Jan. 26, 1960 J. W. BULLS ET AL 2,922,612

AUTOMATIC VACUUM PACKING OF PELLETIZED CARBON BLACK

Filed Dec. 13, 1955 3 Sheets-Sheet 1

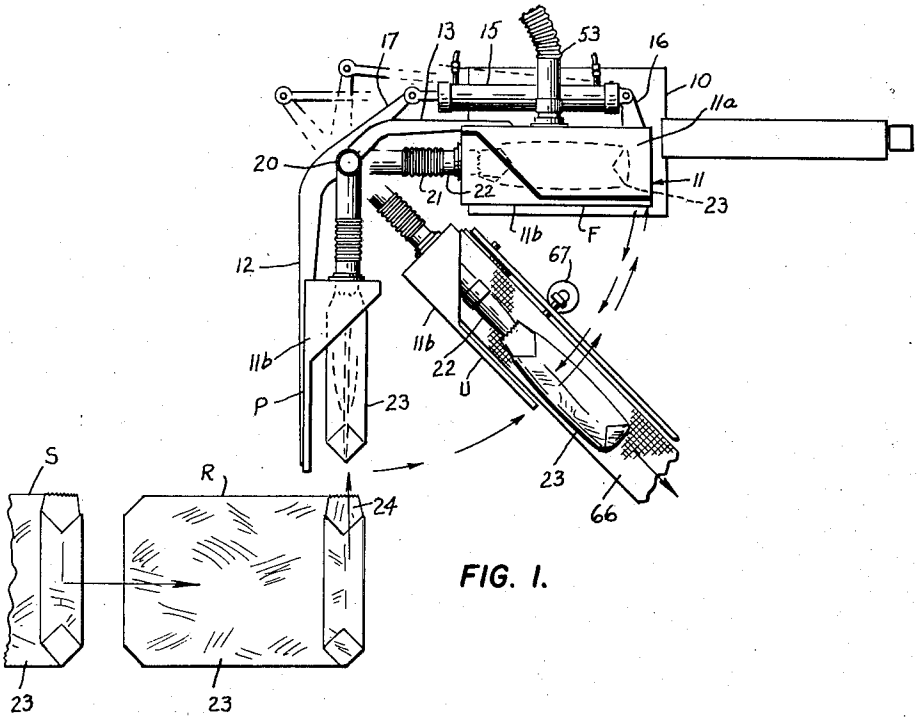


FIG. 1.

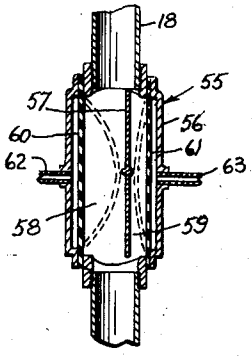


FIG. 3.

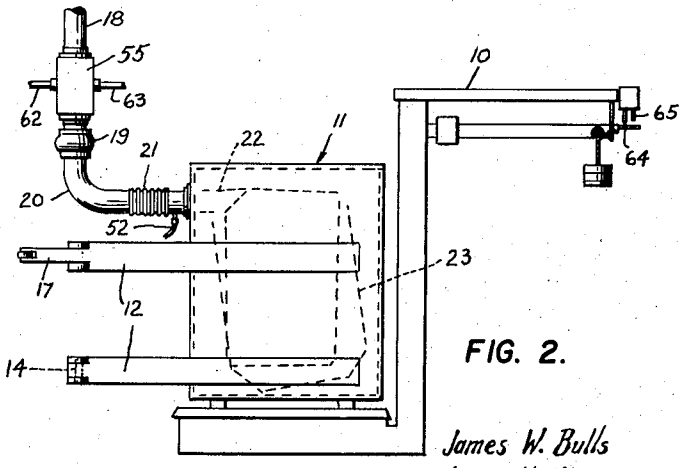


FIG. 2.

