

(57) Abrégé(suite)/Abstract(continued):

machine and wrapping the film around a forming tube. A tube of plastic film is formed by bonding the edges of the film together and the bottom of the tube is sealed. An initial weight is obtained by weighing the mandrel and the tube of plastic film then a slurry composition is deposited inside the closed tube. The present weight of the mandrel, tube of plastic film and contents of the tube are monitored as the slurry is deposited, and the present weight and the initial weight are compared until a desired weight is reached. After the desired weight is reached, the filled bag is sealed and separated from the tube of plastic film.

ABSTRACT

A slurry product is packaged into a plastic bag using a modified form-fill-seal apparatus. A method for making a plastic bag filled with a desired weight of a slurry material on a form/fill/seal machine, includes drawing a plastic film over a mandrel of a form/fill/seal machine and wrapping the film around a forming tube. A tube of plastic film is formed by bonding the edges of the film together and the bottom of the tube is sealed. An initial weight is obtained by weighing the mandrel and the tube of plastic film then a slurry composition is deposited inside the closed tube. The present weight of the mandrel, tube of plastic film and contents of the tube are monitored as the slurry is deposited, and the present weight and the initial weight are compared until a desired weight is reached. After the desired weight is reached, the filled bag is sealed and separated from the tube of plastic film.

APPARATUS AND METHOD FOR WEIGHING PRODUCT DURING FILLING

BACKGROUND

This invention relates to an apparatus and method that forms a flexible bag, fills it with a slurry composition, and seals the bag for shipping. More specifically, it relates to a form-fill-seal apparatus that quickly and accurately
5 fills the bag to an appropriate weight.

In the construction of buildings, one of the most common elements is gypsum wallboard, often known as drywall, used in the construction of walls and/or ceilings. Walls made from gypsum wallboard are conventionally constructed by affixing the panels to studs or joists, and then filling and
10 coating the joints between panels with a specially prepared composition called a joint compound. This process generally proceeds by placing a taping grade joint compound within the joint formed by the abutted edges of the wallboards and embedding a liquid-permeable tape within the taping compound. When
15 dry (or set), a second coating comprising a topping grade joint compound is applied over the joint. This is sanded lightly, then a third coat applied and conventionally finished. Another grade of joint compound is an all-purpose grade that is used both for embedding the tape and for applying the finish coats. A patterned effect may be given to the finished wall and joint with the
all-purpose joint compound to provide a textured finish.

20 There are two general types of joint compound, setting type and drying type. Joint compound of the setting type sets up and becomes firm when hydration reactions convert calcium sulfate hemihydrate and water into an interlocking matrix of calcium sulfate dihydrate crystals. Excess water evaporates. Drying type compound becomes firm upon the loss of water by
25 evaporation.

Each form of joint compound is sold either as a dry powder mix or in the form of an aqueous slurry. The dry powder includes either calcium carbonate or calcined gypsum and dry forms of appropriate additives. Each form has its advantages depending on what is available at the job site. The
30 dry mix certainly requires the transportation of less material. However, it requires the availability of both water and mixing equipment. Where these

materials are not readily available, or where the job is so small that it is inconvenient to obtain them, a ready-mix joint compound may be the most suitable form of joint compound to use.

Preparation of a ready-mix, setting type joint compound requires additional chemical components compared to a drying type joint compound or a dry mix. However, once water is added to the calcined gypsum, the setting process begins unless it is prevented chemically. Set retarders are added in sufficient quantities to prevent hardening. Prior to use, a set accelerator is added to the ready-mix joint compound to overcome the effects of the set retarder. If a drying-type joint compound has water added, hardening of the slurry can be delayed if the water is not permitted to evaporate. Keeping a drying-type joint compound tightly sealed is sufficient to keep it in a slurry form.

Slurry products have been a challenge for packaging specialists. The product is very heavy due to the weight of the water. It is fluid within the packaging, allowing the weight distribution to shift. If the packaging is ruptured or punctured, slurries tend to leak out, making a mess of other product in the vicinity. Conventionally, ready-mix joint compounds have been packaged in either a plastic pail or a plastic-lined carton. The hard exterior of these packages provides rupture and puncture protection to the product, it gives support to the heavy slurry and it provides a package that is easier to stack on a palette without shifting.

However, these forms of packaging are very expensive compared to a plastic bag. In addition to the cost of the packaging materials, additional equipment, including carton formers, bag inserters, carton sealers, lid placers, doily placers and lid sealers are needed to complete the packaging. Additional labor is needed to operate and maintain these extra machines. The collective footprint of the packaging equipment is large, requiring a large facility and the accompanying capital investment.

Some prior art filling machines form the bag and transfer most of the product to the bag at one station, then move the bag to a second station to be topped-off accurately. U.S. Patent No. 5,979,512 reveals a weighing apparatus for filling bags. Bags are filled substantially full at a first station,

then sent to a second "topping-off" station. Upon arrival at the second station, the bag is weighed by a first set of load cells on a frame that accommodates a variety of bag sizes. Time and additional equipment are needed to move a partially filled bag of slurry to the second filling station. Movement of the bag provides opportunities for spillage or damage of the bag as well. While topping and sealing the bag at a second fill station may save a bit more time at that the first station, the total time needed to fill the bag is not necessarily reduced, and it introduces opportunities for product damage. There will also be a cost associated with additional personnel to operate and maintain the extra equipment.

The prior art reveals little about packaging of slurry compositions. Plastic bags are frequently used for packaging of powdered or granular materials greater than 100 microns in particle size. Joint compound slurry has been packaged in a tube as in U.S. Patent No. 4,436,204. The joint compound is pumped into the tube. Air is removed from the tube and it is tied or crimped shut. A humectant is sprayed in the inside of the package of ready-mix joint compound to maintain uniform moisture content in U.S. Patent No. 5,323,588. In U.S. Patent No. 5,413,154, granular materials are fed by an auger into a gravity fed delivery conduit. A custom product mix is obtainable by programming selected quantities of materials, selected proportions or selected rates. The materials are fed to a transfer line which then moves to a delivery location where the blend is placed in containers. Slurries, such as drilling muds, are optionally made by the addition of a liquid to the granular product.

