April 11, 1967 J. ROBINSON 3,313,439

CLOSURES FOR CONTAINERS

Filed Dec. 17, 1965 3 Sheets-Sheet 1

FIG. 1.

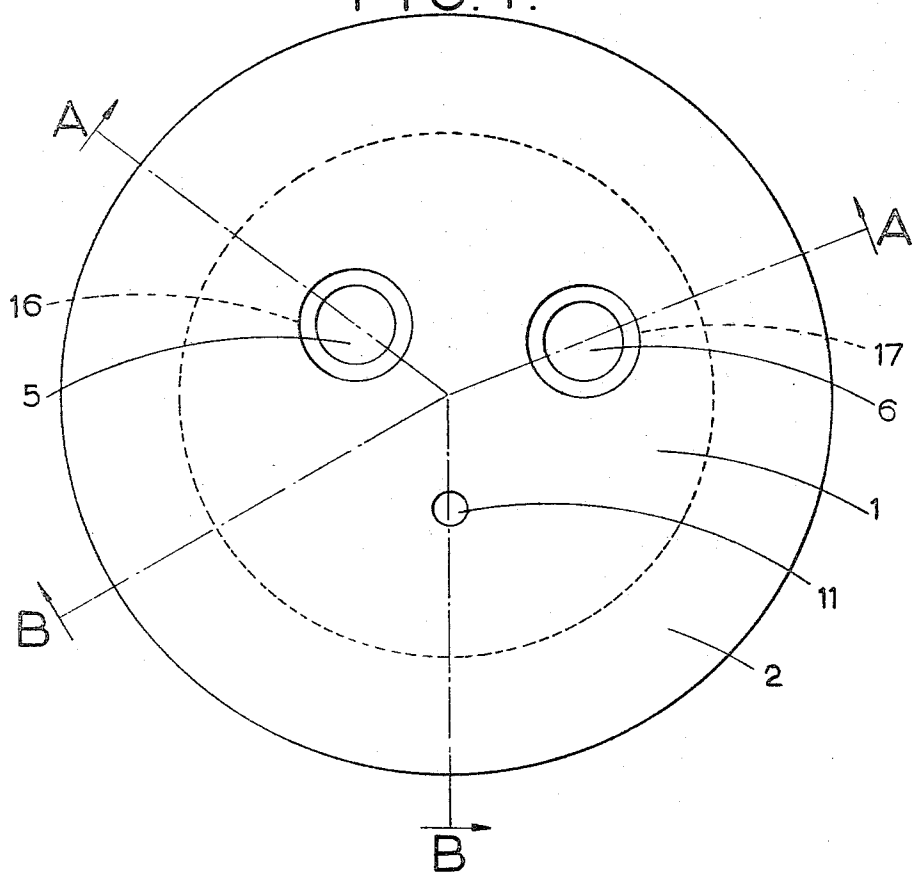
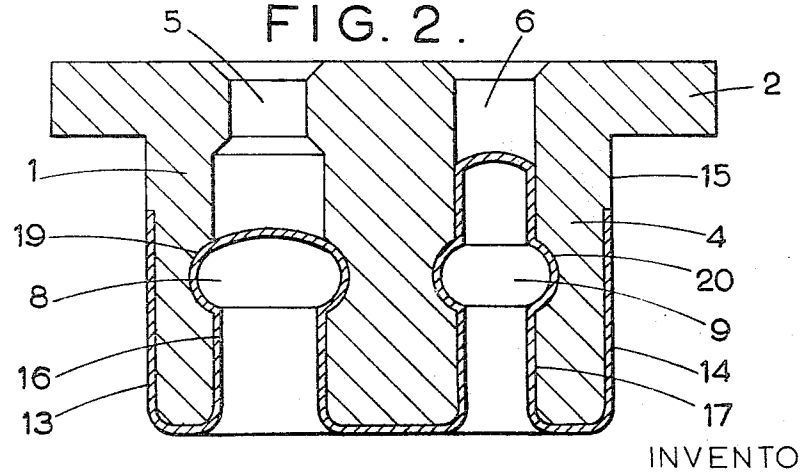


FIG. 2.



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FIG. 3.

