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(54) APPARATUS AND METHOD FOR WEIGHING PRODUCT DURING FILLING

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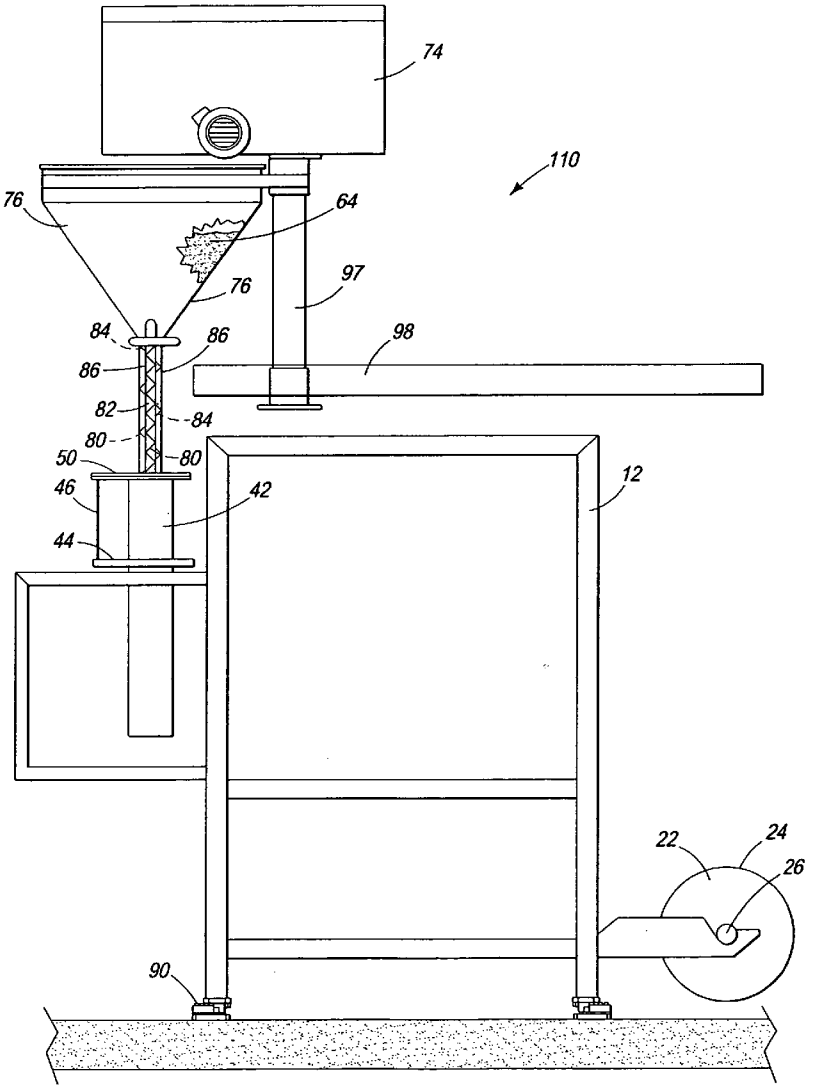
(57) **ABSTRACT**

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.