There is a need in the art for a low-cost packaging alternative to plastic pails and lined cartons for ready-mix gypsum products. There is also a need for a packaging line that accurately measures the product sold by weight. There is yet another need for a packaging system and method that takes up little space and can be operated by a minimum of personnel.

30

SUMMARY OF THE INVENTION

The above-listed needs are met or exceeded by the improved system and apparatus for packaging a slurry material. The system uses a plastic bag at considerably less expense compared to a lined carton or a plastic pail.

More specifically, a slurry product is packaged into a plastic bag using a modified form-fill-seal apparatus. In a broad aspect, the present invention provides a method for making a plastic bag filled with a desired weight of a slurry material on a form/fill/seal machine, comprising: drawing a plastic film over a mandrel of a form/fill/seal machine; wrapping the film around a forming tube; forming a tube of plastic film by bonding the edges of the film together; sealing the bottom of the tube to form an attached bag; weighing the mandrel and the tube of plastic film to obtain an initial weight; depositing a slurry composition inside the closed tube of plastic film using two axially aligned augers positioned on opposing sides of said closed tube, each of said augers positioned inside an auger tube for facilitating movement of material into the closed tube of plastic film without becoming coated on an inside of the forming tube, said augers configured to simultaneously feed said slurry material into said tube; monitoring the present weight of at least the mandrel, tube of plastic film and contents of an attached bag as the slurry material is deposited; comparing the present weight and the initial weight until a desired weight is reached; sealing the attached bag; and separating the filled, sealed attached bag from the tube of plastic film.

The present invention also provides an apparatus for forming and filling a bag of a slurry composition comprising: a first support; a slurry product dispenser mounted to the first support and comprising a hopper and two axially aligned augers positioned on opposing sides of a closed tube, each of said augers positioned inside an auger tube for facilitating movement of the slurry composition into the closed tube, said augers configured to simultaneously feed the slurry composition into the closed tube; a second support; a bag former attached to the second support and comprising a forming tube having a plastic film wrapped thereon and an attached bag descending from the forming tube; load cells associated with exactly one of the first support and the second support, configured to detect the weight of the slurry product as it is transferred from the said first support to said second support; a bag sealer; and a controller in communication

with said load cells, wherein the controller causes slurry product to be dispensed into the attached bag until a target weight is reached, then causes the attached bag to be sealed. In a preferred embodiment, load cells are positioned between an inner frame and an outer frame to determine the weight of at least the mandrel, a closed tube of plastic film and the contents of the plastic film. This system accurately measures the weight added to the attached bag at the end of the film tube.

The method and system of this invention provides fast and accurate filling of bags with slurry. Use of both augers simultaneously speeds filling of the bag. When the bulk auger is stopped, slow filling by the precision auger ensures an accurate amount of slurry is loaded into the bag.

Compared to using conventional packaging, savings are also realized by reducing the amount of equipment needed to package the slurry product. Using a modified form-fill-seal machine, the single machine is all that is needed to form a plastic bag, fill it with slurry, seal the bag and prepare it for shipping. There is no need for carton forming equipment, tiers, bag inserters, carton sealers, lid placers, doily placers or lid sealers. The packaging operation is completed in a much smaller amount of space, allowing part of

the plant to be used for other purposes or requiring a lower capital expenditure.

Fewer people are needed to operate and maintain the packaging equipment because there is less of it. Although the process is automated,
5 workers are still needed to clear jams, perform routine maintenance and supply the machines with raw materials. When there are fewer machines to be serviced, fewer operators and maintenance people are needed.

Yet another advantage of the present invention is the forming, filling and sealing of the bag without moving the bag to another station, reducing the
10 opportunity for spillage or damage to partially filled bags of product.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front plan view of a first embodiment of a form/fill/seal machine of the present invention having loading cells between a primary frame and an inner frame;

15 FIG. 2 is a side plan view of a simplified second embodiment of the present invention having load cells at the base of the primary frame; and

FIG. 3 is a side plan view of a simplified third embodiment of the present invention having load cells at the base of the volumetric filler.

20 DETAILED DESCRIPTION OF THE INVENTION

Directional references described herein refer to the form-fill-seal machine, generally 10 and its components as oriented in FIG. 1. A form-fill-seal machine 10 includes a bag former, a bag filler and a bag sealer. A bag is produced by this machine that is filled with a slurry, such as a gypsum-based
25 ready-mix joint compound.

An apparatus that exemplifies one embodiment is obtainable by modifying a conventional Form/Fill & Seal Machine. A Matrix Pro Max 2024 P Form/Fill & Seal Machine ("2024 Machine") by Matrix Packaging Machinery (Saukville, WI) can be modified to obtain at least one embodiment of this
30 invention. One skilled in the art of designing similar machines would also be able to design and build a form/fill/seal machine having the features described herein.

Referring to FIG. 1, a form-fill-seal packaging machine, generally 10, has supports that bear the weight of particular parts of the machine. The supports can be a frame, a wall, a beam or any device that holds the parts at a convenient height during use. Preferably, one support is a primary frame 12. The material from which the primary frame 12 is made is unimportant, as long as it is sufficiently sturdy to support all components of the packaging machine. Preferably, the primary frame 12 is metal, such as steel, particularly stainless steel. A plurality of vertical supports 14 are part of the primary frame 12, to which other components of the packaging machine are attached. The vertical supports need not be exactly vertical, but are sufficiently vertical to space the machine components into a workable arrangement. The uppermost horizontal portion of the primary frame 12 is a table 16.

