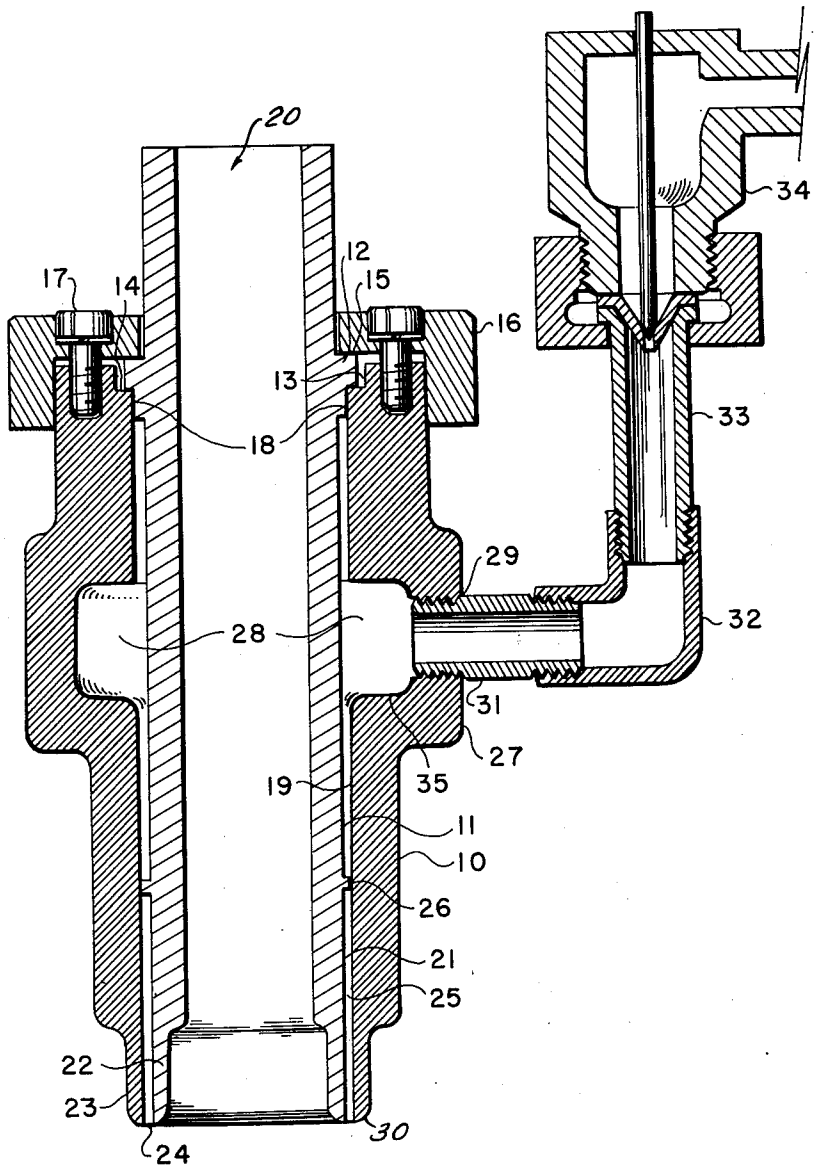
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METHOD AND APPARATUS FOR LINING CONTAINER CLOSURES

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METHOD AND APPARATUS FOR LINING CONTAINER CLOSURES

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This invention is concerned with the application of sealing compound to container closures and particularly to that method which is known as "die lining."

In the container industry, the gasket which is placed on the closures to seal the mating parts, such as can end and can body is known as a "lining." Linings are usually applied to container closures as liquid compositions which are subsequently dried or in other ways consolidated into a solid mass. These compositions are known both as "sealing compounds" and "lining compounds." There are two general methods of "lining compound" application. That which is used almost universally in the "lining" of food can closures consists in rotating a closure beneath a nozzle from which a measured quantity of compound is ejected onto the closure as it is rotating. Consequently, a peripheral stripe of compound is laid on the joint area. This is subsequently dried if the suspending fluid be water or a solvent or it is jelled if the compound is in the nature of a plastisol. Lining by the rotary method is a very fast procedure.