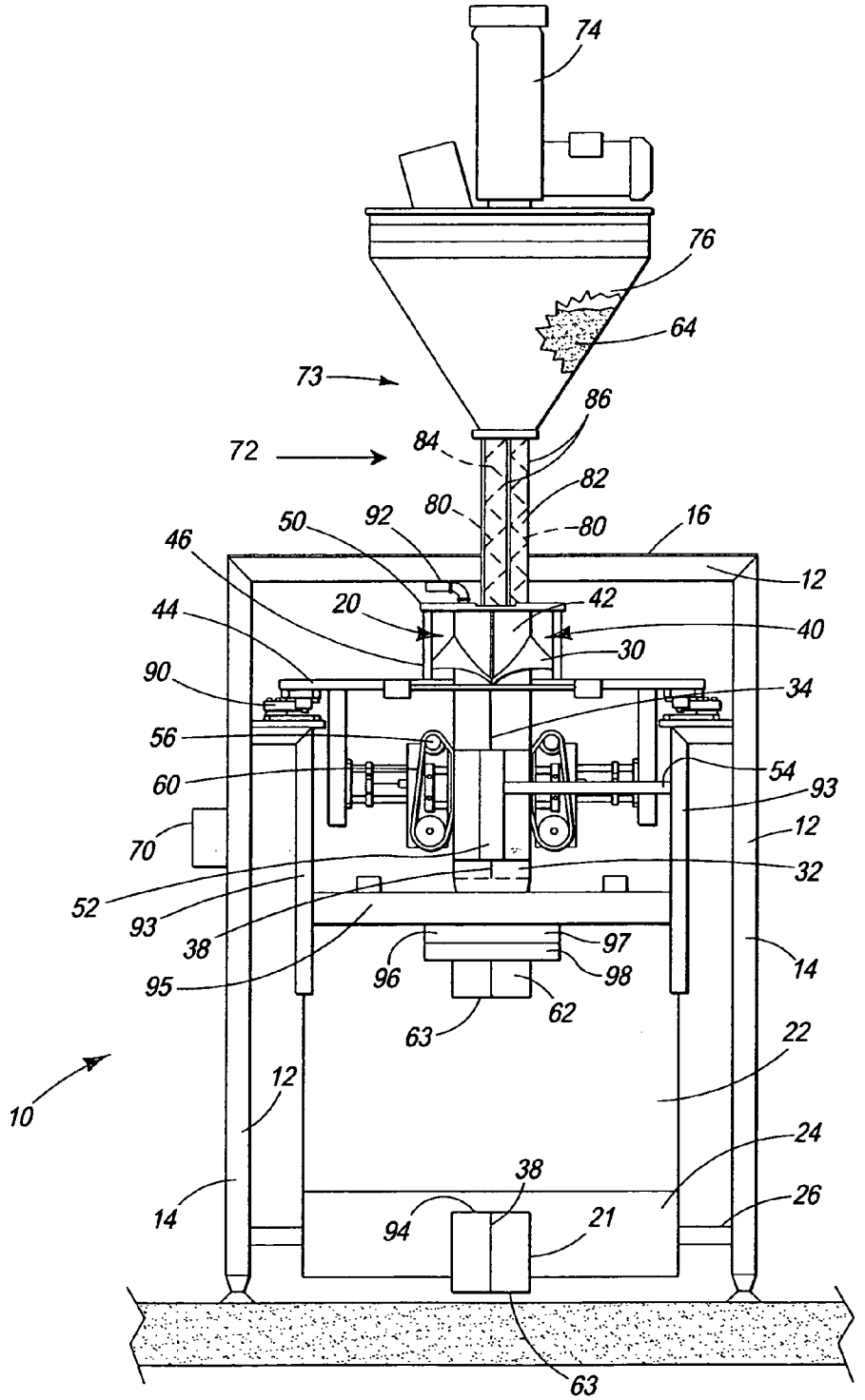

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FIG. 1

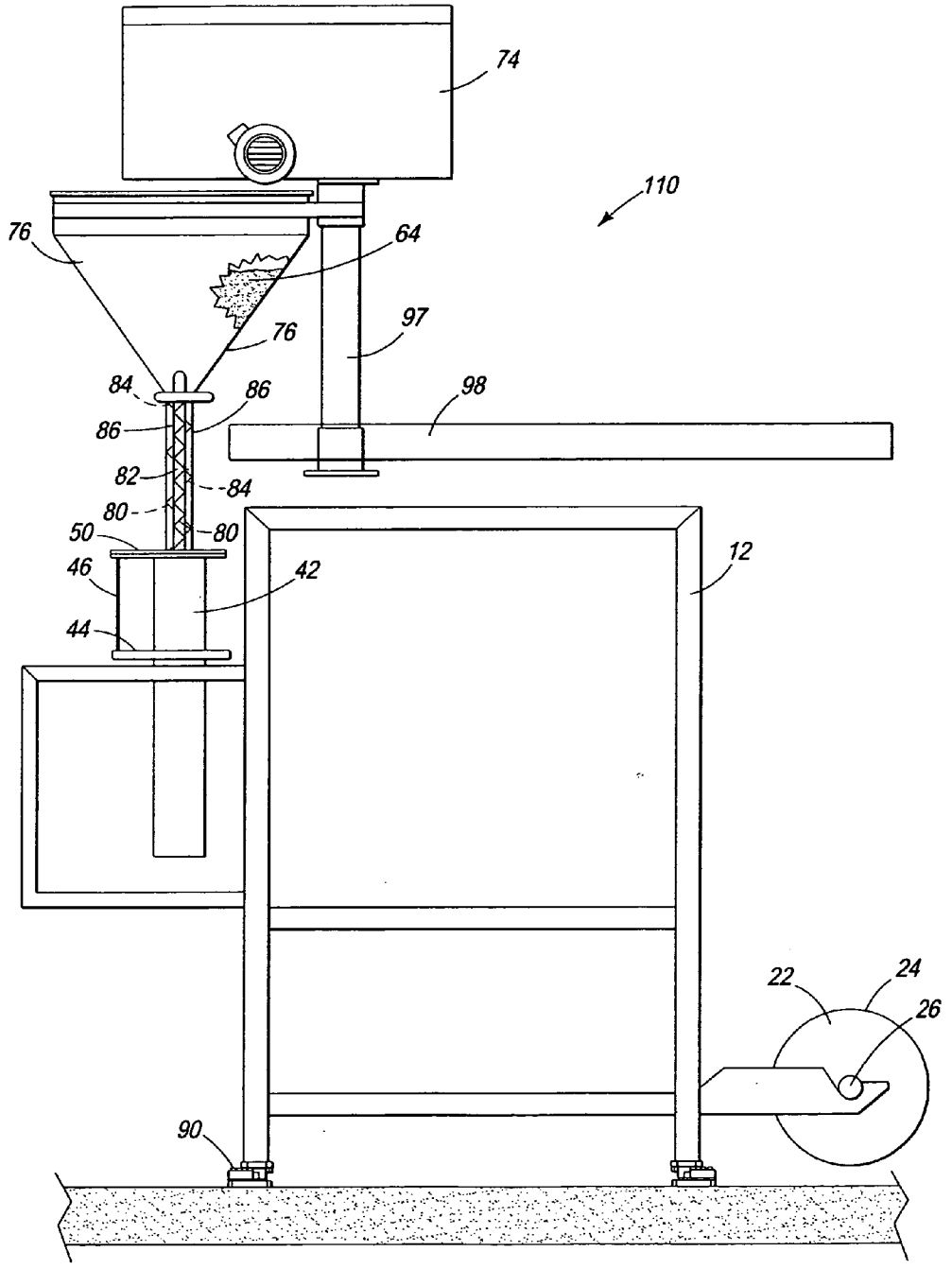

FIG. 2

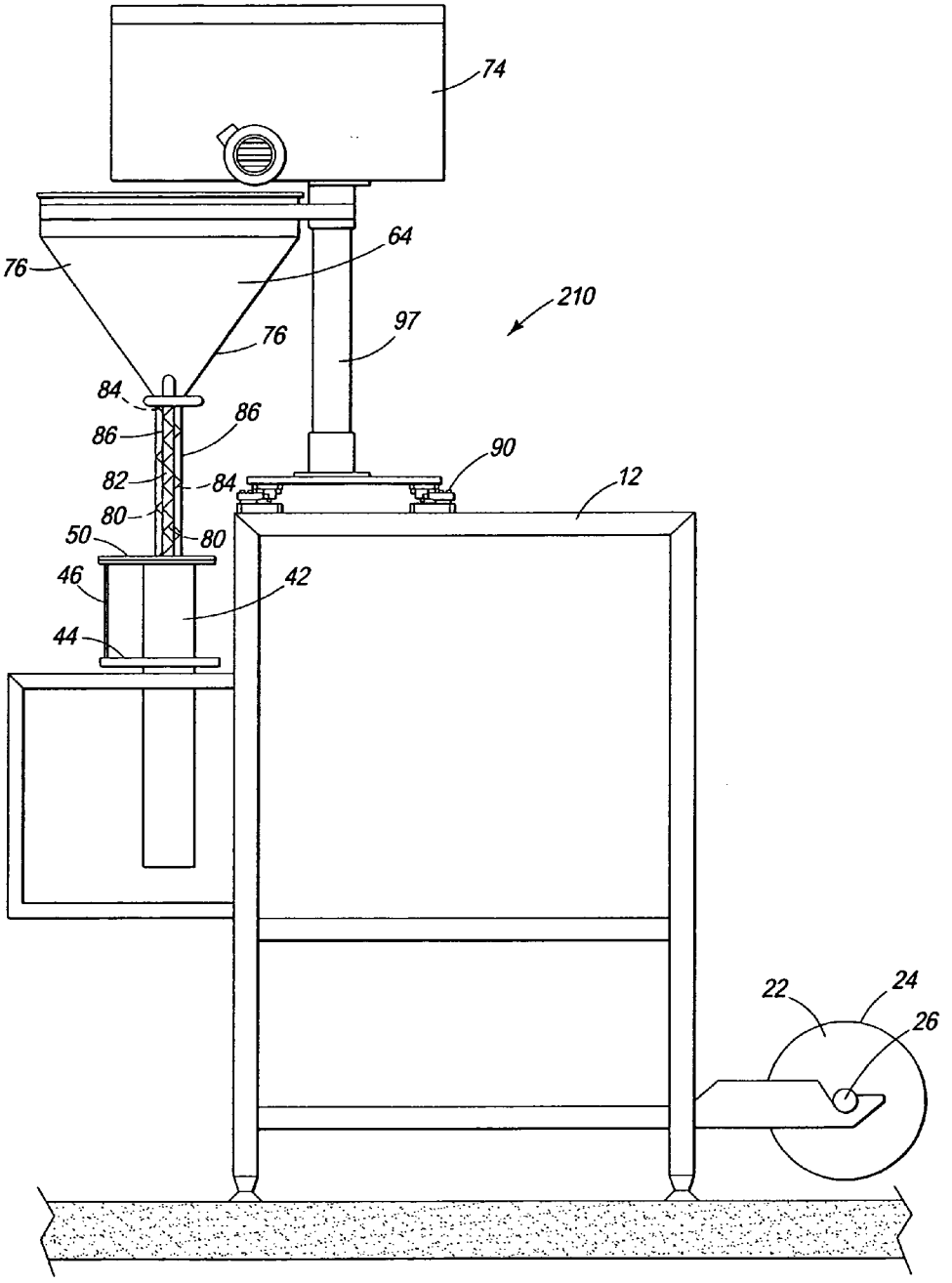

FIG. 3

APPARATUS AND METHOD FOR WEIGHING PRODUCT DURING FILLING

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application is being filed concurrently with U.S. Ser. No. 11/_____ (Attorney Ref. 2033.74641/3926B), hereby incorporated by reference.

BACKGROUND

[0002] 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 fills the bag to an appropriate weight.

[0003] 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 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 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.

[0004] 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 evaporation.

[0005] 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 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.

[0006] 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.

[0007] 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.

[0008] 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.

[0009] 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. Pat. 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.

[0010] 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. Pat. 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. Pat. No. 5,323,588. In U.S. Pat. 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.

[0011] 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.

SUMMARY OF THE INVENTION

[0012] 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.

[0013] More specifically, 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.

[0014] 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.

[0015] 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.

[0016] 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.

[0017] Fewer people are needed to operate and maintain the packaging equipment because there is less of it. Although the process is automated, 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.

[0018] 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 opportunity for spillage or damage to partially filled bags of product.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] 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;

[0020] 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

[0021] 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.

DETAILED DESCRIPTION OF THE INVENTION

[0022] 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 ready-mix joint compound.

[0023] 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, Wis.) can be modified to obtain at least one embodiment of this 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.

[0024] 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**.

[0025] 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.

[0026] 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 0.004" (0.1 mn) to about 0.008" (0.2 mn). 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.

[0027] 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 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 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 **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.