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AUTOMATIC VACUUM PACKING OF PELLETIZED CARBON BLACK

Filed Dec. 13, 1955 3 Sheets-Sheet 2

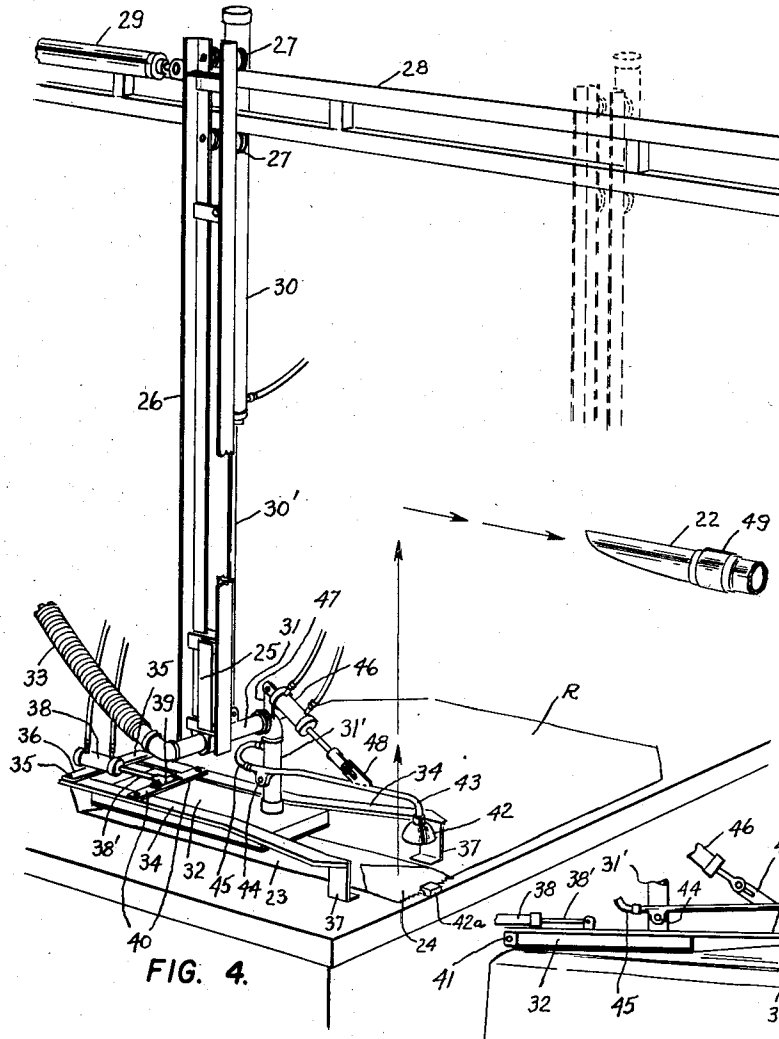


FIG. 4.

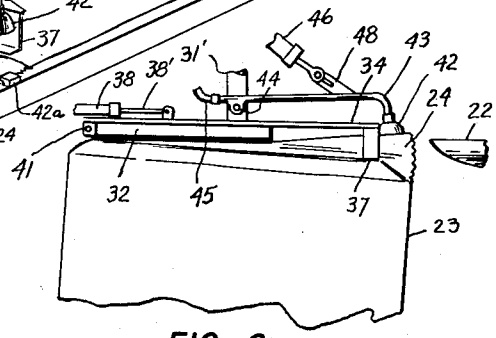


FIG. 6.

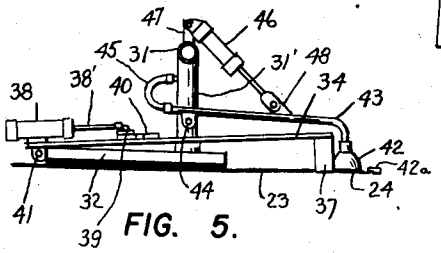


FIG. 5.

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AUTOMATIC VACUUM PACKING OF PELLETIZED CARBON BLACK

Filed Dec. 13, 1955 3 Sheets-Sheet 3

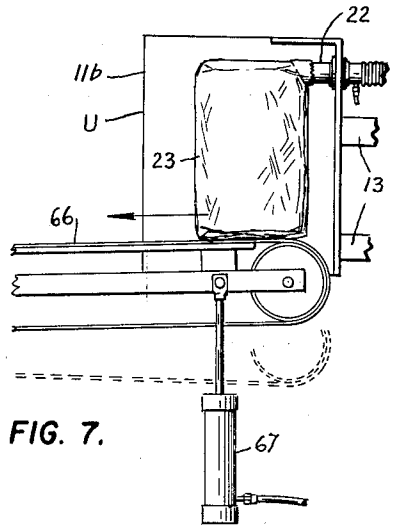


FIG. 7.

