Lesson-27

Filling Operation: Principles and Working of Different Types of Bottle Fillers and Capping Machine

27.1 INTRODUCTION

After the process system, the filler is the heart of any milk handling line in a dairy plant. Whether it is simple 6-head rotary filler, or a high-speed multilane linear machine with a hepafiltration chamber, the filler is the center of line activity.

The landscape of the filler business has changed dramatically in recent years, as more and more beverages (including single serve milk) are being sold in plastic. Packaging materials and package sizes have changed, and many manufacturers are now offering different lines of equipment for use with more than one kind of packaging. Machines are faster and achieve higher levels of hygiene for longer shelf life and ambient storage.

Companies have included blow molded plastic in their lines of packaging and equipment. Some companies have got linear aseptic filler for HDPE bottles in commercial use for low acid food and beverages. Companies can now commercially fill low acid products into HDPE plastic containers and distribute them without refrigeration.

The latest filling machines have features like 64-valves with 32 pocket star wheels and designed to fill plastic and glass bottles with a maximum diameter of 3.0' (76 mm) at speeds up to 800 bpm. Other models are available for larger containers. Special features include demountable valve flanges, electronic level control system, filler driven in-feed conveyor, automated lubrication system, automated cleaning and sanitizing system, and digital control system with touch screen operator interface.

Modern machines can have multi-lane inline equipment and can fill in both Ultra-Clean and Aseptic processes. The machine can receive product/s from one of many different UHT processors. Because it is multi-lane, it may be used to fill more than one type or flavor of product simultaneously. Production rates will vary, depending on the number of lanes, the size of the container and the viscosity of the product. Fill time is the major limit on cycle time, but the bottles can be filled in multiple stages to shorten the cycle time.

