripping by the nozzle. For the same reason, it is thus possible to use containers which are less flexible, thus thicker and stronger than the sheet of plastics material used in the known methods.

BRIEF DESCRIPTION OF THE DRAWINGS

An embodiment of the invention will now be described by way of example, with reference to the accompanying drawings in which:

FIG. 1 shows diagrammatically a perspective view of a packaging machine according to the invention, in its entirety;

FIG. 2 is a central, vertical, sectional view of a detail showing the positioning of a seal of a compressed air supply tube and members for gripping the neck of a bag;

FIGS. 3 and 4 are respectively a fragmentary end view and a fragmentary top view of another detail showing members for gripping the neck of the bag and of a device ensuring their correct positioning;

FIG. 5 is a half view in axial central section of a further detail, showing a telescopic connection of a discharge pipe, of movable hooks and of devices ensuring their correct positioning;

FIG. 6 is an axial sectional view of another detail, showing a weighing chamber for the material to be packaged;

FIG. 7 is a cross sectional view of still another detail, showing one of a pair of heat-sealing heads; and

FIG. 8 is an enlarged sectional view of the walls of the neck of the bag during the sealing along a cross-section of the sealing heads.

DESCRIPTION OF PREFERRED EMBODIMENT

Bags 2 used for packaging material in accordance with the present invention have a shape such that they may be conveyed with reduced volume when they are empty. When they are full, they preferably generally cubic shape, as shown, and have at least one flat side enabling them to be gripped by a suction plate.

Good results have been obtained with substantially cubic bags 2 made from flexible polyethylene of 1 mm. thickness. This thickness is sufficient to make the bag impermeable to gases and to facilitate prolonged storage; it also provides good resistance to impact and to wear.

In order to facilitate handling of the bag by means other than suction plates, it is possible to provide one of its sides with a sunken ring located at the center of the side. Handling of the full bag by means of a ring of this type is enabled by the fact that the differential pressure created by the vacuum established in the bag applies a suction force to the walls of the latter. Around the ring, the wall of the bag has the function of a suction plate on the treated material, provided that it does not deform; to this end, the periphery of the ring is reinforced by an increased thickness of the wall of the bag.

In order to facilitate filling of the bags, an upper end of each bag, as shown in FIG. 1 has a cylindrical neck 3 on a vertical axis, connected to the lateral faces of the bag by a surface in the form of a pyramid.

The bags, as shown, are hung from an endless cable 1, 4 by clips 5, each acting on the wall of a bag in the vicinity of the upper edge 6 of the neck 3 (see FIG. 1).

Near the machine, each bag is manually detached in order to be subjected to an inflating operation intended to provide its maximum internal volume and to eliminate as far as possible the folds which may have formed on its outer surface and which could be detrimental to subsequent manipulation by a suction plate.

The neck 3 of each bag is engaged manually on the lower end portion 8 of a vertical tube 7 at the upper end of which a blower 9 blows in air. When the neck 3 and the lower end 8 are located in the necessary relative positions, a microswitch (not shown) causes inflation of an annular seal 10 placed around and secured to the tube 7, at its lower end 8 (see FIG. 2).

This seal 10, shown deflated in FIG. 2, bears against the inner wall of the neck which it keeps on the air supply tube 7.

The same air supply tube 7 is used to put each bag in position in the machine proper. To do this, the supply tube is mounted to slide on parallel guide bars 11 and 12 which make it possible to supply the bag above the machine and the lower end portion 8 of each tube 7 has telescopic, slidable fit with the tube itself to lower the bag into the machine.

The machine proper comprises two identical packaging chambers 13 and 14, surmounted respectively by chambers 15, 16. Each chamber 15, 16 is disposed for removing gas from, and for weighing, the material to be packaged. The packaging chambers 13, 14 are connected to the degassing and weighing chambers 15, 16 respectively, by vertical pipes 18, 19 for discharging the material to be packaged.

The two packaging chambers 13 and 14 are located side-by-side in a single cylindrical enclosure 17 on a horizontal axis. They are separated from one another by a hermetic transverse partition 17', but are interconnected by a pipe 56 provided with a valve 57 whose purpose will be described hereafter. The two ends of the enclosure 17 may be closed hermetically by vertical circular closure means or doors 20 and 21, mounted on ball sockets sliding on horizontal steel bars 22 and 23, 24 and 25, and disposed to be moved along these bars by jacks such as 26.