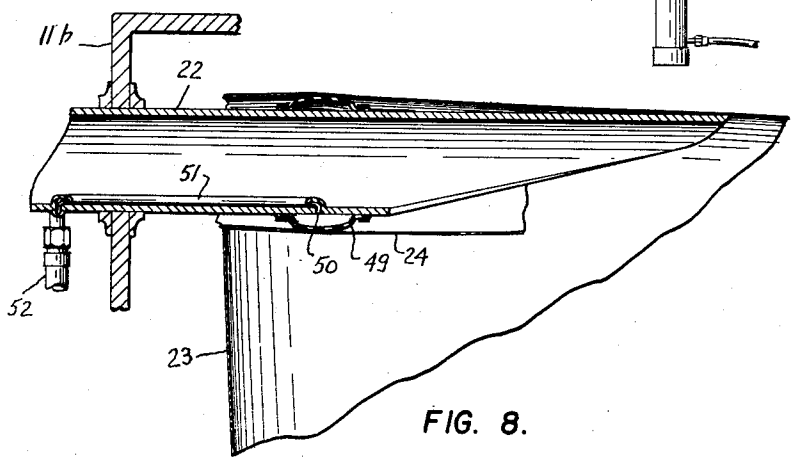


FIG. 8.

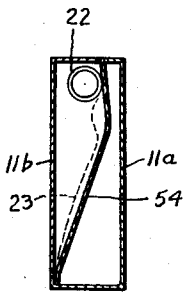


FIG. 9.

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2,922,612

AUTOMATIC VACUUM PACKING OF PELLETIZED CARBON BLACK

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Application December 13, 1955, Serial No. 552,766

6 Claims. (Cl. 249—59)

This invention relates to new and useful improvements in the art of packing and weighing machines, and in particular the invention concerns itself with apparatus for automatic vacuum packing and weighing of bags with pelletized carbon black.

The principal object of the invention is to provide an apparatus of this nature which will rapidly fill and accurately weigh a predetermined quantity of pelletized carbon black into a bag with the expenditure of a minimum amount of manual labor. This object is attained by arranging the apparatus so that it is almost fully automatic in operation, the only manual labor required being to place a supply of bags in place at the bag receiving station of the apparatus and to close the mouth of the filled bags as they emerge from the unloading station.

An important feature of the invention resides in the provision of power means for picking up individual empty bags, opening the mouth thereof and positioning the same on the material delivery nozzle of the machine.

Another important feature resides in the provision of means for controlling the flow of material through the nozzle so that the major portion of the bag is very rapidly filled, whereupon the rate of filling is substantially reduced for efficient control of weight and stopped when the bag is full, thus making it possible to maintain the weight of the filled bag within a very close tolerance of a predetermined amount.

Another important feature of the invention resides in the provision of means for filling the bag by suction, that is, in the presence of substantially reduced atmospheric pressure.

A still further feature of the invention involves the provision of power means for removing a filled bag from the machine.

Some of the advantages of the invention lie in its simplicity of construction and in its efficient and dependable operation.

With the foregoing more important objects and features in view and such other objects and features as may become apparent as this specification proceeds, the invention will be understood from the following description taken in conjunction with the accompanying drawings, wherein like characters of reference are used to designate like parts and wherein:

Fig. 1 is a top plan view of the housing, nozzle and scale used in the invention, also showing a movable portion of the housing in its three positions and illustrating bags at the receiving and positioning stations;

Fig. 2 is a front elevational view of the scale, material supply duct and housing at the bag filling station;

Fig. 3 is a fragmentary vertical sectional detail of the valve means in the material supply duct;

Fig. 4 is a perspective view of the bag pick up and positioning device, including the bag mouth opening means;

Fig. 5 is a fragmentary elevational view showing the bag mouth opening means in its initial position;

Fig. 6 is a fragmentary elevational view showing the bag mouth held open by the opening means;

Fig. 7 is a fragmentary elevational view of the bag unloading means;

Fig. 8 is a fragmentary vertical sectional view of the nozzle and sealing means for the mouth of the bag; and

Fig. 9 is a vertical sectional view of the housing with the bag therein.