27.2 VACUUM FILLING OF BOTTLES

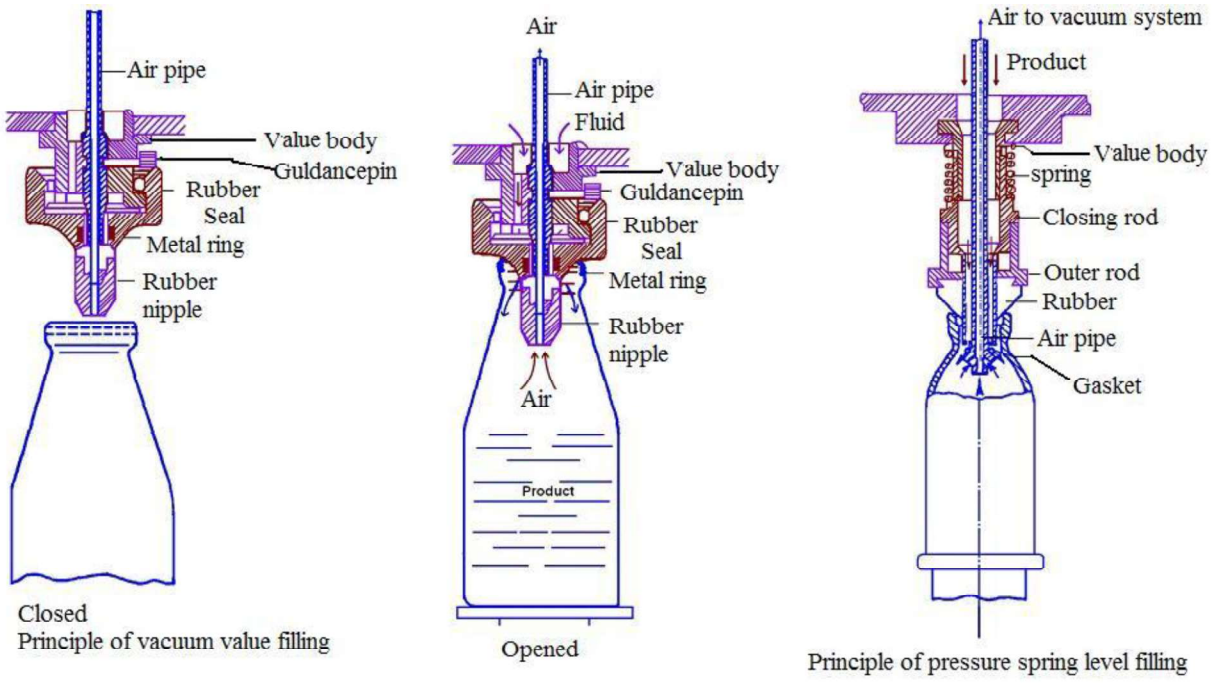

Fig. 27.1 Vacuum filling of bottles

The bottles after bottle washing machine are fed to the bottle filler by conveyor. The bottles are made to feed on to individually by a star wheel on to a Platform. The platform will rise and fall making it to meet the filler valve positioned above. The mouth of the bottle is pushed against the rubber seal of the filling device thus making it air tight. The air in the bottle is removed due to the vacuum which exists in the upper part of the filling vessel, which will also be rotating along with the platform of bottles. Simultaneously, the opening between the rubber seal and filling tube is released by the raise of the bottle against the rubber seal, and milk enters the bottle, due to low pressure existing in bottle. Once the milk has risen to the level of the hole of the filling tube, no more air can be removed from the bottle, and the filling operation is terminated.

This type of filling has the advantages of rapid filling, reduced milk losses. If the mouth of the bottle is damaged, it cannot properly raise the rubber seal, and milk will not be filled in that bottle. This automatically reduces the product loss. The vacuum system also ensures foam free filling.

27.3 CAPPING MACHINE

The capping machine is synchronized with the filling machine. The Al foil, which is usually the capping material, has to pass through a plain or embossed on the die and a punch which is reciprocated o the die. The foil is self lubricated which otherwise will not cut the edges smooth. The foil thickness ranges from 0.04 to 0.05µm. The dia is 38mm and one kg Al foil may give about 3000 caps and a roll of foil may weigh 5 or 6 kg. Plain, coloured or lacquered foils are used.