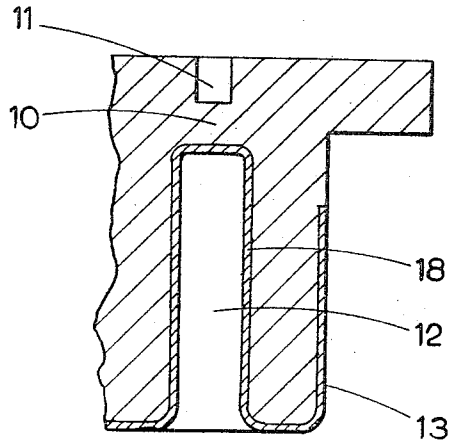
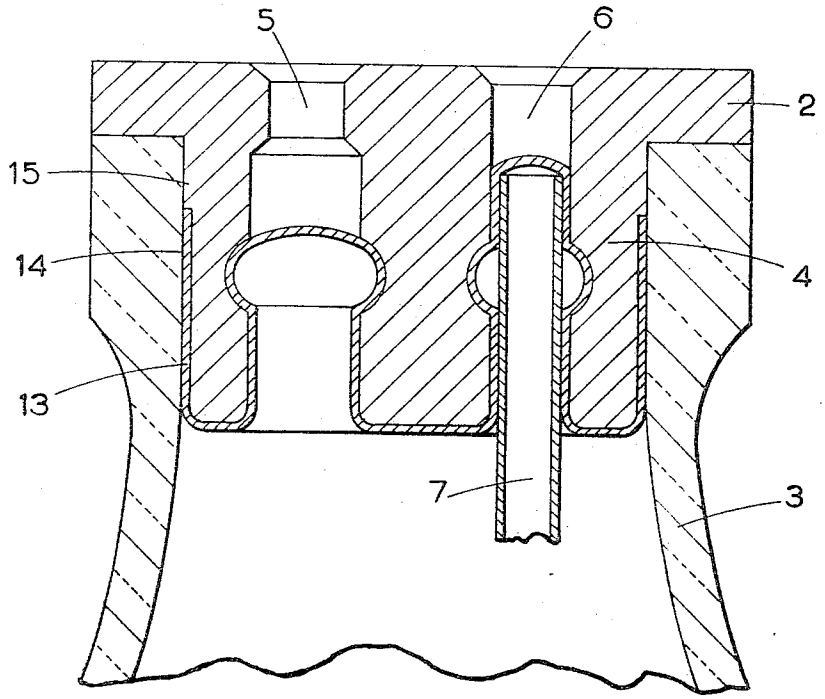


FIG. 4.



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FIG. 5.

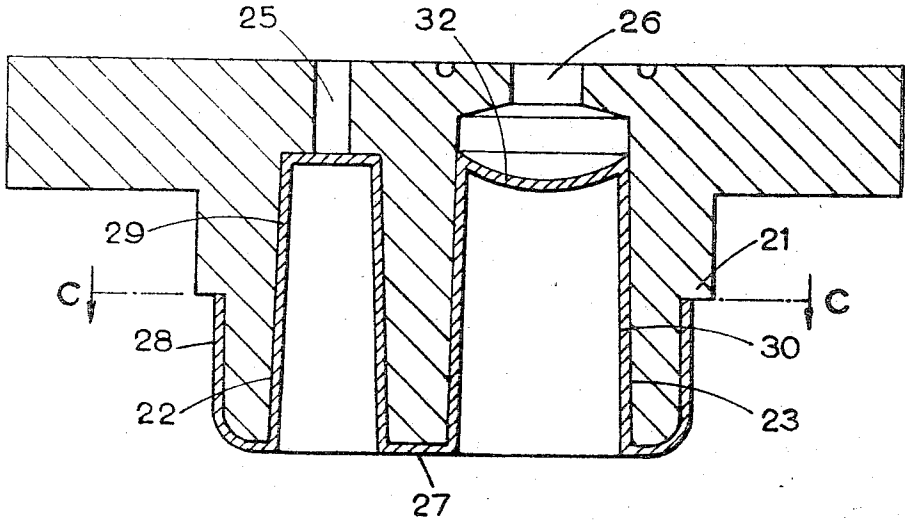
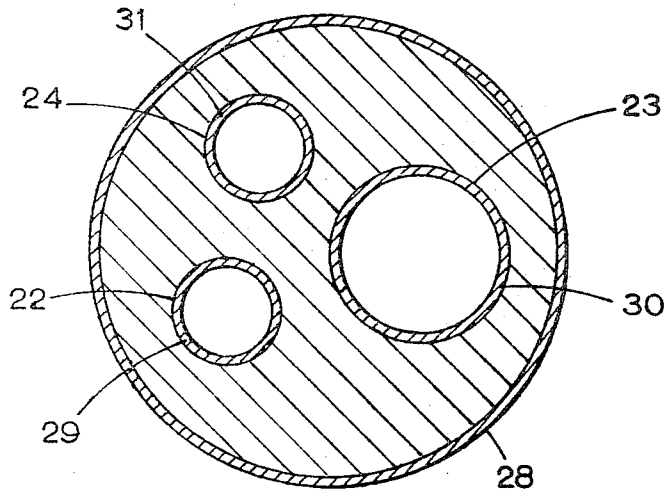


FIG. 6.