As shown in FIGS. 1 and 4, each door, for example the door 20, is rigidly connected with a vertical basket or enclosure 27 whose inner dimensions are the outer dimensions of the cubic part of the bag and whose upper end is open, in order to facilitate the introduction of a bag 2 vertically, by means of the telescopic air supply tube 7, 8 when the door 20 is open. It is the purpose of the basket 27 to retain the walls of the bag during the filling, in order to prevent the formation of folds which may be detrimental to subsequent gripping by means of a suction plate. In the vicinity of its base, each basket or enclosure 27 is provided with a vibrating table 92 intended to facilitate settling of the material in the bag 2 during packaging.

In a preferred embodiment of the machine, the basket 27 is also open at one of its side faces, for example the side 32, in order to facilitate the subsequent gripping of the filled and sealed bag by a device having a vertical suction plate such as 28. When the door 20 is closed, a vertical plate 29, mounted inside the chamber 13 on a horizontal jack (not shown) closes this open side 32 to ensure that the bag 2 is retained over its entire periphery.

FIGS. 3 and 4 show that the end closure door 20 is provided with a device intended to retain the neck of the bag while the bag is filled. In fact, this operation cannot be carried out by the telescopic tube 7, which must be extracted from the neck of the bag before closing the door 20 and after the seal 10 has been deflated.

The neck-retaining device comprises two arcuate members **30** and **31** which, when they are in position, form a horizontal circular ring fitted on the upper edge **6** of the neck of the bag. Each arcuate member comprises a rib **34**, which engages the edge of the neck **6** (see FIG. **2**). An inflatable seal **35**, fitted in the rib, bears against the latter, on the outside, in order to press it tightly against an edge **36** of the rib located inside the neck.

Each of the two members **30** and **31** of the ring is integral with an oblique arm, **37** and **38**, respectively, mounted to rotate about a vertical cylindrical shaft **39** and **40** respectively, integral with a horizontal cross member **45** arranged parallel to the general plane of the door **20**. A jack, **41** and **42** respectively, mounted to rotate, on the one hand, on a vertical pivot, **46** and **47** respectively, integral with the cross member and, on the other hand, on a cam integral with an arm, **43** and **44** respectively, makes it possible to control the movement of the arms **37, 38** between their position retaining the neck **3** and their disengaged position schematically shown at **30***a* and **31***a* respectively. An abutment **48** and **49** respectively (shown in FIG. **4**), integral with the cross member **45**, limits the movement of the cam and makes it possible to obtain a predetermined position for retaining the neck accurately.

In order to facilitate engagement and disengagement of edge **6** with the groove of the ring **35, 36** provided by the members **30, 31**, the cross member **45** supporting the arms **37, 38** is able to move vertically under the action of a vertical jack **50** bearing, on the one hand, against the lower side of the movable cross member **45** and, on the other hand, against a second cross member **51** integral with the door **20**. Guidance of the movable cross member **45** during this vertical movement is ensured by shafts **39** and **40**, extended under the cross member **45** and able to slide in vertical cylindrical apertures in the fixed cross member **51**.

When the door **20** is closed, the bag whose sides are retained by the walls of the basket **17** and by the movable plate **29** and whose neck **3** is retained by the gripping members **30** and **31**, is placed in the filling position, the opening of the neck being located immediately below the pipe **18** for discharging the material to be packaged.

As shown in FIG. **5**, the lower part of the discharge pipe **18** is provided with a telescopic tubular member **33**, coaxial with the pipe **18** and mounted to slide vertically along the latter. The telescopic member **33** is engaged vertically in the neck **3** of the bag before filling the latter and makes it possible to prevent to a maximum losses of material to be packaged from the bag. The vertical movement of the member **33** is controlled by two diametrically opposed synchronised jacks, such as **52**, acting between a fixed frame **53** and a ring **54** integral with the member **33**. The ring **54** is guided in its vertical movement by vertical cylindrical rods such as **55**, on which it is slidably mounted.

As aforementioned, the discharge pipe **18** connects the packaging chamber **13** to the chamber **15** for removing gas and weighing. The two chambers may be separated by a hermetic valve **63** located in the discharge pipe **18** (see FIG. **6**).

The chamber **15** for removing gas and weighing, with which its counterpart **16** is identical, is defined by a wall in the form of a vertical truncated funnel **58** surmounted by a vertical cylinder **59** closed at its upper part by a cover **60**.