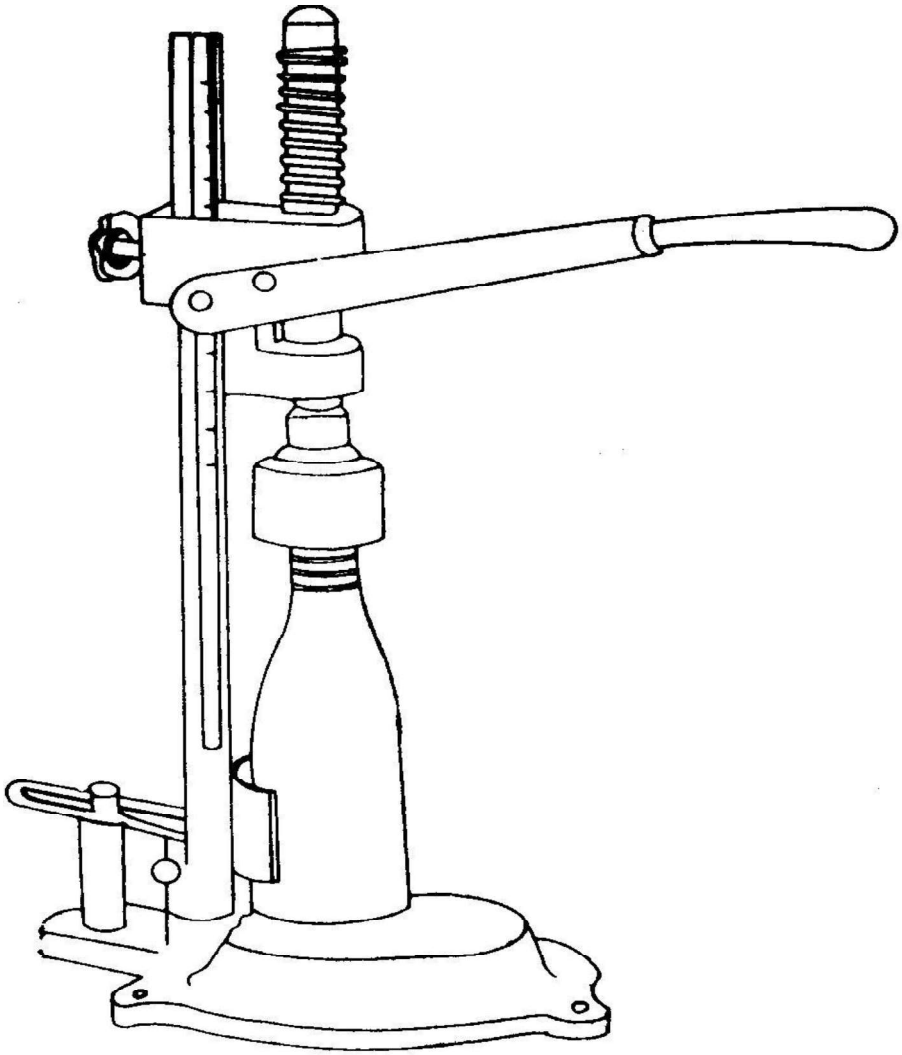

Fig.27.1 Capping machine
(Source: C.P Ananthakrishnan (1987)

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Lesson-28

Pouch Filling Machine: Form-Fill-Seal Types

28.1 INTRODUCTION

The Form Fill Seal machines are a genre of filling equipment that can fill in a flexible packing material. The product should be free flowing type, either liquid or even granular. The equipment may be controlled electro-pneumatic or mechanically or a combination of them. Of late, the mechanical types are being preferred over the electro-pneumatic types for their simple operations as well as low energy consumption.

The process involves certain steps, which will take place cyclically in auto operation.

There is option for variation in size and quantity of the product packed. To a large extent, the market milk is now being sold by packing in these machines.

The following are the operations that go cyclically.

1. Forming of tube of packing material from film in rolled state
2. Simultaneous operation of filling and sealing
3. Movement of film to form next package
4. Simultaneous separation of filled and sealed packet while filling of next packet.

28.2 SEQUENCE OF OPERATION

With reference to the fig 28.1, the film roll is loaded at the backside of the filling machine on a sliding platform. The film edge is passed over end of roll contact lever, dancer roller, UV tube and brought to the front side over to forming plates. The function of UV tube is to stelriize the film. The forming plates roll the flat film in to a tube with a certain band of overlap. Within the tube is the fluid filling pipe enveloped. The tube then passes over to vertical seal jaws that are engaged and disengaged with the help of an air operated piston, or in some machines by mechanical means. In between the jaws, the overlapped part of the film tube passes. The set of jaws have one stationary and one moving jaw. The moving jaw has a Ni-chrome rod, supplied with variable voltage such that the heat is generated when the current passes intermittently. During the period when the current does not pass, when the jaws are disengaged, the cooling water being circulated in the moving jaw cools it and prevents continuous over heating of the sealing rod. The film is supported by Teflon cloth and rubber cushion, as well as protected by Teflon cloth from sealing rod. This arrangement prevents electricity passing on to the film and other parts, while allowing only the heat to pass on to the film and partly melting and fusing the vertical joint.

Lower down the film tube, there is a pair of nip rollers giving a holding and pulling down action, when the jaws are disengaged, making the film to move to seal the next portion of vertical overlap.

Further lower down the film tube is engaged by horizontal jaws, at a sufficiently below the lower edge of fluid filling pipe. This arrangement allows the formation of lower seal of the packet, while the fluid is being filled to a known quantity. The quantity of flow is controlled by a valve operated by a rod. The rod is lifted by a solenoid coil positioned at the top of machine, just at the feeding line from

the over head tank carrying the fluid to be filled. While filling is taking place, a pair of flat blades operated by spring keeps the film perfectly flat at horizontal edge so that there are no folds and horizontal seal is perfect.

When the filling of fluid and the horizontal sealing is complete, the horizontal jaws (as well as vertical jaws) get disengaged, and the nip rollers start rolling to bring the next length of film tube to be filled for next packet. While the second packet is being filled, the first packet already filled will be getting the horizontal seal of top portion of the filled packet. When the next time the jaws open, the first packet drops down by its own weight because of weakened connection to the rest of the tube.