The other process, "die lining" is essentially a printing operation. A die, shaped to conform to the sealing periphery of the closure, is first coated with lining compound then pressed into contact with the closure. Since the closure need not rotate, die lining makes it possible to line ends having odd shapes. The rectangular end used for the common sardine can is a typical example of an odd shaped end.

However, die lining is slow because it is necessary first to coat the die and then move the coated die into contact with the closure. The machine output of a die lining machine seldom exceeds one hundred and fifty closures a minute. For comparison, the output of rotary machines is commonly about 350 closures a minute. Slowness is due not only to the time required to translate the die from pickup to printing positions but time limitations are also imposed by the nature of the compounds that must be used in die lining.

Die lining requires that the lining compound possess contradictory properties. When the die enters the pan of compound, the compound must stick to the die. When the die is lowered onto the closure, the compound must leave the die and stick to the closure. The compound cannot be stringy or sticky, for it must break away cleanly, smoothly and uniformly when the die is lifted to assure that the amount of compound deposited on each closure remains uniform throughout the closure run. As in all cases where properties must conflict, the operative result is a compromise. Those compromises which are necessary in formulation severely restrict the compounder in his choice of materials and limit the range of lining characteristics that he may give to the lining.

There have been various attempts to speed up the mechanical operation and eliminate some of the contradictory requirements in compounding by feeding the die with compound led to its printing face through internal passageways. For example, it has been proposed to provide a die with some thirty small needle valves placed around the periphery of the die. The valves were arranged to open when the die contacted the closure and to discharge compound onto the closure through orifices beneath each valve. This proposal is not satisfactory because since all sealing compounds contain suspensoids, bits of coagulum or agglomerates so alter the relative discharge rate of each valve that the individual nozzles deliver unequal quantities of compound after a very few minutes of operation under commercial conditions. It is my experience that other suggested internally fed dies have not produced satisfactory results because the distribution of compound on the printing surface of the die does not remain constant and, consequently, the cross-section of the deposited gasket varies around the periphery of the closure.

The objects of this invention are to achieve linings of uniform cross-section and to produce a lining die on which the distribution of compound on its closure contacting surface will be uniform. An equally important object is to produce a die which will deliver compound to the closure rapidly and uniformly. An auxiliary object is to produce a die which may be used as an accessory on rotary machines and thus produce die-lined ends with the rapidity which characterizes the rotary apparatus. The single figure is a vertical cross-section through my improved die.

I have found that if the compound which is fed to the printing tip is forced through a long and exceedingly narrow passage in which the pressure drop is at least approximately two orders of magnitude higher than the pressure drop which exists around the header feeding the passageway, the amount of compound moving out of the exit and onto the printing tip is substantially, peripherally uniform; and further, if the passageway is sufficiently narrow, compound will not flow out of it unless it is impelled by pressure in the header passage. The dimensions of the narrow passageway which are necessary to achieve these results are a function of the viscosity of the compound. If that viscosity is high, for instance, about 20,000 centipoises at 6 r.p.m. and 8500 centipoises at 60 r.p.m. as measured on a Brookfield viscometer using a #4 spindle, the gap width may be 0.025 inch. If the gap width is reduced to 0.015 inch, then quite conventional compounds with their much lower viscosities will run satisfactorily.

The ratio of length of passageway to its width also is a function of viscosity. It may be 40 to 1 in the case of high viscosity material and 100 to 1 when the viscosity is substantially lower.

Further, if the required amount of compound is allowed to "bloom" onto the die face by opening the needle valve while the die is out of contact with the closure, compound flow can take place during a period which exceeds 50% of the machine cycle. The bloomed material can then be detached from the die and caused to adhere to the closure by a very quick contacting die stroke which needs to last but a few milliseconds.

