June 13, 1939. G. A. SODERBERG 2,162,464

APPARATUS FOR FILLING AND CLOSING COLLAPSIBLE METAL TUBES

Filed May 17, 1934 2 Sheets-Sheet 1

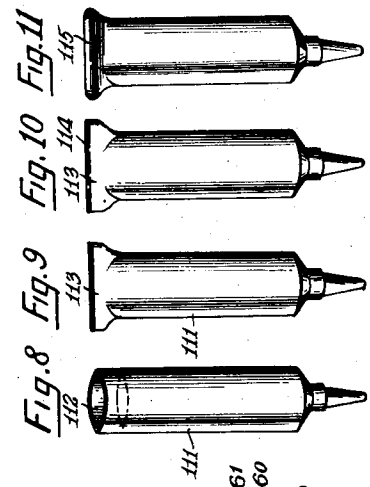


Fig. 1

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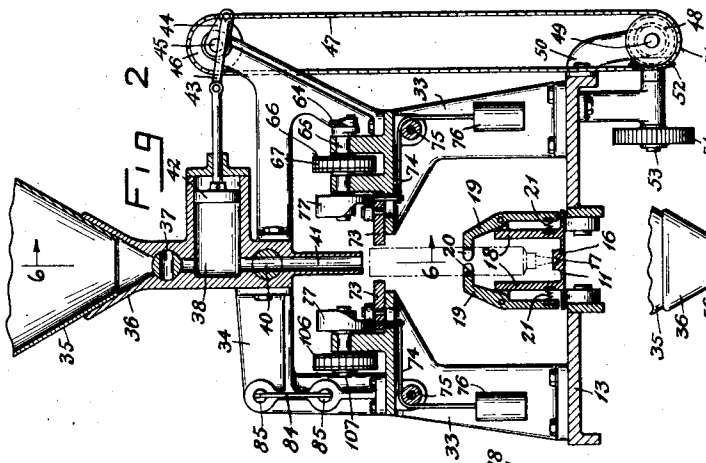