[0028] 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 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 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.

[0029] 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 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**.

[0030] Optionally, movement of the plastic film **22** along the length of the 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 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** 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 tube **42**.

[0031] 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. 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, Wis. The use of controllers **70** for automation of Form/Fill & Seal processes is well known to those in the art.

[0032] 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, Ill.). 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.

[0033] 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.

[0034] 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.).

[0035] 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 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 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, 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).

[0036] Each auger **80** is optionally fit inside an auger tube **86** having an inside 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 vacuum to the filled attached bag **62**, withdrawing unwanted air prior to sealing of the attached bag.

[0037] 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 Industrial Dust Collector by Beckert and Heister, Inc. of Saginaw, Mich. 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** snuggly, 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.

[0038] 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**.

[0039] 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**.

[0040] 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 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**.

[0041] 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 **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 compound **64** or volume of joint compound when the attached bag **62** is full. Delivery of the joint compound **64** ceases at that time.

[0042] 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 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 cells **90** that is changing.

[0043] 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 transmission.

[0044] 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** 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 conveyor to be packaged and/or shipped to users.

[0045] 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 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.

[0046] 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 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 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.

[0047] 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 horizontal top seam **94** of the attached bag **62** to be effected by a second sealer **96**.

[0048] 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 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 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**.

[0049] An alternate position for the loading cells is shown on FIG. **2**. Although 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**, 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 filling process, the weight on the load cells **90** increases as the attached bag **62** fills with slurry **64** from the feed augers **80**.

[0050] 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 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 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 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**.

[0051] 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 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 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.

[0052] 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 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.

[0053] While particular embodiments of the dual auger system for filling a bag 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.

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;

monitoring the present weight of at least the mandrel, tube of plastic film and contents of an attached bag as the slurry 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** wherein said depositing step includes using at least one auger to move the slurry from a hopper to the bag.

3. The method of claim **1** further comprising weighing the contents of the attached bag using load cells.

4. The method of claim **1** wherein said second sealing step and said separating step occur substantially simultaneously.

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

6. The method of claim **1** wherein said filling step further comprises positioning the a bulk auger and a precision auger to feed slurry from opposite sides of the attached bag.

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

8. 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 at least one feed auger;

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.

9. The apparatus of claim **8** wherein the product dispenser further comprises a bulk auger and a precision auger.

10. The apparatus of claim **9** wherein the bulk auger is from about 2.5 inches to about 3.5 inches in diameter.

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

12. The apparatus of claim **8** wherein said bag former comprises a forming tube assembly.

13. The apparatus of claim **12** 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.

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

15. The apparatus of claim **8** wherein said frame further comprises an upper mounting plate and said upper mounting plate is supported by said mounting plate with forming tube supports.

16. The apparatus of claim **8** wherein said frame further comprises a swingable arm mounted to said frame that supports at least one component of the sealer.

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