The above cycle of operation is repeated when the controls are in automatic operation, while single action takes place when in manual operation during initial adjustment of time and temperature combination for obtaining proper seal.

28.2.1 Controls

The Form Fill Seal Machine has various controls for the following operations.

1. Adjusting the temperature of sealing rod by controlling the electric supply, to match to the thickness of the film to be sealed.
2. Adjusting the timing for the jaws to be engaged and simultaneously filling operations to take place, with a known quantity of fluid.
3. Adjusting the quantity of fluid to be filled when jaws are engaged
4. Adjusting the timing for the jaws to be disengaged and allow time for movement of film to the required length of package.

The other useful instrumentation are the end of film indicator (gives audio signal), so that the new film roll can be changed easily, fine adjustments for the quantity of fluid filled in few grams range, fine adjustment of timings, etc. There is a provision to print the batch number and date of filling on the packet.

The equipment will require water for cooling the jaws at a fixed flow rate and of low temperature. Also, compressed air is required which is at a particular pressure and free of condensed moisture.

The filling machine comes in both Single header and double header types. The double header undertakes similar operations simultaneously as that of a single header.

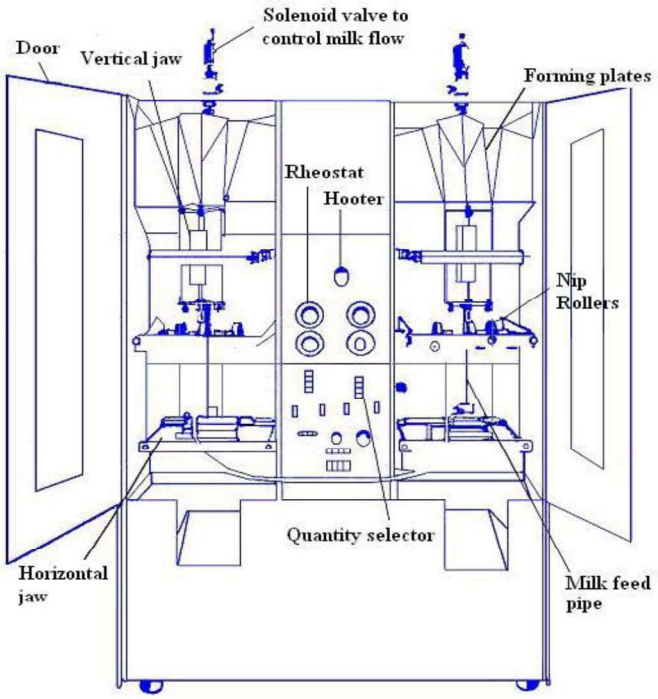

Fig.28.1 Form-Fill-seal machine

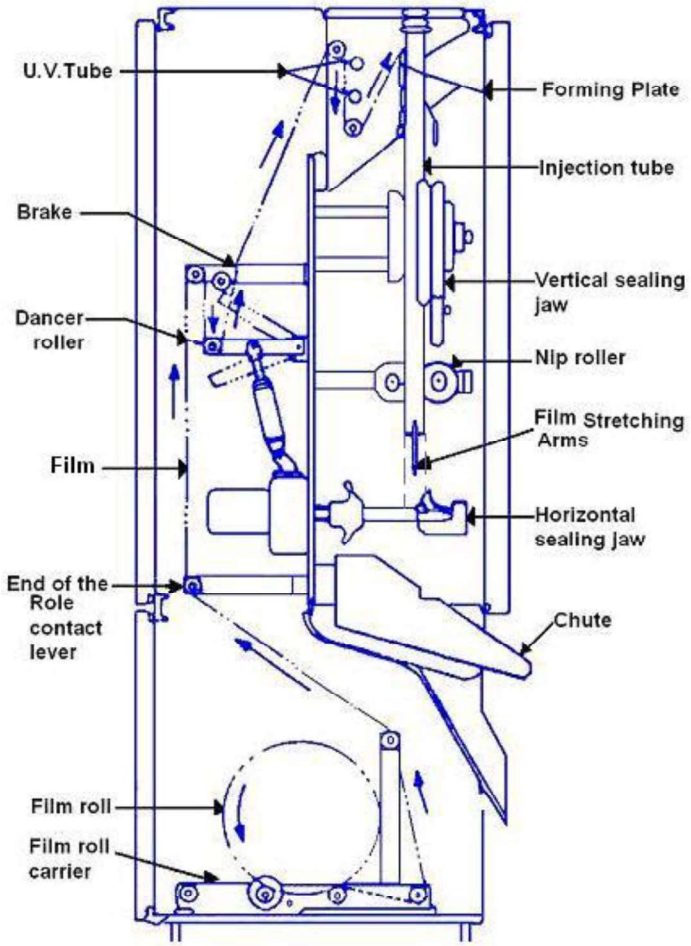

Fig.28.2 Film feed circuit

Lesson-29

Aseptic Filling by Bulk Handling System, Care and Maintenance

29.1 INTRODUCTION

With increasing consumption of long life foods like milk, fruit juices and other liquid foods, as well as certain pharmaceutical applications, the bulk handling of foods aseptically is taking prominence.

The above operation is possible with improvement in packing material and related technologies. The large size packages that can withstand mechanical damage and ability to have perfect seal are being manufactured. The packing containers are heat sealable like the milk pouch film sealing. There is also both one way as well as returnable containers being manufactured.

29.2 BULK ASEPTIC FILLING EQUIPMENT

The Bulk fillers like individual package fillers, are located very near to the UHT plant, and the product is not stored in between. The product is filled as it comes out of UHT plant.