The bag former assembly, generally 20, forms a bag 21 from plastic film sheeting 22 from a roll 24. The roll 24 of flexible, sealable plastic film 22 suitable for use in packaging is mounted to the primary frame 12, preferably on an axle 26 that allows it to rotate and freely feed the film 22 to a mandrel 30. One or more pinch rolls (not shown) are used to take up slack as the film 22 comes off the roll 24 and to feed the plastic to an exact length by sensing pre-printed eye-spots. The pinch rolls also provide an appropriate tension for the bag forming process.

The bags 21 are made using any flexible, sealable plastic film 22. Preferred films 22 include polyethylene, polyester and co-extruded nylon, however, any plastic film usable in a form-fill-seal machine can be used. Multi-layer films, such as those having both nylon and polyethylene plies, are particularly useful for large bags 21 where additional strength is needed to carry the weight. Thickness of the film varies from .004" (0.1mn) to about .008" (0.2mn). Preferably, the film sheeting 22 is sized so that the film is sufficiently wide to form the circumference of a tube 32 from which the bag 21 is formed, with an allowance for edges 34 to form a seam 38 to close the tube.

A forming tube assembly, generally 40, shapes the film 22 into the bag 21. The forming tube assembly 40 includes the mandrel 30, a forming tube 42, and at least one mounting plate 44. This assembly determines the size of

the bag 21 to be made. If the bag 21 of a different size is required, it is necessary to change the size of the forming tube 42. Use of a quick release connector (not shown) that is optional so that the forming tube 42 is easily removed for replacement by a forming tube assembly of another size to

5 produce a different size bag 21. Another method of mounting the forming tube 42 is by bolting it to an upper mounting plate 50 that is held in place by mounting plate supports 46. The mounting plate 44 is attached to the upper mounting plate 50 by one or more of the forming tube supports 46 at a point uncovered with the plastic film 22 when the machine is in use. This

10 arrangement allows the forming tube 42 and mandrel 30 to be suspended from the upper mounting plate 50. The forming tube 42 often has a circular cross section, although the use of other shapes is contemplated. One preferred forming tube 42 is a rectangle with semicircular ends. Flat plastic film 22 comes from the roll 24 and pinch rollers and is drawn over the mandrel

15 30, which guides the film as it wraps around the forming tube 42 to form a tube 32. Once the film 22 is wrapped around the forming tube 42, both the forming tube and film pass through an opening in the mounting plate 44. Preferably the forming tube 42 varies from about 10 to about 15 inches (25 to about 38 cm) in width.

20 Next, the edges of the film 22 are brought together and the edge seal 38 is formed with a first sealer 52 to form the substantially continuous tube 32. The edge seal 38 extends along the length of the continuous tube 32 in a direction that is parallel to the longitudinal axis of the forming tube 42. On the finished bag 21, the edge seal 38 runs along the side or back of the bag from

25 top to bottom. The first sealer 52 is often in a vertical position and uses heat to bonds the edges of the film 22 together. A preferred first sealing device 52 is a stream of hot air aimed at the edges 34 of the film, bonding them together. Any type of sealing device, including an impulse sealer or a resistance sealer, could also be used as the first sealer 52. An artisan in the

30 packaging industry will readily recognize that other types of seals, including lap seals and pinch seals are usable in this type of equipment with a suitable choice of forming units.

For ease in changing the forming tube assembly, the first sealing device is mounted to the frame by a swinging arm 54 attached to part of the primary frame 12 or the inner frame 93. The swinging arm 54 moves the first sealing device 52 away from the forming tube 42. This action provides space
5 around the forming tube 42 when the forming tube assembly 40 is changed to a different size to make bags 21 of various sizes. When the new forming tube assembly 40 is in place, the swinging arm 54 is returned to its position with the first sealing device 52 adjacent the forming tube 42.

Optionally, movement of the plastic film 22 along the length of the
10 exterior of the forming tube 42 assisted by one or more bag movers 56. Examples of the bag movers 56 include a motorized feed belt 60, tread or wheel (not shown) that are positioned against the film 22 so that friction from the bag mover 56 pushes the film downwardly along the forming tube 42. An attached bag 62 is the portion of the plastic film 22 at the bottom of the
15 forming tube 42 having a bottom seam 63 so that it is capable of accepting a slurry product 64. Preferably, the feed belts 60 change speed, start or stop, depending on the speed at which the attached bag 62 is being filled with slurry 64. While filling of the attached bag 62 is occurring, the feed belts 60 move the continuous tube 32 slowly, if at all. While the filled attached bag 62
20 is being sealed and cut, the feed belts 60 are stopped. The feed belts 60 move the continuous tube 32 quickly after a filled bag 21 falls away and the attached bag 62 starts to fill. When the attached bag 62 is being topped-off, the fill rate, and thus the rate of movement of the bag, slows. Preferably there are at least two bag movers 56 positioned on opposing sides of the forming
25 tube 42.

The bag mover 56 is operated by a computerized controller 70 that coordinates the operation of the moving parts so that high-speed operation is obtainable. For example, the controller 70 determines the fill rate, the movement of the plastic film 22 and the operation of the one or more sealers.
30 Preferably, the controller 70 is a digital device, such as a microcomputer. However, the use of one or more analog control devices is also contemplated. An especially preferred controller 70 is any one designed for use with Form/Fill & Seal equipment, such as those made by Rockwell Automation

Allen-Bradley & Rockwell Software Brands of Milwaukee, WI. The use of controllers 70 for automation of Form/Fill & Seal processes is well known to those in the art.