Referring now to the accompanying drawings in detail, particularly Figs. 1 and 2 thereof, the automatic bag packing and weighing apparatus in accordance with the invention embodies in its construction a suitable weighing scale **10**, on the platform of which is positioned a substantially rectangular housing **11**. This housing is composed of two complemental portions, namely, a relatively stationary portion **11***a* which may be secured to the platform of the scale, and a relatively movable portion **11***b* which is secured to hinge arms **12** connected, in turn, to hinge arms **13** on the stationary portion **11***a*. The hinge pins of the arms **12**, **13** are indicated at **14** and it will be observed from the foregoing that the movable housing portion **11***b* may be swung laterally from the portion **11***a* to any one of the positions shown in Fig. 1. For convenience of description, the stationary housing portion **11***a* may be identified as the bag filling station, the position of the housing portion **11***b* at this station being designated by the letter F. When the housing portion **11***b* is swung through approximately 90°, it is at the bag positioning station P, while the bag unloading station U is located intermediate the stations F and P, as indicated. A stack of bags to be filled by the machine is manually or otherwise delivered from a supply station S to a bag receiving station R.

Power means are provided for moving the housing portion **11***b*, these means comprising a double-acting hydraulic or air cylinder **15** pivoted at one end thereof to a bracket **16** on the housing portion **11***a* and having its piston pivoted to a crank **17** on one of the hinge arms **12**.

A material supply duct **18** extends downwardly from a suitable hopper (not shown) in axial alignment with the aforementioned hinge pins **14** and is provided at its lower end with a swivel coupling **19** attached to an elbow **20**. The latter, in turn, is connected by a flexible hose **21** to a bag filling nozzle **22** which is secured to and projects into the upper portion of the movable housing portion **11***b*, as is best shown in Fig. 8.

It is to be noted that the entire weight of the housing portions **11***a*, **11***b* as well as that of the nozzle **22** is supported by the scale **10**, and that the flexible hose **21** permits the housing and nozzle to move vertically with the platform of the scale while the duct elbow **20** remains relatively stationary. It will also be observed that the elbow **20**, hose **21**, nozzle **22** and housing portion **11***b* may swing laterally between the stations F, U and P, as facilitated by the swivel coupling **19** connecting the elbow **20** to the duct **18**.

Means are provided for picking up individual bags from the bag receiving station R, opening the mouth of each bag and positioning the same on the nozzle **22** when the housing portion **11***b* is at the positioning station P. The bags employed are preferably of the pasted end, valve closure type, the mouth of which can be expeditiously opened and readily sealed after filling. One of such bags is shown at **23**, with the mouth portion thereof indicated at **24**.

The bag pick-up, opening and positioning device comprises a carrier **25** slidable vertically on a relatively stationary frame-work **26** having rollers **27** at its upper end portion traveling along an overhead rail unit **28**, the traveling movement of the frame-work along the rail unit being effected by a suitably arranged hydraulic or air cylinder **29**, as indicated in Fig. 4. The vertical sliding movement of the carrier **25** on the frame-work **26** is similarly effected by a hydraulic or air cylinder **30** which is suitably secured to the frame-work and has its piston rod **30'** connected to a transverse suction line

or pipe 31 having a downturned portion 31' connected to a horizontally disposed suction plate 32. The latter has an apertured underside so that when it is brought in contact with a bag and atmopsheric pressure in the line 31, 31' is reduced, the bag adheres to the underside of the plate and may be picked up thereby. The line or pipe 31 is connected by a flexible hose 33 to a suitable air pump (not shown).

A pair of coacting arms 34 are pivoted at 35 to a cross bar 36, these arms being movable horizontally toward and away from each other and having free ends provided with opposing bag engaging jaws 37, which are adapted to support the bag adjacent the mouth 24 thereof. The arms 34 are moved toward and away from each other by a hydraulic or air cylinder 38 mounted on the cross bar 36 and having its piston rod 38' connected to a yoke 39 which, in turn, is operatively connected to intermediate portions of the arms 34 by a pair of links 40.

The cross bar 36 is provided with depending ears connected by horizontal pivot pins 41 to one end of the plate 32, whereby the arms 34 may be raised or lowered relative to the plate.

The means for opening the mouth of the bag comprise a suction cup 42 carried by a conduit or pipe 43 which is pivoted at 44 to the pipe portion 31' and is connected by a flexible hose 45 to the pipe portion 31', so that the suction cup is energized simultaneously with the suction plate 32. The pipe 43 is swingable in a vertical plane on the pivot 44 by means of a hydraulic or air cylinder 46 having one end thereof attached to a bracket 47 on the pipe 31 while the piston rod of the cylinder is connected to a bracket 48 on the pipe 43. The suction cup 42 is engageable with the top thickness or layer of the mouth of the bag, while the bottom thickness or layer thereof is prevented from lifting by a stationary keeper lip 42*a* suitably mounted at the station R.