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CLOSURES FOR CONTAINERS

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Claims priority, application Great Britain, Dec. 22, 1964, 52,115/64
4 Claims. (Cl. 215—37)

This invention relates to closures for containers and particularly, but not exclusively, to closures for containers such as bottles used for administering parenteral solutions.

Parenteral solutions must be maintained in a completely sterile condition. It is therefore necessary to keep them in containers having closures which provide a completely hermetic seal. The closures of such containers are usually made of rubber, which is the best known sealing material for producing a sterile seal, and usually have passages leading to the interior of the container. At least two such passages are normally provided, one being arranged to receive a delivery tube for discharging the contents of the container with the other being arranged to receive an air inlet tube extending almost to the bottom of the bottle. The external openings of the passages are sealed until the contents of the container are used in order to maintain the contents in a sterile condition. Various seals have been employed in the past. For example, the outer surface of a rubber closure has been covered by a flexible rubber sealing disc or the passages may be closed by removable plugs or the passages may not extend through the entire closure, the remaining portion of the closure being penetrable by a hollow needle of, for example, the delivery tube.

Such closures have all suffered from the disadvantage that the contents of the containers may become contaminated with particulate, colloidal or soluble extractial material from the rubber closure during sterilisation and when maintained over long periods of time after sterilisation. Various attempts have been made to overcome this difficulty. For example, it has been proposed to cover the surface of the closure in contact with the contents of the bottle with lacquer or to modify the surface by treatment with halogen. Such a modified surface can, if desired, be coated with nylon. None of these proposals is entirely satisfactory since the barriers between the closure and the solution are not completely impervious or the barriers are time-consuming and costly to apply.

It is an object of the present invention to provide a closure for parenteral solution bottles which does not suffer from these disadvantages, but retains the high efficiency of the sealing properties of rubber.

Accordingly the present invention provides a closure for a container comprising, a stopper made of resilient material adapted to be tightly seated in the neck of the container and having at least one passage extending completely through the closure in the axial direction thereof and a protective cap of inert material fitted on the internal surface of the stopper so as to prevent the stopper coming into contact with the contents of the container, the said cap having a pierceable protuberance fitted in, and closing, the passage or each passage.

The stopper is preferably of rubber. The protective cap is preferably of a thermoplastic material which is resistant to sterilization temperatures; examples of suitable materials are polypropylene or high density polyethylene. The cap may be a moulding and may be fitted on the internal surface of the stopper before the latter is inserted in the neck of the container.

It is important that the cap is firmly secured to the stopper especially if the container is under vacuum as the cap will then tend to be forced into the container. The protuberance, or each of them, grips the sidewalls of the passage and provide a good seal between the cap and the stopper. The protuberance or each of them may be enlarged at the outer end and the enlarged portion may fit tightly into a corresponding recess in a passage. When the pressure outside the container is greater than that inside, the enlarged portion of a protuberance is forced against the walls of the recess thereby effectively sealing the passageways. The pressure created when the closure is compressed by insertion into the neck of the container also forces the cap firmly on to the stopper and the effect of the sterilisation temperature on the thermoplastic material of the cap produces intimate contact, and possibly some bonding together, of the cap and the stopper.

In the accompanying drawings:

FIG. 1 is a plan view of the upper surface of the closure,

FIG. 2 is a sectional view of the closure of line A—A,

FIG. 3 is a partial sectional view similar to FIGURE 2 but on line B—B,

FIG. 4 is sectional view corresponding to FIG. 2 howing the closure fitted in the neck of the container,

FIGURE 5 is a view similar to FIGURE 2 but of a modified closure, and

FIGURE 6 is a sectional view of the same closure taken on line C—C.

FIGURES 1 to 4 of the drawings illustrate a closure comprising a rubber stopper **1** having a flange **2** which fits over the rim of the neck of a bottle **3** and a spigot portion **4** which fits inside the neck. The stopper **1** has two passages **5** and **6** extending through the stopper in the axial direction thereof towards the interior of the neck. The passage **5** is intended to receive and grip a delivery tube when the bottle is to be emptied and the passage **6** is arranged to receive at its inner end an air-inlet tube **7** which extends almost to the bottom of the bottle **3**. The passages **5** and **6** have enlarged recesses **8** and **9** respectively.

The stopper has a portion **10** of reduced thickness provided by blind passages **11** and **12**. A hollow needle for the introduction of additional medicament may be inserted into the bottle through the reduced portion **10**.