The assembly which may be called a "nozzle" has as main elements a jacket **10** and a liner **11**. Their configuration is that of the gasket to be applied and hence the die assembly may be square, round, or even follow the exotic shape of some novelty package. The liner **11** is retained longitudinally in jacket **10** by its shoulder **12** which is seated in a recess or counterbore **13** cut in the top face **14** of jacket **10**. The upper face **15** of shoulder **12** is engaged by a retainer plate **16** held in position by the cap screws **17**. The liner **11** is centered by the short centering shoulder **18**, the dimensions of which are such as to form a close fit within the interior walls **19** of the jacket **10**. Below shoulder **18** the exterior wall **21** of liner **11** does not contact the jacket but is spaced from the interior wall **19** of jacket **10** a minute distance, for example, about 0.015 inch. The lower extremities both of jacket **10** and liner **11** narrow into tip portions **22** and **23** respectively and together form the printing tip **24** of the die. The exterior walls

of tip portions 22 and 23 extend upwardly and outwardly away from the interior margins as shown at 30. The passageway 25 which is thus formed between jacket 10 and liner 11 is completely unobstructed save for three or four small centering pins 26 which project from the wall 21 of the liner and engage the wall 19 of the jacket.

Towards its upper end, jacket 10 swells out into a large peripheral boss 27 which covers a large, open-faced channet 28, surrounding liner 11. A port 29, is formed at one point in the boss 27, into which pipe nipple 31 is tapped. Nipple 31, together with elbow 32, and valve connector 33, form an entrance conduit for compound which is admitted into the die through the needle valve 34. Preferably this valve is identical to those developed for use on rotary lining machines and may be operated either by a mechanical linkage or electromagnetically. Since this element is well known and has achieved a separate status in the art (for example, see U.S. Patent Number 2,442,179) it will not be further described. All such valves operate in timed relation to the movement of the closure through a lining machine and all serve to deliver a predetermined and uniform amount of compound to the closure during their operating cycle. Following conventional practice, compound is supplied to the valve from a tank equipped with a pneumatic inlet and pressure adjusting valve to provide an adjustable pneumatic head pressure. In this instance a head pressure is chosen which will force the proper amount of compound to accumulate on the tip. Of course, the pressure must be varied to accord with the viscosity of the particular compound which is used.

There is a large free air passage 20 through the liner 11. Always, the liner, whatever its peripheral configuration, is tubular and has open ends. Were these ends closed, air trapped under the die as it descends on the closure would blow the lining out of place.

The linear extent of the gap 25 between the lower wall 35, of channel 28 and the extremity 24 of the tip is quite long. Its optimum length depends upon the characteristics of the compound, but, as an example, if the gap 25 is $\frac{15}{1,000}$ of an inch wide, the linear dimension of the gap between the lower wall of channel 28 and the extremity 24 is approximately an inch and a half. The volumetric capacity of the channel or compound header 28 should be large. Preferably, in order to minimize pressure fluctuations, it should be ten times or more the volumetric capacity of the gap 25 between channel 28 and tip 24.

The effect of this design is to impose a high resistance to the flow of compound in the exit passage and consequently to mantain a very considerable back pressure on the compound occupying channel 28. As a result of the high back pressure, the pressure exerted all around the periphery is quite uniform and a uniform flow of compound moves down the exit passageway 25. Spotty or streaky delivery is eliminated.

The use of these nozzles on a conventional slide type lining machine will now be described. Such machines have been known for years.

Essentially these machines consist of a chuck which is cyclicly lifted and lowered by a cam. The chuck is loaded and unloaded by a slide which reciprocates horizontally across the working face of the machine. Unlined closures are stacked at one end. In its retreating stroke, the slide passes beneath the stack of closures. On its advance, knives on the slide cut the lowermost closure from the stack and place the closure on the chuck. Meanwhile, the forward end of the slide has engaged the closure previously resting on the chuck and carried it forward to tuck it beneath a stack of lined closures which piles up at the opposite end of the machine. Such machines are equipped with cams having very wide adjustability which may operate a mechanical linkage connected to the needle valve of the compound nozzle, but more frequently today open and close an electrical breaker which

controls the electric circuit of an electro pneumatic needle valve opening and closing device.