Fig. 2

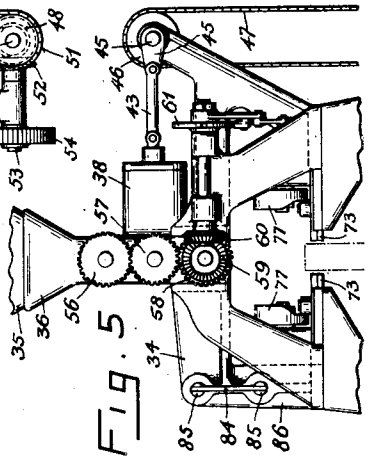


Fig. 5

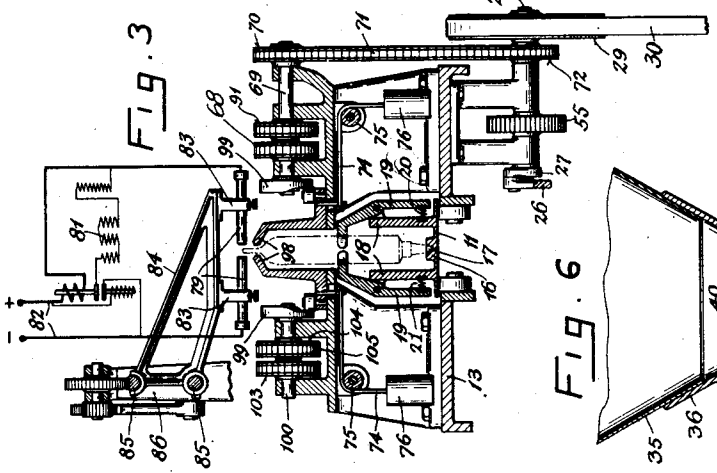


Fig. 3

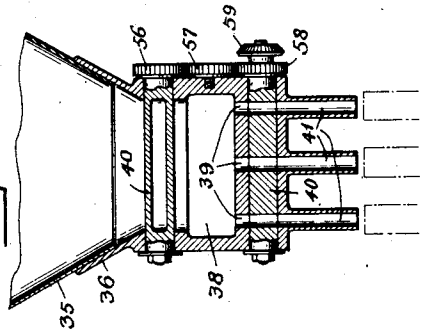


Fig. 6

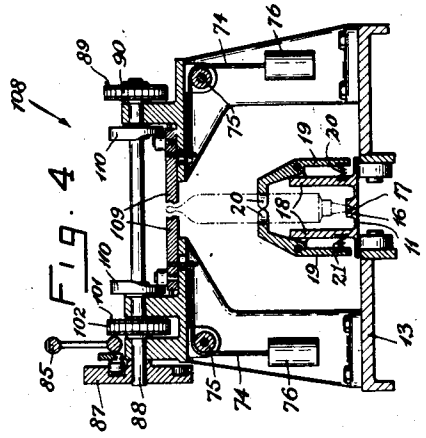


Fig. 4

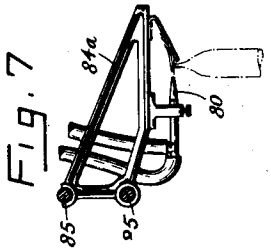


Fig. 7

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2,162,464

APPARATUS FOR FILLING AND CLOSING COLLAPSIBLE METAL TUBES

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8 Claims. (Cl. 226—75)

This invention relates to filling and closing collapsible metal tubes, such as are used to contain and dispense liquid and semi-solid materials.

These tubes are filled from the bottoms, after which the bottom of each tube is folded over and fastened so to close the tube, except for the discharge nozzle or neck at the other end of the tube which is usually provided with a screw cap.

With this method, the filling end of the tube is not hermetically sealed and hence liquid of high viscosity and low surface tension may seep thru the folds and escape. It has been found that ordinary light lubricating oil contained in such a tube, when exposed to a temperature of about 75° F. seeps through the folded closed end of tube. Not only does this result in the loss of the contents of the tube, but the escaping fluid may damage or spoil other things with which it comes in contact.

An object of this invention is to hermetically seal the filling end of a filled collapsible tube so that regardless of the penetrating tendencies of the liquid contained thereby it cannot escape at the closed end.

A feature of this invention is the provision of means for progressively filling, closing, and sealing such tubes as they pass through the machine.

The sealing according to this invention is accomplished by welding or fusing together the metal of which the tube is made. This may be done by the use of an electric arc or by gas or other flame or heat producing medium.

After the end of the tube is welded or fused, it is preferable, as provided for by this invention, that the seam be smoothed down or otherwise suitably shaped so that no burs or jagged pieces are left to catch into things or scratch them and also to improve the appearance and marketability of the merchandise.

The present invention also includes the provision of a novel and improved form of measuring and filling machine whereby the exact quantity desired is discharged into a plurality of tubes at one time thereby speeding-up the operation of filling, closing, and sealing the tubes.

Other features and advantages will hereinafter appear.

In the accompanying drawings, which illustrate the present invention—

Fig. 1 is a side elevation of a machine for filling and closing collapsible tubes, and for welding and shaping the ends thereof.

Fig. 2 is a transverse sectional view, taken on the line 2—2 of Fig. 1, showing the filling and closing mechanism.

Fig. 3 is a transverse sectional view, taken on the line 3—3 of Fig. 1, showing the welding mechanism.

Fig. 4 is a sectional view, taken on the line 4—4 of Fig. 1, showing the mechanism for finishing the welded ends of the tube.

Fig. 5 is an end view of the machine shown in Fig. 1.

Fig. 6 is a longitudinal sectional view of the filling mechanism taken on the line 6—6 of Fig. 2.

Fig. 7 is a detail view, showing the mechanism for welding or fusing the closed ends of the tubes by gas or the like.

Figs. 8 to 11, inclusive, are elevations, of the collapsible metal tubes in filled, closed, welded and shaped conditions, respectively.

The finished and empty collapsible metal tubes, having their filling ends left open (as is the usual custom) may, in the broader aspects of this invention, be carried or conveyed from station to station in the filling and closing machine of the present invention by any suitable means. The means disclosed herein for the purpose comprises an endless conveyor 10 made up of a series of links 11 carried over octagonal wheels 12, one at each end of the machine frame 13 and carried on shafts 14 suitably supported on the frame.

According to the present invention, a plurality of tubes are presented simultaneously to each station so as to increase the efficiency or productivity of the machine. Hence, each link 11 is provided with a plurality of tube holders 15.

For holding the tubes upright and presenting them to the several stations of the machine, each link 11 is provided with a plate 16 having a socket 17 suitably shaped to receive the cap or discharge end of the tube and a pair of vertical side plates 18. On each of the latter there is pivotally mounted a plurality of holding arms 19—opposite arms facing each other and having semi-circular jaws 20. Springs 21 between the lower ends of the arms 19 and the vertical side plates 18 urge the jaws together and hold, in a vertical position, the tubes inserted therein, as illustrated in Figs. 2, 3, and 4, in which the tubes are shown in dot-and-dash lines.