The bag filling assembly 72 includes the equipment to dispense the product slurry 64 into the bags 21. A slurry product dispenser, generally 73, is mounted to the first support and comprising a hopper 76 and at least one feed auger 80. A volumetric filler 74 distributes slurry 64 in discrete batches to the hopper or feed tank 76. The hopper 76 continuously feeds the slurry 64 and is preferably in an elevated location so that gravity assists with flow of the slurry. The preferred slurry 64 is a ready-mix joint compound of either the setting type or the drying type. Setting-type joint compound is based on calcium sulfate hemihydrate that is converted to calcium sulfate dihydrate upon the addition of water. A preferred product for use with this invention is SHEETROCK® Brand Lightweight Setting-Type Joint Compounds (USG Corp., Chicago, IL). Calcium carbonate is the primary component of drying-type joint compound. Both are sold in a ready-mix form and are suitable for use with this invention. Other materials, such as drilling mud, that are sold as a slurry or paste are also suitable for packaging in this manner.

Slurry 64 is transported from the hopper 76 to the bag 21 by one or more feed augers 80 positioned within the forming tube 42. A drive (not shown) that is regulated by the controller 70 turns the feed auger 80 to deliver the slurry at appropriate rates during the filling cycle.

In a preferred embodiment, the feed auger 80 is made up of at least two feed augers, a precision auger 82 and a bulk auger 84. The bulk auger 84 is preferably large and moves large amounts of joint compound 64 quickly. During rapid filling of the bag 21, it is also contemplated that both the precision auger 82 and the bulk auger 84 be used simultaneously to increase the rate of slurry 64 transfer. Fine adjustments in the final slurry 64 weight are made by the precision auger 82 alone. Slow filling of the bag by the precision auger 82 is accomplished by using an auger having a smaller diameter, turning it much more slowly than the bulk auger 84 or both. Where two augers 80 are used, both are operated by the controller 70. Preferred auger

fillers are Mateer-Burt 1990 HD Auger Fillers with an electric clutch motor (Wayne, PA).

Optimum auger size depends on the size of the bag 21 and the speed with which it is to be filled. The feed augers 80 are sized to fit within the forming tube 42 and to fill the bag 21 in a reasonable amount of time. For a 5 30 pound (13.6 Kg) bag of joint compound, preferably the bulk auger 84 is approximately 2.5 inches (6 cm) to about 3.5 inches (9 cm) in diameter and dispenses joint compound 64 at the rate of 50 gal/min. An especially preferred bulk auger 84 is about 3 inches (7.5 cm) in diameter and is made by 10 Mateer-Burt. In contrast, the precision auger 82 is about 0.8 inch (2 cm) in diameter to about 1.2 inches (3 cm) in diameter, moving joint compound 64 at the rate of 10 gal/min. The preferred precision auger 82 is 1 inch (2.5 cm) in diameter and is made by Mateer-Burt. Variation in auger diameter of at least 20% is contemplated. If a single auger is used, the preferred auger is a #52, 15 4 inch diameter auger (Mateer-Burt, Wayne, PA). Preferred feed augers 80 for this application were four feet in length (122 cm). These dimensions are variable as the size of the bag 21 changes. In this case, the bag 21 produced was 3 inches (7.6 cm) by 12 inches (30 cm) by 24 inches (61 cm).

Each auger 80 is optionally fit inside an auger tube 86 having an inside 20 diameter that is only slightly larger than the outside diameter of the feed auger. This tube 86 keeps the slurry moving toward the bag without allowing it to become coated on the inside of the forming tube 42. Use of an auger tube 86 also allows the top of the forming tube 42 to be sealed by the upper mounting plate 50. Sealing of the forming tube 42 is preferably to apply a 25 vacuum to the filled attached bag 62, withdrawing unwanted air prior to sealing of the attached bag.

A vacuum tube 92 runs from inside the forming tube 42 to a vacuum pump (not shown) for this purpose. Preferably, air is removed from the attached bag 62 prior to sealing the bag. A preferred vacuum pump is the 30 Industrial Dust Collector by Beckert and Heister, Inc. of Saginaw, MI. There are holes (not shown) in the mounting plate to allow the augers 80 inside the auger tubes 86 to pass from the hopper 76 through the mounting plate 44 to the top of the forming tube 42. The holes should be configured to fit the auger

tubes 86 snugly, including a seal between the auger tube and the mounting plate 44 if necessary. When the vacuum pump is activated, air from the inside of the attached bag 62 and the forming tube 42 is drawn toward the pump. The attached bag 62 is then sealed prior to deactivation of the vacuum pump. Removal of excess air from the attached bag 62 allows it to lay flat when stacked for shipping or on a store shelf.

Slurry 64 from the volumetric filler 74 is deposited periodically into the hopper 76. When the controller 70 calls for the slurry 64 to be put into the attached bag 62, motion of the bulk auger 84 and/or the precision auger 82 causes slurry to be drawn from the hopper 76 down the length of the forming tube 42. During a first period, when movement of a new charge of slurry 64 begins, it is advantageous to move large amounts of product very quickly. At this time, both the bulk auger 84 and the precision auger 82 are moving together to fill the attached bag 62 quickly. However, as the weight of product inside the attached bag 62 approaches the final weight, the bulk auger 84 stops and a second period begins. During the second period, the precision auger 82 alone continues to supply slurry 64 to the attached bag 62. Since the precision auger 82 is smaller than the bulk auger 84, the rate of slurry 64 being added to the attached bag 62 decreases, making it easier to control the final weight dispensed. The second period ends when the attached bag 62 is substantially filled to the weight stated on the bag with the slurry 64.

The bulk auger 84 and the precision auger 82 are positioned to allow both of them to feed slurry 64 simultaneously to the attached bag 62. Both of the augers 80 are supported from a drive mechanism above the hopper 76. They descend through the hopper 76 and the forming tube 42. As the augers 80 rotate, slurry 64 is trapped by the turns of the augers, pushing the slurry from the hopper 76, and down the length of the forming tube 42. At the end of the auger 80, the slurry 64 is pushed from the auger by the slurry behind it, allowing it to fall by gravity into the attached bag 62. Preferably the two augers 82, 84 oppose each other, feeding from two sides of the attached bag 62.