A pipe **64** opening in the truncated funnel **58** of the wall, permanently connectes the inside of the chamber **15** and that of the chamber **16** to a source of vacuum **93**, valves **65** and **66** making it possible to isolate either chamber in the case where only half the machine is to be used (FIG. **1**). As noted above, the vacuum source **93** can be replaced by other means for maintaining a controlled gaseous atmosphere, for the packaging of certain finely divided materials.

Opening into the cover **60** is the lower part of a chute **61** which receives the material from which gas is to be removed and which is to be packaged, the chute **61** being able to be separated from the chamber **15** by a hermetic valve **62**. In practice, it is appropriate to always keep the chute **61** full, in order that opening the valve **62**, at the time of introducing material into the chamber **15**, does not cause the simultaneous entrance of too great a quantity of air.

Inside the chamber **15**, the raw material introduced through the valve **62** is collected by a vertical funnel **67**, whose lower part is in the form of a cylindrical pipe **68** coaxial with the discharge pipe **18**, closed by a valve **69**.

The funnel **67** is mounted on a weighing machine of known type, not shown in FIG. **6**, but shown diagrammatically by a dial **70** in FIG. **1** (and by a dial **71** in the case of the degassing and weighing chamber **16**), this device making it possible to introduce into the chamber **15**, then into the packaging chamber **13**, through the intermediary of the valve **69** and valve **63**, the quantity of material corresponding exactly to the quantity to be packaged in one bag. Various stages of this introduction will be described hereafter, at the same time as the operation of the entire installation.

Once the bag has been filled, it is sealed transversely under vacuum in the vicinity of its neck **3** by means of a device contained in the chamber **13** (the chamber **14** contains an identical device).

Previously, it is necessary to give the neck **3**, which is originally cylindrical, a flattened shape in order for it to have two joined walls. For this, as indicated by FIG. **5**, two hooks **72** which are diametrically opposed with respect to the axis of the neck are used, acting vertically in a plane which in this case is perpendicular to the plane of the jacks controlling the telescopic member **33** of the discharge pipe **18**.

These two hooks, located in the vicinity of the lower part of the telescopic member **33** when they are stationary, move downwards at the same time as the latter under the action of two diametrically opposed jacks **73**, each acting between the fixed frame **53** and a sleeve **74** sliding on a stationary vertical cylindrical rod **75**; a vertical jack **76**, which is stationary in this first descending stage of the hook, transmits the movement to the support for each hook, for example to the support **77** of the hook **72**. The support **77** is guided vertically during this movement by a vertical cylindrical rod **78** with which it is integral, said rod sliding vertically in the ring **54** integral with the telescopic member **33** and being integral with a sleeve **79** sliding on the rod **55** for guiding this same ring. The same is true for the second hook. Very accurate guiding of each hook is thus obtained.

Since the telescopic member **33** is fitted as well as possible inside the neck **3** of the bag, it is necessary to provide a vertical groove **80** in its wall for the passage of each hook **72**.

At the end of the first stage of their descent, the hooks **72** are placed on the edge **6** of the neck **3**, inside the latter, at the two ends of the diameter of the latter. They are interposed between the two members **30** and **31** for gripping the neck (FIG. 4).

When the bag is filled, their action of preparing the neck **3** for sealing begins, after raising the telescopic tube **33** and disengaging the members **30** and **31** for gripping the neck. Simultaneously, a horizontal jack **81**, integral with the support for each hook, brings about the action of the hooks at a distance apart on the edge of the neck, whereas the second set of vertical jacks **76** causes a new downwards movement of the hooks, allowing them to remain on the edge of the neck.

The neck is sealed by two rectilinear sealing heads **82**, located horizontally opposite each other, parallel to the two joined walls which form the neck **3** after preparation, i.e. parallel to the vertical plane in which the two hooks **72** act. These two heads, located at the upper part of the packaging chamber **13**, inside the latter, are moved towards the neck by two jacks **96**, (FIG. **1**) acting horizontally below the level in which the hooks **72** act.

FIG. **7** is a cross section of one of the heads **82**. Located inside a U-shaped longitudinal section **83**, whose opening is directed towards the neck of the bag and insulated from this section by a heat-resistant material **84**, is a longitudinal sealing strip **85**. Provided inside the sealing strip **85** is a longitudinal electric resistance element **86**, fixed by a longitudinal plate **87**, made like the strip **85** from a good heat-conducting material.

The active part of the sealing strip **85** projects from the section **83** and it is provided, at the point where it is intended to come into contact with the material strip to be sealed, with a rod **88** of a material intended to transmit the heat necessary for sealing, whilst able to be readily detached from the sealed material, before cooling.