A cap **13** is fitted to the inner surface of the stopper **1**. This cap **13** is made of, for example, polypropylene or high density polyethylene. The cap **13** has a wall or skirt **14** which covers most of the walls of the spigot **4**, a small region **15** of the spigot wall near the rim of the neck being not covered so as to provide a good seal with the portion of the neck in contact with it.

The skirt **14** may have a circular beading around its outermost edge and this beading may fit into a complementary groove in the stopper. This also helps to secure the cap **13** to the stopper **1**.

The cap **13** has protuberances **16**, **17** and **18** which enter and close passageways **5**, **6** and **12** respectively and extend to a position intermediate the ends of the passageways. The protuberances **16** and **17** have enlarged portions **19** and **20** which engage with the recesses **8** and **9** of passageways **5** and **6**.

The external surface of the closure may have a dust-cover such as a thin rubber diaphragm held in place by a tear-off cap made of, for example, aluminium.

When it is desired to administer the contents of the bottle, the tear-off cap and the dust-cover are removed to expose the ends of the enlarged portions, **19** and **20**, of the protuberances, **16** and **17**, in the passages **5** and **6**. If the delivery tube has a plastic needle this may be pushed through the portion **19** while a plastic or metal air-inlet needle may be similarly inserted through the protuberance **17** into the air-inlet tube **7**. If the delivery tube is made of glass the protuberances **16** and **17** are pierced with, for example, a hollow needle and the de-

livery tube is then inserted in the broken protuberance **16**. The hollow needle used for piercing the protuberances may, if desired be left in the air-inlet hole **6**.

FIGURES 5 and 6 illustrate a modified closure which is used in the same way as that of FIGURES 1 to 4 and includes a rubber stopper **21** basically the same as the stopper **1**. Extending through this stopper, are passages **22**, **23** and **24**, each of these passages having reduced outer portions of which only the portions **25** and **26** of the passages **22** and **23** are visible in the drawings. A cap **27** of polypropylene has a skirt **28** fitting on the outside of the stopper **21** and protuberances **29**, **30** and **31** tightly fitting in the passages **22**, **23** and **24** respectively. These protuberances differ from the corresponding ones (**16**, **17** and **18**) of the embodiment of FIGURES 1 to 4 in that they do not have enlarged portions. The protuberance **30** is of larger diameter than the others and has a closure end surface **32** which is concave or dished towards the interior of the protuberance. This assists in ensuring that a needle pushed through this end will pierce the centre of the end surface.

If desired, the protuberances of both embodiments can be of such a length that they will, when the closure is fitted in the neck of a bottle, extend above the level of the rim of the neck. This will increase the area of the cap gripped by the rubber of the stopper when the rubber is compressed by the insertion of the stopper into a bottle neck.

A tight grip between the cap and the stopper can also be assisted by providing the protuberances with one or more annular beads.

What is claimed is:

1. A closure for a container which closure comprises a stopper made of resilient material so that it can be tightly seated in a neck of said container and having a passage extending completely through the closure in the axial direction thereof; and a protective cap of inert material fitted on the internal surface of said stopper so as to prevent said stopper coming into contact with the contents of the container, said cap having a pierceable protuberance fitted in, and closing, said passage.

2. In a neck of a container for liquids, a closure comprising a rubber stopper which is tightly seated in said neck and has a plurality of passages extending completely therethrough in the axial direction thereof; and a protective cap of an inert material fitted to the internal surface of said stopper so as to prevent said stopper coming into contact with the contents of said container, said cap having a plurality of pierceable protuberances each of which is fitted in, and closes, one of said passages.

3. A bottle closure comprising a stopper of resilient material with a spigot adapted to fit in a bottle neck and a flange adapted to fit over the rim of said neck, said stopper having a plurality of passages therethrough; and a cap of inert material with a skirt extending over part of the surface of said spigot and a plurality of pierceable protuberances each of which fits in, and closes, one of said passages, each of said protuberances extending to a position intermediate the ends of the passage in which it is located.

4. In a container having a neck, a closure comprising a resilient stopper with a spigot fitted in said neck and a flange fitted on the rim of said neck, said stopper having a plurality of passages extending therethrough to provide access to the interior of said container; and a cap of inert material with a skirt extending over part of the surface of said spigot and a plurality of pierceable protuberances each of which fits in and closes one of said passages, said protuberances having annular bulges intermediate their ends.

References Cited by the Examiner

UNITED STATES PATENTS

2,072,853	3/1937	Baxter.	
2,747,756	5/1956	Hartop et al.	215—47

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