The first period is defined as the time from the start of movement of joint compound slurry 64 into the attached bag 62 until the bulk auger 84

stops. This period is definable in many ways. Time is one useful way to determine the end of the first period. When the apparatus is operating consistently, after a given time approximately the same amount of joint compound slurry 64 will have been loaded into the attached bag 62. Another
5 way of defining the end of the first period is by measuring the amount, either by weight or volume, of the slurry 64 that has been dispensed to the attached bag 62.

Preferably, the end of the first period is determined when at least 75% of the final weight of joint compound slurry 64 is present in the attached bag
10 62. More preferably, at least 80% to about 95% of the joint compound slurry 64 should be present in the attached bag 62 to define the first period. When the end of the first period arrives, the bulk auger 84 stops and the precision auger 82 continues delivery of the joint compound 64 during the second period. The end of the second period is defined by either time, weight of joint
15 compound 64 or volume of joint compound when the attached bag 62 is full. Delivery of the joint compound 64 ceases at that time.

Preferably, filling of the attached bag 62 is monitored by the controller 70 by the weight of the slurry 64 in the bag. Load cells 90 are positioned to detect the changes in weight of the attached bag 62 as the slurry 64 detaches
20 from the end of the feed augers 80 and falls into the bag. The slurry 64 weight is measurable either as it is lost from the feed augers 80 or as it is gained by the attached bag 62. The load cells 90 are positionable anywhere where 1) they bear the weight of exactly one of the feed augers 80 or the attached bag 62; and 2) the slurry is the only part of the weight on the load
25 cells 90 that is changing.

The load cells 90 are in communication with the controller 70 so that the weight on the load cells is detectable by the controller upon demand. Conventional wiring (not shown) is the preferred means of communication, although any means of communication is useful, including infrared beam
30 transmission.

Formation of the bags can be interrupted when the film roll 24 is changed or when the forming tube 42 is changed. When the film 22 approached the end of the roll 24, the film is cut or allowed to be used up.

The machine 10 is shut down and the newly charged film 22 is connected to the preceding film using a splicer (not shown). If necessary, the controller 70 causes the bag mover 56 to advance the film 22 to the end of the roll 24 so that the forming tube assembly 40 is cleared of plastic film. After the film 22
5 flow has stopped, the roll 24 or the forming tube assembly 40 is replaced. Delivery of the slurry 64 ceases during that time. The packaging machine 10 also optionally includes a printing device for printing information, such as the manufacturing date or the lot number, on the film 22. After the bag 21 has been separated from the film 22 and machine 10, it is usually moved on a
10 conveyor to be packaged and/or shipped to users.

Referring to FIG. 1, the load cells 90 are positioned between an inner frame 93 and the primary frame 12. In this position, the load cells 90 bear the weight of at least the forming tube assembly 40, the plastic film 22 on the forming tube 42 or the mandrel 30, and the weight of the slurry 64 in the
15 attached bag 62. The weight of the slurry 64 in the hopper 76 and on the augers 80 is borne by the support for the volumetric filler 74 and not by the load cells.

At the beginning of the first period, the controller 70 reads the weight on the load cells 90 then computes and records the weight thereon. Since a
20 new attached bag 62 has just moved into position, the recorded weight should be the weight of the equipment on the load cells 90 which does not change. The controller 70 causes the drivers of the feed augers 80 to begin feeding slurry 64 to the attached bag 62. Monitoring of the weight of the attached bag 62 is regulated by the controller 70, preferably continuously, but monitoring at
25 discrete intervals is also contemplated. An appropriate time interval will depend upon the size bag utilized and the speed with which the form/fill/seal machine 10 advances the film 22 and fills the attached bag 62. Intervals of up to about 3 seconds between load cell readings are useful for most applications.

30 When the controller 70 computes the weight of slurry 64 added to the attached bag 62 to be about 75% to 80% of the intended final weight, the controller initiates the second period by causing the bulk auger 84 to stop feeding slurry 64. The precision auger 82 continues feeding slurry 64 while

the controller 70 monitors the load cell weight. When the controller 70 computes that the full intended weight of slurry 64 has been added to the attached bag 62, the controller causes all slurry 64 feed to stop, activates the vacuum system to draw air from the attached bag 62 and causes the
5 horizontal top seam 94 of the attached bag 62 to be effected by a second sealer 96.

The second sealer 96 seals the cylinder of film 22 to simultaneously form the top seam 94 of the attached bag 62 and the bottom seam 63 of the next bag 21. Preferably the seam 63 created by the second sealer 96 is
10 oriented in a transverse direction to the axis of the forming tube 42. In many embodiments, the second sealer 96 includes a cutter (not shown) to separate the sealed attached bag from the remainder of the film 22. Any sealing method suitable for a plastic bag is usable, but impulse and resistance sealers are preferred. In some embodiments, the second sealer 96 includes two
15 separate sealers. A top second sealer 97 seals the bottom of an attached bag 62 adjacent to the attached bag that was just filled. A bottom second sealer seals the top of the filled attached bag. The second sealer 96 is optionally positioned at the outlet of the forming tube 42.

An alternate position for the loading cells is shown on FIG. 2. Although
20 the drawing has been simplified, all components of the second embodiment of the form/fill/seal machine, generally 110, are the same as the first embodiment 10, except that the support structure and the placement of the loading cells differ. In the second embodiment 110, like structures have been given like numbers. The weight of at least the volumetric filler 74, hopper 76,
25 feed augers 80 and the slurry 64 therein are is not borne by the primary frame 12 of the machine 110. Another support, such as but not limited to a separate support beam 98 holds the weight of these components. Load cells 90 are positioned under the primary frame 12 supporting the weight of at least the forming tube assembly 40, plastic film 22 and attached bag 62. During the
30 filling process, the weight on the load cells 90 increases as the attached bag 62 fills with slurry 64 from the feed augers 80.