The conveyor 10 is moved step by step by means of a driving pawl 22 carried by an arm 23 and engaging notches 24 in a driving wheel 25 carried by the shaft 14, which also carries the octagonal wheel for the conveyor belt. The pawl 22 and its arm 23 is oscillated on the shaft 14 by a pitman 26 connected to a crank 27 (see Fig. 1) on a shaft 28 having a pulley 29 carrying a belt 30

connected to an electric motor or other suitable source of power 31

At the right-hand end of the machine, as viewed in Fig. 1, the tube carriers 15 are accessible to receive the tubes which may be placed therein by the operator of the machine. Directly to the left is a tube filling station 32. At this place, there are supported on the main frame 13, brackets 33 carrying a frame 34 for the measuring and filling mechanism.

This mechanism consists of a hopper or receiving funnel 35 for receiving the liquid or semi-solid substance with which the tubes are to be filled. This is carried by a housing 36 having at its upper end a valve 37. A measuring chamber 38 is located under the valve 37. As shown more clearly in Fig. 6, there is a plurality of outlets 39 from the measuring chamber controlled by a rotary valve 40 which connects the outlets 39 with nozzles 41 spaced apart at their lower end, according to the spacing of the tube holders 15 on the conveyor, and located just above the upper ends of the tubes which pass beneath and come to rest under them.

The measuring chamber has an ejecting plunger or piston 42 connected by a pitman 43 to a crank 44 carried by a shaft 45. The shaft 45 carries a pulley or sprocket 46 having a chain 47 passing over a similar pulley 48 at its lower end connected to a shaft 49 mounted in a bracket 50 (see Figs. 1 and 3). The shaft 49 has a bevel gear 51 meshing with a bevel gear 52 on a shaft 53 carrying a gear 54 meshing with a gear 55 on the shaft 28 which is connected by a belt 30 to the motor 31.

The connections are such that during the movement of the shaft 28 which causes the pawl 22 to advance the conveyor one step, the plunger 42 is moved to the right, and, during the idle or return stroke of the drive pawl 22, the plunger 42 is moved toward the left, ejecting the contents of the cylinder 38 through the nozzles 41 into the open ends of the collapsible tubes.

During the movement of the plunger 42 to the left, the valve 37 and valve 40 are in the positions shown in Fig. 2, where the contents of the measuring chamber 38 cannot move upwardly because the valve 37 is closed and can only pass downwardly and outwardly because the valve 40 is open. During the movement of the plunger 42 to the right, however, the positions of the valves are reversed, and the valve 37 is opened while the valve 40 is closed, so that the material in the hopper 35 is sucked into the chamber 38.

These valves 37 and 38 are interconnected by gearing for coordinate action. This gearing consists of a gear 56 for the valve 37 and intermediate gear 57 and a gear 58 for the valve 40. The gear 56 is provided with a bevel gear 59 meshing with a bevel gear 60 carrying a ratchet wheel 61 and this is moved step by step by a pawl 62 operated by a pitman 63 connected to a crank 64 on a shaft 65 having a pulley or sprocket 66 connected by a chain 67 to another pulley or sprocket 68 on a countershaft 69 having another pulley or sprocket 70 connected by a chain 71 to a pulley or sprocket 72 on the shaft 28. Thus it will be seen that the opening and closing of the valves 37 and 40 are in coordination with each other and with operations of the plunger and the advancement of the conveyor and tubes carried thereby.

After the tubes have been filled at the station 32, they may be advanced to another station to close the open end of the tube. However, in the form of the invention shown herein, the squeezing of the open end of the tube together is accomplished at the filling station 32. For this purpose, the brackets 33 at the right and left of the machine, as viewed in Fig. 2, are each provided with a slide 73 normally held in retracted position by a cable 74 passing over a pulley 75 and having a weight 76. After the tube has been filled, the slides 73 are moved toward each other to engage and squeeze flat the open end of the tube by means of cams 77. The cam 77 at the right of Fig. 2 is secured to the shaft 65 carrying the arm 64 for operating the valve mechanism, and thus this cam is operated by the chain 67 above referred to. The cam 77 on the left-hand side of Fig. 2, however, is driven in rather a circuitous way, to be herein described, because free passage must be left through the center of the machine for the tubes to travel and for other mechanism to pass.