Standard equipment basically has an arm protruding out like a cantilever, from a support base. The arm carries a long pair of horizontal jaws for sealing, supplied with heating element. The arm also carries a valve sealing equipment that exactly matches with the nozzle of the packing bag. Once the valve is connected to the nozzle of the packing bag, it creates an air tight grip on to it. The arm is connected with vacuum line, which when activated, draws away the air from the bag to be filled. The option of circular valve or horizontal jaws depends on the type of bag that the bulk filling is done. This action is similar to the vacuum cleaner.

Once the bag is cleared of the air, the product flows through another pipe connected to the arm, and a known quantity is filled into the bag. The choice of the quantity, the time of sealing, the temperature etc is programmed. The sample packing for smaller bags can be done manually. If the bag is large, the arm has adjustment facility to lift the bag to the required height and hold it till the product is filled, so that there are no empty pockets in the bag.

The controls can be simple touch screen type and has all the machine modes and also any alarm that are required for indicating any process deviations to the operating personnel. There is a control for the sealing time, temperature, change in volume etc. The controls have both the Manual and Auto operation facility, so that filling operation goes on continuously, once the process parameters are achieved. The manual operation is usually done for sample package sealing that is required for the quality control laboratories from time to time. The touch screen controls can also be custom

programmed to give the information about history of filling operations, shift basis or day basis in addition to the operation.

All product contact surfaces are of AISI 316, for maintaining proper hygiene and prevent corrosion. The CIP cleaning is done by fitting an adopter into the filling jaws. No manual strip down of equipment for cleaning is required.

The capacities of bags can be 5 lts to 1000 lts. The large bags are further supported by drums in which they are positioned while filling it. The equipment can also fill variety of containers. The filled packets are moved away from the filling arm, by roller conveyors for quick filling operations.

Fig.29.1 Bulk filler

Fig.29.2 Aseptic closure assembly

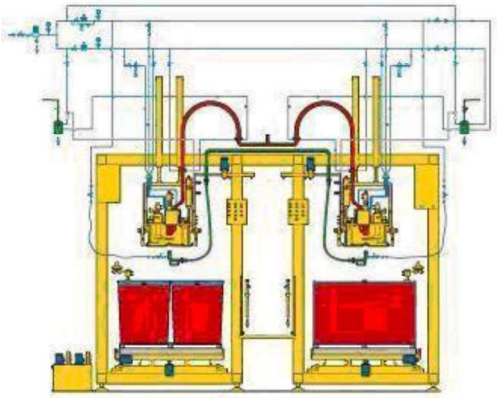

Fig.29.3 Schematic diagram of bulk filler

Fig.29.4 Package material holder cum filling tube

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