Referring to FIG. 3, a third embodiment, generally 210, of this apparatus demonstrates a weight loss system of measurement. As in the

second embodiment, the components are the same as the first two embodiments, but some are differently positioned. Like parts have been given like numbers in this simplified drawing. In this embodiment, the load cells report the weight of at least the volumetric filler 74, the hopper 76, feed
5 augers 80 and the slurry 64 included therein. The support for the volumetric hopper acts as the support for these features, while the primary frame 12 supports the remaining components. The load cells 90 are positioned between these two supports. At the beginning of the first period, the controller 70 computes and records the weight on the load cells 90. As slurry 64 is
10 discharged from the feed augers 80 to the attached bag 62, its weight is transferred from the load cells 90 to the primary frame 12. Thus the weight on the load cells 90 decreases as the attached bag 62 is filled. When the controller 70 determines that the decrease in weight on the load cells 90 has reached the full intended weight of slurry 64 that is to be transferred to the
15 attached bag 62, the controller 70 causes the second sealer 96 to seal the attached bag 62 and cut it from the plastic film 22.

In use, a product composition is prepared for packaging. The preferred product is a joint compound slurry, however, the use of this process for packaging of a dry powder, such as a joint compound mix, is also
20 contemplated. The bag is formed to receive the product. When a form/fill/seal machine is used, the plastic film is shaped over the mandrel, then is wrapped around the forming tube. As the film is moved by the bag mover, a continuous edge seam is formed to make a continuous plastic film tube. The bottom seal of an attached bag is made when the top of the previous bag
25 is sealed. After the previous bag has been separated from the plastic film, the attached bag is moved into position by a controller to be filled.

Filling the attached bag with the product composition uses at least a bulk auger and a precision auger. Both augers are managed by the controller, which also monitors the weight of product being deposited into the
30 attached bag using load cells. At least the bulk auger, and preferably both augers, turn to deposit the product composition within the attached bag during a first period. The precision auger only feeds slurry to the bag for a second period. When the target weight has been reached, the controller moves the

attached bag into position and seals the bag. Filling of the bag is completed at this single station or position, without moving of the bag to a different station for topping off or weighing.

- While particular embodiments of the dual auger system for filling a bag
- 5 has been shown and described, it will be appreciated by those skilled in the art that changes and modifications may be made thereto without departing from the invention in its broader aspects and as set forth in the following claims.

What is claimed is:

1. A method for making a plastic bag filled with a desired weight of a slurry material on a form/fill/seal machine, comprising:
 - drawing a plastic film over a mandrel of a form/fill/seal machine;
 - wrapping the film around a forming tube;
 - forming a tube of plastic film by bonding the edges of the film together;
 - sealing the bottom of the tube to form an attached bag;
 - weighing the mandrel and the tube of plastic film to obtain an initial weight;
 - depositing a slurry composition inside the closed tube of plastic film using two axially aligned augers positioned on opposing sides of said closed tube, each of said augers positioned inside an auger tube for facilitating movement of material into the closed tube of plastic film without becoming coated on an inside of the forming tube, said augers configured to simultaneously feed said slurry material into said tube;
 - monitoring the present weight of at least the mandrel, tube of plastic film and contents of an attached bag as the slurry material is deposited;
 - comparing the present weight and the initial weight until a desired weight is reached;
 - sealing the attached bag; and
 - separating the filled, sealed attached bag from the tube of plastic film.
2. The method of claim 1 further comprising weighing the contents of the attached bag using load cells.
3. The method of claim 1 wherein said second sealing step and said separating step occur substantially simultaneously.

4. The method of claim 1 wherein said monitoring step is performed by a computerized controller.

5. The method of claim 1 further comprising sending the sealed bag for stacking on a palette.

6. An apparatus for forming and filling a bag of a slurry composition comprising:

a first support;

a slurry product dispenser mounted to the first support and comprising a hopper and two axially aligned augers positioned on opposing sides of a closed tube, each of said augers positioned inside an auger tube for facilitating movement of the slurry composition into the closed tube, said augers configured to simultaneously feed the slurry composition into the closed tube;

a second support;

a bag former attached to the second support and comprising a forming tube having a plastic film wrapped thereon and an attached bag descending from the forming tube;

load cells associated with exactly one of the first support and the second support, configured to detect the weight of the slurry product as it is transferred from the said first support to said second support;

a bag sealer; and

a controller in communication with said load cells, wherein the controller causes slurry product to be dispensed into the attached bag until a target weight is reached, then causes the attached bag to be sealed.