In the case of a bag made from polyethylene of 1 mm. thickness, good results have been obtained using rods **88** of PTFE filled with a conducting material such as bronze, heated to the melting point of the film of polyethylene, namely 130° to 150°C, the strips being applied under a pressure of the order of about 10 kg/cm^2.

Rods **88** firstly cause melting of the wall of the polyethylene, penetrating therethrough under the action of jacks **96**. They have contours **88*a*** and **88*b*** (FIG. **8**) causing a flow of the melted material to promote thorough sealing, for example in the regions **101** of the two joined walls of the neck **3**. The penetration extends for several dozen mm., then it is limited by longitudinal abutments such as **89**, fixed laterally to the section **83**. As they are sufficiently close to each other, they thus cause the sealing proper. An operating process of this type makes it possible to seal walls of great thickness.

An abutment plate **94** is interposed between the sealing strip **85** and the heat insulation **84** located at the base of the section **83**, in order to distribute the stress on the insulation as well as possible. In addition, a sheet of shock-absorbent material **95**, such as cellular rubber, is interposed between the base of the section **83** and the insulation **84** in order to prolong the sealing action by applying slight pressure after the abutments **89** have come into contact.

After sealing, the full bag which has been hermetically sealed may be placed in the open air. A valve, **90** and **91** respectively, FIG. **1**, makes it possible to connect each packaging chamber **13** and **14** respectively, with the open air.

The machine described as an example is provided with a device for discharging full sealed bags. Located at the side of each packaging chamber **13** and **14** is a handling device comprising a suction plate. Each of these devices, for example the arrangement associated with the chamber **13**, is composed of a support **97** on which is mounted a vertical suction plate **28**, capable of rotating with respect to a vertical shaft integral with the support **97**. The support **97** slides on two horizontal rails **98** and **99**, perpendicular to the general direction of the guide bars **22** and **23** of the door **20**. The arrangement is such that the suction plate **28** adheres against the side of the bag left free by the basket **27**, when the door **20** is open. A horizontal jack **100** pivoted on the one hand on the frame of the machine and, on the other hand, on the support **97** of the suction plate, controls the removal of the latter with respect to the basket, the suction plate moving the bag. One rotation of the suction plate **28** thus makes it possible to move the bag to a point where it may be discharged by a known system.

The various stages of operation of the machine are as follows:

The bags **2**, supplied by the supply chain **1**, are manually unhooked in order to be fixed by their neck **3** on the lower end **8** of the vertical blowing tube **7**. As above-described, a micro-switch located on the tube **7** causes the inflation of the seal **10** placed around the lower end **8** of the tube **7**. This seal **10** bears against the inner wall of the neck, which it presses against the tube **7** throughout the period of inflation.

The bag is also retained by the seal **10** whilst being put in position in the basket **27** of the machine. As above-described, this positioning is effected by sliding the tube **7** on guide bars **11** and **12**, this sliding bringing the bag above the basket **27**, then by telescopic elongation of the lower part **8** of the tube **7**, this elongation causing the downwards movement of the bag into the basket.

When the bag is in position in the basket, the jacks **41** and **42**, acting on the cams **43** and **44** respectively, bring about the positioning of the gripping members **30** and **31** above the edge **6** of the neck **3** of the bag, the inner seal **35** being deflated. Then, the jack **50** brings about the downwards movement of the cross member **45** and thus the downwards movement of the two members **30** and **31** which engage the edge **6** of the neck. The inner seal **35** of the gripping members is then inflated, retaining the neck in the stationary position. The seal **10** of the telescopic blowing tube **7** is then deflated and the tube **7** moved upwards.

The door **20** is then reclosed, by the action of the jack **26**. With its closing movement it entrains the basket **27** and the bag which it contains, and the neck of the bag is placed directly below the lower part of the discharge pipe **18** at the end of this closure. The inner door **29** moved by a jack which is not shown, then closes the open side **32** of the basket **27** in order to retain the bag perfectly in the basket.

Since the second packaging chamber **14** is at this time under vacuum, if the two halves of the machine operate alternately, it is possible to open the valve **57**, in order to counterbalance the vacuums in the two packaging chambers **13** and **14**. This makes it possible to make a saving on vacuum, since it is nevertheless necessary to re-establish normal atmospheric pressure in the chamber **14** before opening it.

The telescopic connection **33** of the discharge pipe **18** then moves downwards, under the action of jacks **52** in order to engage in the neck **3** of the bag. Simultaneously, the two hooks **72** complete the first stage of their downwards movement under the action of jacks **73** and are placed on the edge **6** of the neck.