It is sufficient to point out now that the cams 77 at opposite sides of the tube operate simultaneously to squeeze the tube substantially flat and bring the sides thus formed into intimate contact with each other.

This having been done, the conveyor advances the set of tubes filled and closed to the sealing station 78. In this position, according to the present invention, the closed ends of the tubes are welded to hermetically seal them. This may be done by means of an electric arc passing between electrodes 79 in the form of the invention shown in Fig. 3, or gas flame issuing from a nozzle 80 in the form of the invention shown in Fig. 7.

As diagrammatically illustrated in Fig. 3, the electrodes 79 are connected electrically to the usual or suitable arc light controlling means 81 eventually connected to current supply wires 82. The electrodes are separately and insulatedly secured in brackets 83 mounted in a carriage 84 having rods 85 mounted in bearings 86.

In the broader aspects of this invention, the arcs or other heating devices may be mounted stationary and the closed tubes advanced relative to them to weld the tubes, but, according to the present invention, by filling and closing a plurality of tubes at one operation, which requires some time but no more time than would be required to fill one tube, it is advantageous to advance the welding mechanism relative to the group of tubes and thus have the ends of the tubes heated uniformly and for only short intervals of time at only one point, so as not to deleteriously affect the contents of the tube.

After the filled and closed tubes move to the station 78, the carriage 84 begins to travel toward the right, as seen in Fig. 1, to move the electrodes 79 across the closed end of the tubes to heat the metal thereof and cause the end of the tube to be welded together and hermetically sealed. This is accomplished by means of a cam 87 mounted on a shaft 88 (see Figs. 1 and 4) and having a sprocket or pulley 89 connected by a chain 90 to a pulley 91 (see Fig. 3) on the countershaft 69 connected to the main drive. The cam 87 has a follower arm 92, the upper end of which has a segmental rack meshing with a pinion 94 on a shaft 95 which has a gear meshing with a rack 97 formed on the upper carriage rod 85. The cam is approximately heart-shaped and is double acting, so that when it is rotated the follower arm 92 is oscillated back and forth, causing the carriage to move from right to left and return.

During the filling operations at station 32, the pair of electrodes on the carriage 84 or the nozzle 80 on the carriage 84a shown in Fig. 7, travels across the closed ends of the tubes previously filled and causes the metal of the tube, which is relatively soft and has a low fusing point, to flow together. During the travel of the conveyor 10 and tubes carried thereby, the electrodes 79 and the carriage 84 return to the position shown in Fig. 1.

To protect the main portion of the tube against the electric arc or the gas flame during the welding or fusing action, there is provided a pair of guards 96 slidably mounted on the main frame and controlled by cams 99 in the same manner as the closing members 73 are operated at the filling station 32. The cam 99 at the right in Fig. 3 is mounted directly on the countershaft 69, while the cam on the left is mounted on an independent shaft 100. Power for operating the cams 99 and 77 at the left-hand side of the machine by the shaft 88 shown in Fig. 4, which has a pulley or sprocket 101 connected by a chain 102 (see Fig. 1) to a pulley 103 carried on the shaft 100 at the sealing station 78. The shaft 100 has the cam 99 for controlling the guard fingers mounted directly on it and it has another pulley or sprocket 104 connected by a chain 105 (see Figs. 1 and 2) riding over a pulley or sprocket 106 carried by a shaft 107 on which the cam 77 for the closing members is mounted.

The tubes, after being hermetically sealed, may be taken from the tube holders 15 to be packed and shipped. However, it is preferable that the fused end of the tubes be shaped so as to enhance their appearance and remove any burrs or projections which might be left on the tube after the metal is fused. For this purpose, the present invention provides at a finishing station 108, a pair of shaping bars 109 slidably mounted and controlled in the same way as the guard bars 78 in Fig. 3 and closing bars 73 in Fig. 2. These shaping bars 109 are operated by cams 110 mounted on the shaft 88, and when brought together against the fused end of the tube, which is still warm, impress the material in any desired shape or form.

As shown in Fig. 8, the collapsible metal tube 111 is first filled to within a short distance of its open end top 112 with the material to be dispensed from the tube. This is performed at station 32 in the machine shown in the accompanying drawings. Then, the tube has its top portion 112 squeezed together as shown in Fig. 9, forming two flat sides 113 at the end of the tube. This is also performed at station 32 in the form of the invention herein disclosed, although it could be performed at station 78 if desired. Then the tube 111 has its closed top end 113 welded or fused together to hermetically seal the same. This may leave burrs or roughness 114 at the seam.