The die of this invention is substituted for the conventional electro pneumatic needle nozzle. A chuck designed to receive, for example, a closure or "end" of a sardine can is substituted for the round chuck. The miter gearing which causes the chuck to rotate continuously is disabled. The height of the die is so adjusted that, when the chuck lifts, the end just contacts the tip of the die. The timing cam is adjusted to open and close the needle valve while the die is out of contact with the closure and the lift of the needle valve is adjusted to cause the delivery of the desired amount of sealing compound to the die during the time that the needle valve is open. When the chuck rises and brings the closure into contact with the tip of the die and then drops, the closure falls away, bearing with it compound which has been exuded on the tip of the die during the out-of-contact period.

Since it is not necessary to design a compound which will stick to the die when it is dipped into the mass, a much wider range of compounds can be used. Webby or stringy compounds can be completely avoided. Compounds which possess quick, sharp break characteristics can be used. Further, because the compound does not flow into the tip as it is being deposited on the end (a requirement in prior dies) contact time can be very short, and need by only the time required to permit the chuck lifting cam to lift and lower the chuck smoothly, a matter of twenty milliseconds. The compound may gather on the tip during the whole out-of-contact cycle, but practically about 40 milliseconds are allowed for the compound gathering cycle. Consequently, this die lining operation is very fast. The machine output reaches about twice that of conventional die lining machinery. The quality of the lining is also improved. It is more uniform and holds a better cross-section.

I claim:

1. An internally fed lining die adapted for use in combination with die lining machinery comprising a body having a terminal printing tip shaped to conform to the sealing periphery of the container closure to which the lining is to be applied, a straight, parallel-walled passageway having a closed upper end interiorly located in the body and having a uniform spacing between its walls not exceeding 0.025 inch, the passage ending in a continuous opening in the extremity of said tip, a channel having its open face directed towards the interior wall formed in the exterior wall of the passage and normal to said passage, forming thereby a compound header having a volumetric capacity of not less than ten times that of the volume of the passage between the channel and the tip opening, the zone of discharge from the channel into the passage being located at a distance from the tip opening of not less than 40 times the width of the passage, an air vent comprising an open bore extending longitudinally through the body and occupying a major portion of the cross-sectional area enclosed by said passage, a port to admit compound into the channel, a conduit connected to the port, and a valve in the conduit adapted to be opened and closed in timed relation to the movement of closures through the machine.

2. That method of forming lining elements on container closures which comprises providing an internally fed die having a printing tip having as its contour the desired shape of the lining element and provided with a continuous peripheral slot communicating with a like-shaped compound feed passage, applying pressure to lining compound supplied to said passage only when the tip is out of contact with a container to permit the build-up on said tip of a pendant exudation of compound all parts of which are uniform in cross-section, cutting off the pressure when the pendant compound reaches a preselected volume, then printing-off the exudation by bringing an unlined closure into momentary contact with said printing tip while preventing the displacement of the de-

posited compound by venting the air in the area enclosed by said compound through a central air vent, removing the closure, and repeating the succession of operations on successive unlined closures.

3. An internally fed lining die adapted for use in combination with die lining machinery comprising a tubular jacket having a straight walled bore the cross-section of which conforms to the shape and size of the lining to be imprinted on a container closure, a horizontal channel formed in the jacket surrounding the bore and having its open face directed towards the bore, a tubular liner the exterior walls of which enclose a shape geometrically similar to that of the bore maintained in spaced relation to the walls of said bore by aligning means adjacent the upper end of the jacket to form a straight, parallel walled passage of a uniform width not exceeding 0.025 inch, the walls of the passage defining a continuous opening in said tip, said tip being located not less than 40 times the width of the passage below the channel, the walls of the channel together together with the liner forming a compound header having a volumetric capacity not less than ten times that of the passage below said channel, the bore

of the liner occupying a major portion of the cross-sectional area of said liner and forming an unobstructed air passage open to the atmosphere at its upper end, the walls of both the jacket and the liner at said printing tip leading abruptly upward and outwardly from the margin of the passage to permit contact with the closure at said tip only at the margin of the passage, a port leading into the channel, a conduit connected to the port, and a valve in the conduit adapted to be opened and closed in timed relation to the motion of closures through the machine.

4. An internally fed lining die in accordance with claim 1 wherein the pressure drop in the passage leading from the compound header to the printing tip is at least two orders of magnitude higher than the pressure drop around the channel forming the header.

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