The equalizing valve **57** is then closed. One then opens the valve **63** providing a connection between the packaging chamber **13** and the weighing and degassing chamber **15,** which is always under vacuum due to the action of the pump **93.** At this time, the finely divided material to be packaged contained in the funnel **67** has already been in the chamber **15** for a sufficient period of time to have been degassed: it is thus ready to be packaged.

The valve **69** is then opened and the material to be packaged drops into the bag, in a quantity predetermined at the time of weighing, which is carried out in the chamber **15,** before opening the valve **63.** The bag is filled quickly and without dust, owing to the vacuum and to the short gap separating the outer wall of the telescopic tube **33** from the inner wall of the neck **3**. During filling, a vibrator **92** is started up, which causes settling of the material in the bag and makes it possible to obtain flat faces which bear perfectly against the walls of the basket **27.**

When the bag is full and the weighing funnel **67** is empty, the supply valve **69** and then the connection valve **63** are re-closed.

A new weighing operation may then be undertaken in the chamber **15,** by opening the measuring valve **62** for connecting the chute **61** and the weighing funnel **67.** The output of the supply devices for the chute **61** of material to be packaged is such that this chute is always full, whereby vacuum losses at the time of this introduction are minimal.

The full bag which is located in the chamber **13** is then sealed transversely. Prior to this, jacks **52** bring about an upwards movement of the telescopic tube **33,** the seal **35** for the gripping members **30** and **31** is deflated and these members are returned to their stationary position by the action of the jack **50,** which causes their disengagement from the neck, then of the jacks **41** and **42,** which act at a distance apart. It should be noted that the deflation of the seal **35** should take place by suction, since it is necessary to compensate the vacuum existing inside the chamber **13.** Then, simultaneously, the vertical jacks **76** bring about the downwards movement of the hooks **72,** whereas the horizontal jacks **81** bring about a pulling action of the hooks on the edge of the neck. The neck deforms and at the end of its preparation it is in the shape of two joined walls, which may then be sealed by means of the rectilinear heads **82.**

As above-described, the two sealing heads **82** are brought together by jacks acting horizontally. In a first stage, they penetrate the wall of the neck of the bag by causing this wall to melt, until the abutments **89** are pressed against the wall. In a second stage, when the heads are sufficiently close to each other, the two joined walls are sealed.

Once the bag is sealed, it is easy to disengage the sealing heads **88** by the action of their control jack, the material used for their manufacture preventing any adhesion.

Since the package is sealed under vacuum, it is possible to re-establish atmospheric pressure in the chamber **13.** Previously, for the purpose of economy, the equalizing valve **57** is opened to establish a first partial vacuum inside the chamber **14,** whose operating cycle is alternated with that of the chamber **13.** At the same time, vertical jacks **73** and **76** bring about the return of the hooks **72** to their upper position, whereas horizontal jacks **81** cause them to return to their position in grooves **80** of the telescopic tube **33.** When the vacuums between the two chambers **13** and **14** have been compensated, the equalizing valve **57** is re-closed, then the valve **91** for connecting the chamber **13** to the outside air is opened.

After having retracted the inner door **29,** one may then proceed to open the door **20** by the action of the jack **26.** On opening, the door **20** pulls the basket **27** and the full sealed bag towards the outside.

The jack **100** then causes the translation of the suction plate **28** towards the full bag, the suction plate bearing against the free side of the latter. A vacuum is established between the suction plate **28** and the wall of the bag against which it is applied, a jack lifts the arrangement, then the support **97** of the suction plate is returned to its original position by means of the jack **100.** The suction plate **28** is then caused to rotate on its support to a new position **28*a*** in order to bring the bag into the discharge region; atmospheric pressure is re-established between the suction plate **28** and the bag, which is released.

All the operations are accomplished virtually without any production of dust. In fact, supplying the weighing chamber takes place by suction of the material to be packed, thus without the production of dust and filling of the bag also takes place as above-described.

The above-described operation according to the invention makes it possible to keep losses to a minimum. In addition this operation has proved particularly advantageous in the case where it is intended to pack products having a very low mesh size, or toxic products, whose packaging by known methods is dangerous for the operators.

With a machine of this construction, it is possible to achieve a filling rate of up to one bag per minute. In principle, the two halves of the machine are designed to operate simultaneously, but separate automation is provided for each of them, in order that they may accomplish their operating cycle separately.