7. The apparatus of claim 6 wherein said two axially aligned augers include a bulk auger and a precision auger.

8. The apparatus of claim 7 wherein the bulk auger is from about 2.5 inches to about 3.5 inches in diameter.

9. The apparatus of claim 7 wherein said precision auger is from about 0.8 inches to about 1.2 inches in diameter.

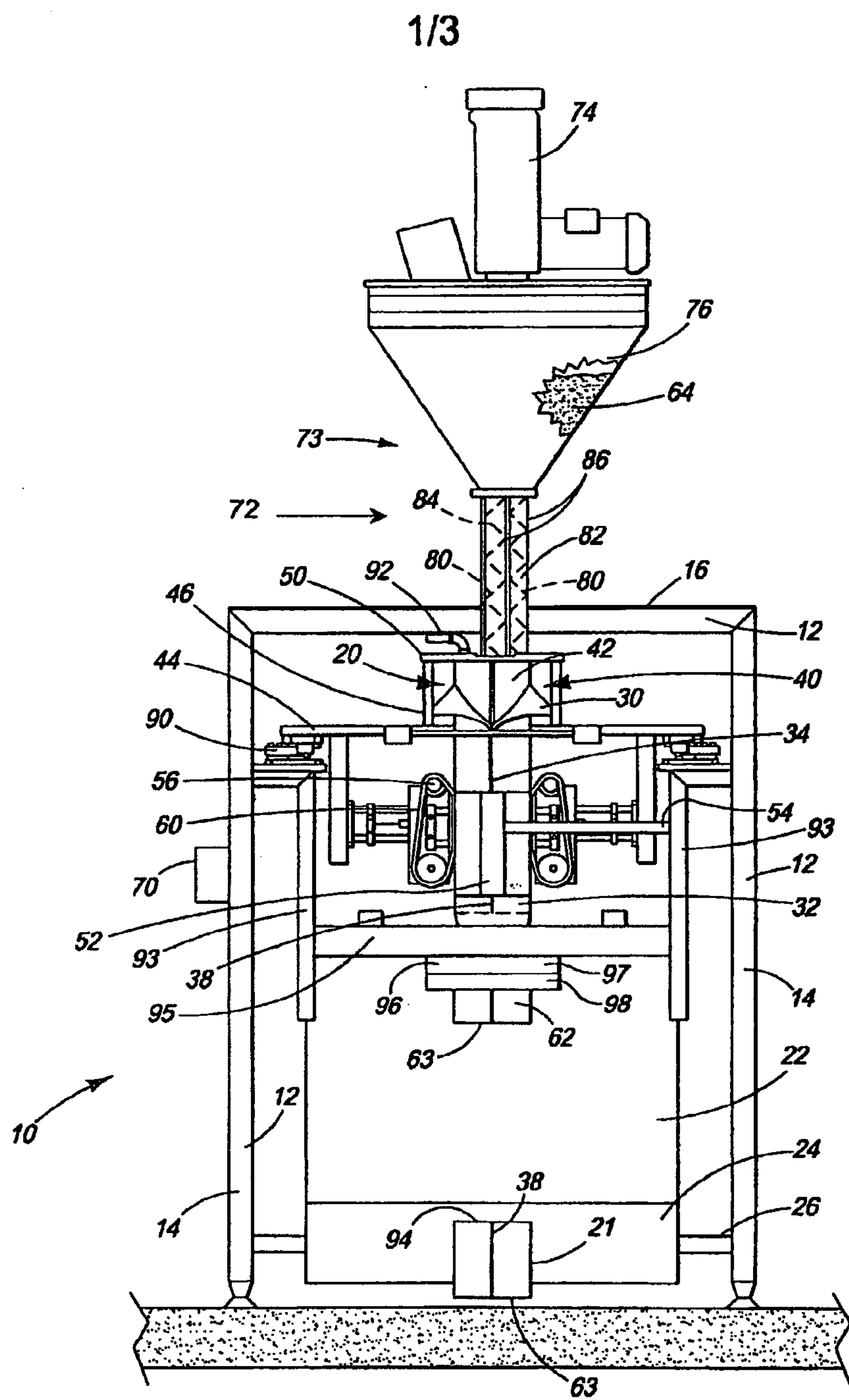
10. The apparatus of claim 6 wherein said bag former comprises a forming tube assembly.

11. The apparatus of claim 10 wherein said first support is a primary frame and said second support is an inner support assembly that contacts said primary frame only at a load cell.

12. The apparatus of 10 above wherein said forming tube assembly further comprises a forming tube, a mandrel and at least one mounting plate.

13. The apparatus of claim 6 wherein said frame further comprises an upper mounting plate and said upper mounting plate is supported by said mounting plate with forming tube supports.

14. The apparatus of claim 6 wherein said frame further comprises a swingable arm mounted to said frame that supports at least one component of the sealer.