Means are provided for sealing the mouth 24 of the bag 23 around the nozzle 22 when the bag is positioned on the nozzle as shown in Fig. 8, these means comprising an inflatable collar 49 of suitable resilient material which is mounted on the nozzle and communicates through an aperture 50 with a conduit 51 extending inside the nozzle to a point outside the wall of the housing portion 11*b*, at which point the conduit 51 is extended outwardly and connected by a flexible hose 52 to a source of air pressure. Accordingly, when air under pressure is admitted into the collar 49, the latter is inflated and brought into engagement with the mouth 24 of the bag, to effectively seal the same around the nozzle 22.

While the bag filling operation is in progress at the filling station F, the housing portions 11*a*, 11*b* are together and, for vacuum packing, air is exhausted from the inside of the housing through a suitable conduit or pipe 53 connected to the housing portion 11*a*. To safeguard any possibility of air leakage into the housing in this position, a flexible diaphragm or a resilient gasket 54 which may be of soft rubber or the like is provided in the housing portion 11*a* adjacent the bag, as shown in Fig. 9.

The flow of material through the nozzle 22 is controlled by a valve unit 55 provided in the aforementioned duct 18 immediately above the swivel coupling 19, this valve unit being best shown in Fig. 3 from which it will be apparent that it comprises a casing 56 provided with a longitudinal partition 57 which divides the same into a relatively large main passage 58 and a relative small secondary passage 59, having a main valve member 60 and a secondary valve member 61, respectively, therein. These valve members are of the flexible diaphragm type, responding to changes in air pressure applied thereto through the respective pipe lines 62, 63 communicating with opposite side portions of the casing 56. The lines 62, 63 are connected to solenoid valves (not shown) which, in turn, are individually controlled by micro-switches 64, 65 responding to the movement of the balance beam of the scale 10.

Means are provided for unloading filled bags from the nozzle 22 at the unloading station U, these means being best shown in Fig. 7 and comprising a power driven endless conveyor 66 suitably mounted for raising and lowering movement by a hydraulic or air cylinder 67 and adapted to operatively engage the bottom of filled bags at the unloading station U, as illustrated.

Operation

Having thus described the construction of the invention, the operation thereof will now be explained.

A stack of empty bags 23 is positioned at the bag supply station S, from which a single bag is manually or otherwise delivered to the station R. At that station each individual bag is so positioned that the lower thickness or layer of the mouth thereof underlies the keeper lip 42*a*. The machine is then set in motion so that the cylinder 29 moves the frame-work 26 along the rail 28 to a position above the single bag at the station R and the cylinder 30 slides the carrier 25 downwardly until the suction plate 32 contacts the bag. Simultaneously, the pipe 43 is lowered by the cylinder 46 so that the suction cup 42 contacts top layer or thickness of the mouth portion 24 of the bag. Then, with the plate 32 energized, the bag is lifted by action of the cylinder 30 and is shifted toward the bag positioning station P.

While the bag is being carried by the suction plate 32 the cup 42 is energized and raised by the pipe 43 to separate the upper and lower layers of the bag mouth while the arms 34 are actuated by the cylinder 38 so that the jaws 37 engage the mouth portion of the bag and asssit in opening the same, as illustrated in Fig. 6.

The frame-work 26 then continues to travel toward the positioning station P, and in the meantime the cylinder 15 has been actuated to swing the housing portion 11*b* to the station P, with the nozzle 22 in alignment with the open mouth of the bag. In the final stage of its movement the carrier 25 causes the open mouth of the bag to slide over the nozzle 22, suction of the plate 32 and cup 42 is released, the arms 34 are retracted and the bag is supported by the nozzle. At that time air under pressure is admitted through the conduit 51 into the collar 49 so as to expand the latter into a sealing engagement with the open mouth of the bag.

The cylinder 15 then swings the housing portion 11*b* together with the bag therein to the filling station F, wherein the housing portions 11*a*, 11*b* come together and vacuum is produced in the housing by exhausting air through the conduit 53.