I claim:

1. A machine for packaging finely divided material, comprising;

support means for supporting and laterally confining a bag of flexible material, said support means comprising flat rigid walls defining an enclosure open at at least its upper part, to prevent deformation of the bag when the bag is filled with divided material;

means for defining a first chamber, for sealing it tightly and for receiving therein the material to be packaged in the bag; a discharge pipe for discharging the material received in the first chamber from that chamber; means for defining a second chamber and for sealing it tightly, and into which chamber the discharge pipe opens;

means for maintaining a controlled gaseous atmosphere selectively in said first chamber for treatment of the material received therein, and in both chambers for controlled filling of the bag;

closure means for supporting the support means, for enabling introduction of the support means and of the bag thereon into the second chamber, and for positioning a neck of the bag under the discharge pipe to enable filling of the bag, in the controlled gaseous atmosphere, with finely divided material previously treated by exposure to such atmosphere in the first chamber; and

means in the second chamber for sealing the neck of the bag pursuant to the filling of the bag.

2. Packaging machine according to claim 1, further including means for inflating the bag before its introduction into the enclosure.

3. Packaging machine according to claim 2, in which the means for inflating the bag comprise:

a supply tube for compressed air insertable in the neck of the bag; and

inflatable annular seal means surrounding the tube for engaging the inner side of the neck of the bag;

said tube being telescopic and having means for telescopically sliding a lower end portion thereof into said neck.

4. Packaging machine according to claom 1, in which the first chamber comprises means for weighing the material received therein.

5. Packaging machine according to claim 1, in which the first chamber is located above the second chamber and the discharge pipe has valve means for enabling controlled descent of the material by gravity from the first chamber to the second, in said atmosphere.

6. Packaging machine according to claim 1, in which the discharge pipe comprises a telescopic, lower end portion and means for introducing the latter into the neck of the bag to facilitate filling the bag.

7. Packaging machine according to claim 1, in which the second chamber comprises means for retaining the neck of the bag during filling, in predetermined position relative to the discharge pipe.

8. Packaging machine according to claim 1, in which the support means for the bag is integral with the closure means of the second chamber.

9. Packaging machine according to claim 1, in which the second chamber comprises means for retaining the neck of the bag, during filling, in predetermined position and wherein the support means for the bag is integral with the closure means of the second chamber, the means for retaining the neck of the bag during filling comprising arms, each pivoted at one of its ends, on an inner face of the closure means, and means for gripping the neck of the bag on the other end of each arm.

10. Packaging machine according to claim 9, in which each of said arms has an arcuate rib thereon and an inflatable seal located in said rib and engageable with the neck, the arms having means for positioning the rib, relative to the neck to enable and control the engaging of the seal with the neck.

11. Packaging machine according to claim 1, in which the second chamber comprises means for deforming the neck of the bag into a pair of flat joined walls.

12. Packaging machine according to claim 11, in which said means for deforming the neck of the bag comprise two hooks disposed on either side of the discharge pipe, means for introducing said hooks into the neck of the bag, and means for moving said hooks symmetrically away from the discharge pipe, with portions of the edge of the neck engaged by the hooks, to prepare the neck for sealing.

13. Packaging machine according to claim 1, in which said means for sealing the neck of the bag comprise two heatable head means for heat sealing sheets of synthetic plastic material to one another; means for pressing said heated head means in mutually opposite directions against either side of the neck of a bag, of synthetic, plastic material; heat-conductive, low-adhesion rod means on each head means for contact with the neck of the bag, and abutment means for limiting the pressing of the head means against the neck and the resulting depth of penetration of the head means into the neck.

14. Packaging machine according to claim 13, in which each rod has a contour having a contour portion projecting from the rod, whereby, when the two rods penetrate into the neck of the synthetic plastic bag to be sealed, flowing of melted plastic material is produced, relative to the projecting contour portion.

15. Packaging machine according to claim 8, further including means for horizontally ejecting the bag from the support means after filling and sealing of the bag, said support means having a lateral opening for facilitating the ejecting of the bag.

16. Packaging machine according to claim 15, in which the second chamber has inner door means for closing the lateral opening of the support means.

17. Packaging machine according to claim 1, further including an additional subcombination, similar to the first-mentioned one, of a first chamber, a second chamber, a support means, a discharge pipe, a closure means and a sealing means, for filling another bag; and valve means for interconnecting the two second chambers to equalize and control the maintaining of a controlled atmosphere in said two second chambers.

18. Packaging machine according to claim 1 in which the means for maintaining a controlled atmosphere comprises means for maintaining a high vacuum.

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