2/3

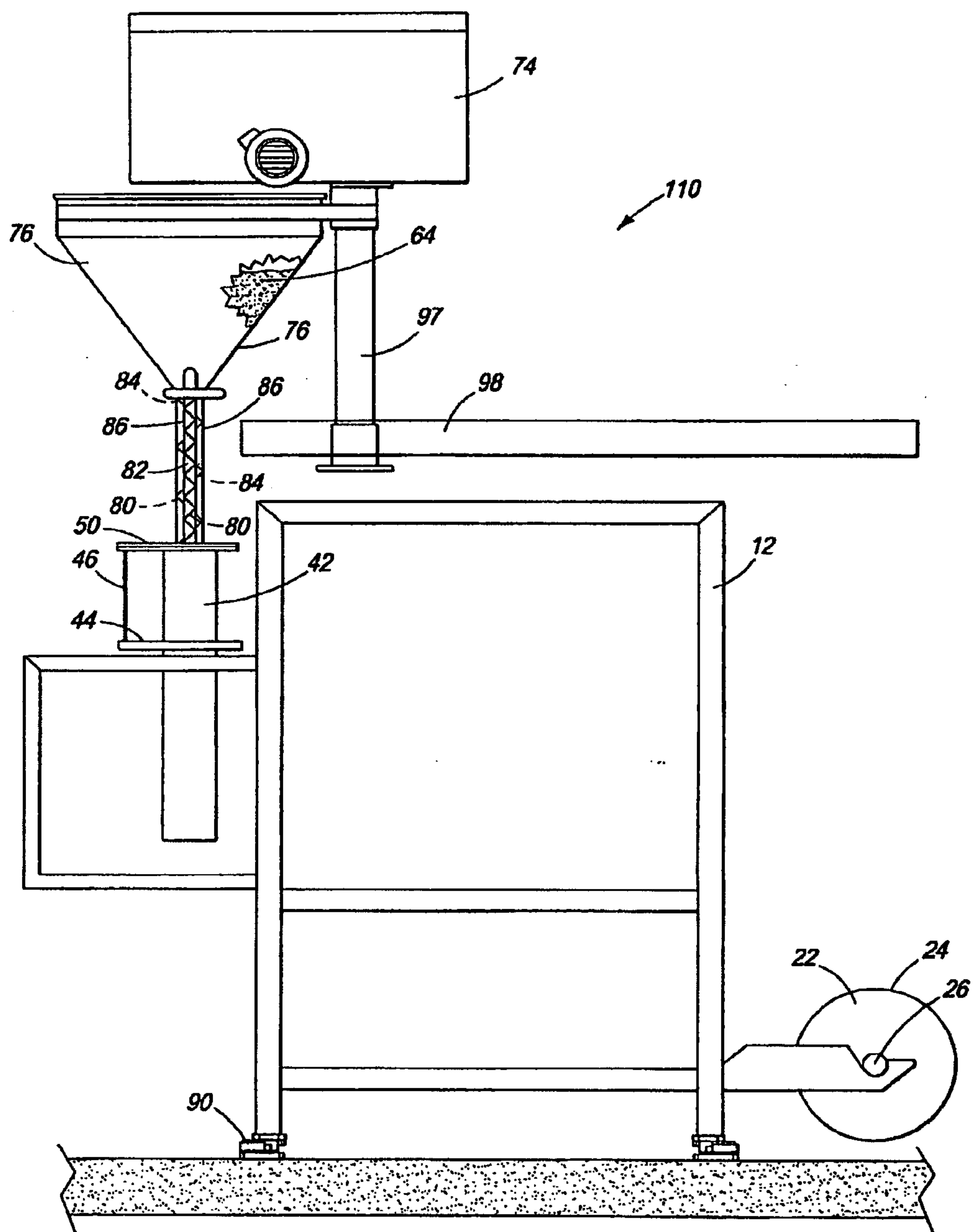


FIG. 2

3/3

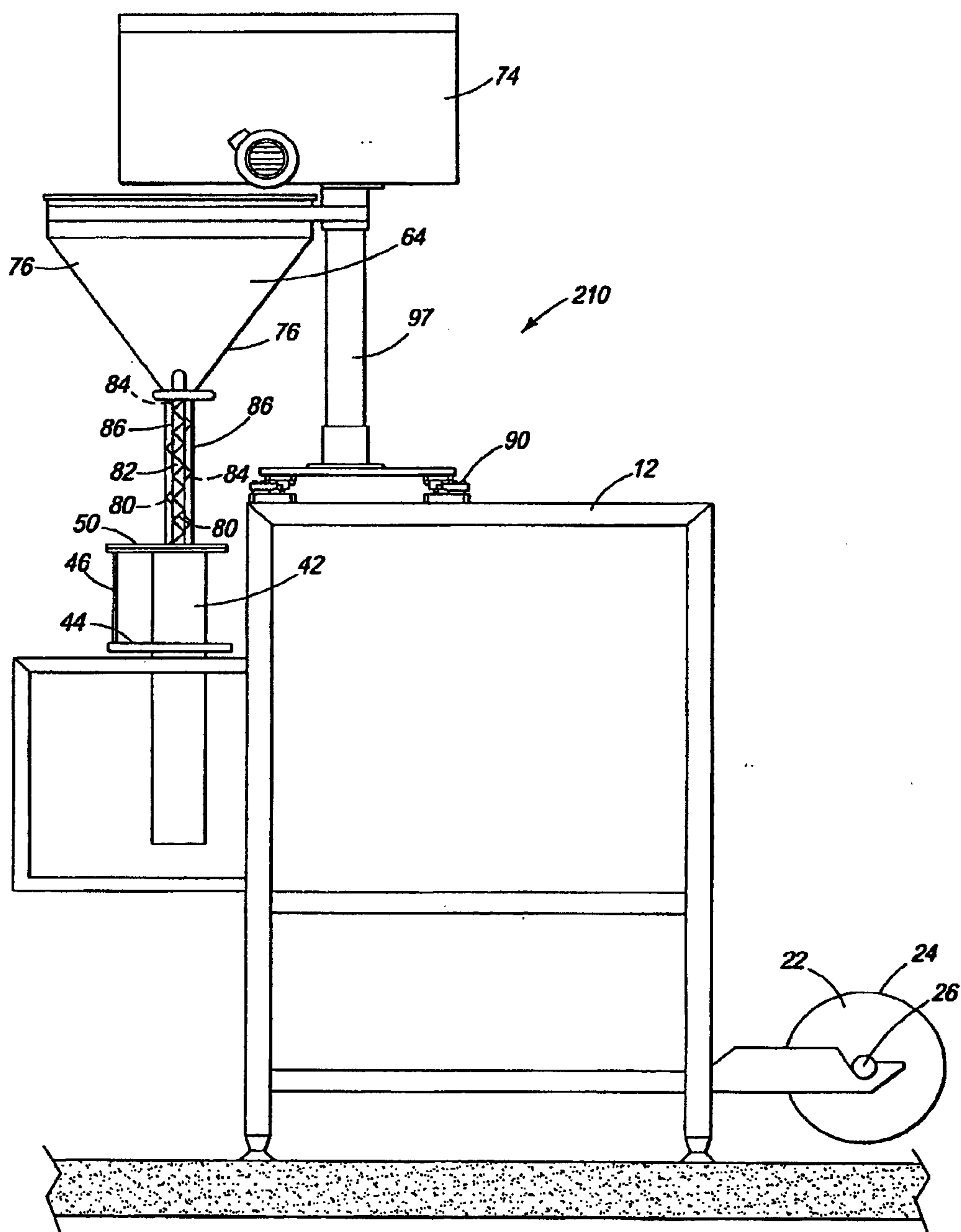


FIG. 3