The tube may then be moved to station 108 at which the burrs 114 may be smoothed out and the fused end of the tube given any desired shape, as, for instance, the bead 115 shown in Fig. 11.

Of course, if desired, the tubes may be filled by hand and they may have their open ends closed, as shown in Fig. 9, by hand; but, in the preferred embodiment of the present invention, the tubes are filled, closed and welded, and also shaped, if desired, and wide variations and modifications of the apparatus shown in the accompanying drawings for carrying out the method herein described may be made within the scope of this invention, and portions of the improvements may be used without others.

Having thus described the invention, what is claimed as new and for which it is desired to obtain Letters Patent, is:

1. In combination, means for carrying filled open-ended collapsible tubes along a predetermined path past a plurality of stations and for halting a plurality of said tubes at one time at each station; means at one station for simultaneously flattening and thereby closing the open ends of all the tubes of said plurality into an unfolded relation during halting of said plurality at said station; and means at another station for hermetically sealing the ends of all the tubes of said plurality closed at the first-named station, the means last-named operating on one after another of all of the tubes of said plurality during halting of said plurality at the second-named station, by fusing and coalescing the metal of the tubes where flattened and unfolded for closing.

2. In combination, means for carrying a plurality of filled open-ended collapsible metal tubes along a predetermined path past a plurality of stations; means at one station for pressing the walls together in face-to-face engagement thereby closing the open end of the tube; means at another station for welding the unfolded end of the tube closed at a previous station to fuse the metal in the walls of the tube at the closed end; and means at said welding station for protecting the remainder of the tube against the heat of the sealing means.

3. In a machine for filling and sealing collapsible metal tubes, means for filling a tube with liquid or semi-solid material through an open end of the tube; means operating intermediate successive filling operations for moving said tube away from filling position; means for pressing said open end closed following a filling operation but before an operation of said moving means; means for welding the pressed closed end of said tube to seal the tube, after the last-mentioned operation of said moving means; and means at another station for shaping the end of the welded tube while the metal thereof is still hot and therefore plastic.

4. In a machine of the kind described, a frame; means for advancing a succession of filled open-ended cylindrical metal tubes step-by-step thereover from station to station; means at one station for simultaneously flattening the open ends of a plurality of filled tubes and pressing the opposite sides together; means at one station for supporting the tubes with the ends of the tubes pressed together; and means at the last-named station for welding one after another the ends of the tubes while held together by said holding means to hermetically seal the said ends of the tubes.

5. In a machine of the kind described, a frame; means for advancing a succession of filled open-ended cylindrical metal tubes step-by-step thereover from station to station; means at one station for simultaneously flattening the open ends of a plurality of filled tubes and pressing the opposite sides together; means at one station for supporting the tubes with the ends of the tubes pressed together; and means at the last-named station for welding one after another the ends of the tubes while held together by said holding means to hermetically seal the said ends of the tubes, said welding device being mounted to travel from one to another of said plurality of tubes

while the tubes carrying and advancing means is stationary and during the filling of the next plurality of tubes.

6. In combination, means for carrying a plurality of filled open-ended collapsible metal tubes along a predetermined path past a plurality of stations; means at one station for measuring and filling a tube with liquid or semi-solid material through the open end of the tube; means at said filling station for closing the open end of a filled tube; and means at another station for hermetically sealing the end of the tube filled at a previous station.

7. In combination, means for carrying a plurality of filled open-ended collapsible metal tubes along a predetermined path past a plurality of stations; means at one station for closing the open end of a tube in unfolded relation; means at another station for welding the end of the tube closed at a previous station, said welding means being spaced from the tube and comprising a device for discharging a welding heat and delivering the same to the unfolded tube-end while said device is out of contact with said tube-end; and means for shielding the body of the tube against the welding heat during the welding operation.

8. In a machine for filling and sealing collapsible metal tubes, means for filling a tube with liquid or semi-solid material through an open end of the tube; means operating intermediate successive filling operations for moving said tube away from filling position; means for pressing said open end closed following a filling operation but before an operation of said moving means; and means for welding the pressed closed end of said tube to seal the tube, after the last-mentioned operation of said moving means.

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