Thereupon both valve members 60, 61 are opened and material from the hopper (not shown) is drawn through the duct 18 and nozzle 22 into the bag. When the bag is nearly filled the weight thereof acting through the balance beam of the scale 10 will actuate the micro-switch 64, which, in turn, will cause the main valve member 60 to close, thus substantially reducing the rate of material flow through the nozzle. However, the material will still continue to flow through the secondary valve passage 59 at a comparatively slow rate until the bag is filled to predetermined capacity. At that time the second micro-switch 65 will close the secondary valve member 61 and completely stop the flow of material to the bag. By virtue of this arrangement the bag can be filled very rapidly to almost its full capacity, and the filling operation may be finished at a comparatively slow rate to assure accuracy in maintaining the weight of the filled bag within very close limits.

With the filling operation completed, the housing portion 11*b* is swung by the cylinder 15 to the unloading station U and the conveyor 66 is raised by the cylinder 67 so that it engages the bottom of the filled bag and removes the same from the nozzle 22 to any suitable point where the open mouth of the bag is manually closed by the

operator. The housing portion **11***b* then continues to the positioning station P for the next cycle of operation.

The various actuating cylinders, etc., used in the apparatus may be manually controlled by the use of suitable valves, or alternatively, they may respond to an automatic control mechanism timed in accordance with the operational sequence already described.

If desired, the weighing operation and the fine delivery of material into the nearly filled bag may be omitted, and the material weighed either before or after filling. Also, the bag pick-up and positioning device per se may be employed separately as such, in environments other than that disclosed herein.

It will be also understood that while the invention is primarily intended for use in packaging pelletized carbon black, it may be also used for packing and weighing of any similar fluent material.

While in the foregoing there has been described and shown the preferred embodiment of the invention, various modifications may become apparent to those skilled in the art to which the invention relates. Accordingly, it is not desired to limit the invention to this disclosure, and various modifications may be resorted to, such as may lie within the spirit and scope of the appended claims.

What is claimed as new is:

1. In an automatic bag packing apparatus, the combination of a housing including a relatively stationary portion constituting a bag filling station and a complemental bag receiving portion movable from said stationary portion selectively to a bag positioning station and a bag unloading station, power means for moving the bag receiving portion of said housing, a nozzle provided in the bag receiving portion of the housing and operatively connected to a material supply, power means for picking up a bag and positioning the mouth thereof on said nozzle when the bag receiving portion of the housing is at the positioning station, valve means for controlling the flow of material through said nozzle when the bag receiving portion of the housing is at the filling station, means for exhausting air from said housing while a bag on said nozzle is being filled, means for automatically closing said valve means when the bag is filled, and power means at said unloading station for removing a filled bag from said nozzle.

2. An automatic bag packing and weighing apparatus, comprising in combination, a scale, a housing positioned on said scale and including a relatively stationary portion constituting a bag filling station and a complemental bag receiving portion movable from said stationary portion selectively to a bag positioning station and a bag unloading station, power means for moving the bag receiving portion of said housing, a nozzle provided in the bag receiving portion of the housing, means operatively connecting said nozzle to a material supply, power means for picking up a bag and positioning the mouth thereof on said nozzle when the bag receiving portion of the housing is at the positioning station, means for sealing the mouth of a bag on said nozzle when in position thereon, valve means for controlling the flow of material through said nozzle when the bag receiving portion of the housing is at the filling station, means for exhausting air from said housing while a bag on said nozzle is being filled, means responsive to actuation of said scale for automatically closing said valve means when the bag is filled, and power means at said loading station for removing a filled bag from said nozzle.

3. The apparatus as defined in claim 2 wherein the bag pick up and positioning means include means for opening the mouth of the bag prior to positioning thereof on said nozzle.

4. The apparatus as defined in claim 2 wherein the bag pick up and positioning means comprise a movable carrier, power means for moving the same, a bag engaging suction plate supported by said carrier, a set of bag engaging arms movably connected to the carrier, power means for moving said arms, a bag mouth engaging suction cup provided on the carrier, and means for actuating said suction plate and said suction cup, whereby a bag may be picked up and the mouth thereof opened prior to positioning by said carrier on said nozzle.

5. The apparatus as defined in claim 2 wherein said means for operatively connecting said nozzle to a material supply comprise a material duct having said valve means provided intermediate the ends thereof, and a flexible hose connection between said duct and said nozzle, whereby to permit movement of said housing on said scale relative to said duct.

6. The apparatus as defined in claim 2 wherein said valve means include a relatively large main passage and a main valve member therein and a relatively small secondary passage and a secondary valve member therein, said means for automatically closing the valve means comprising independent actuators responsive to said scale for closing the main valve member in advance of the secondary valve member.

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