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H. E. MORTON

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TEST TUBE CLOSURE

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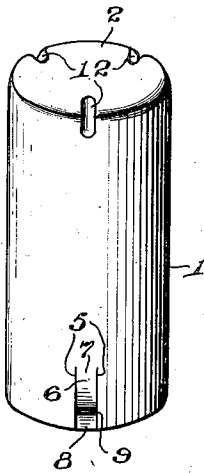


Fig. 1.

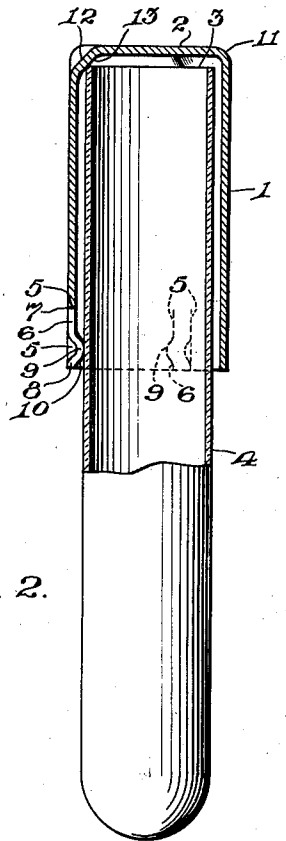


Fig. 2.

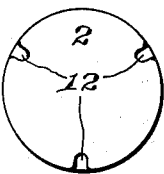


Fig. 3.

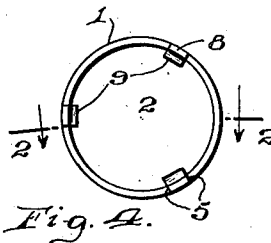


Fig. 4.

INVENTOR
Harry E. Morton
BY
J. Stuart Freeman
ATTORNEY

UNITED STATES PATENT OFFICE

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TEST TUBE CLOSURE

Harry E. Morton, Drexel Hill, Pa.

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2 Claims. (Cl. 215—38)

The object of the invention is to provide improvements in closures for test tubes and other vessels employed in microbiological work, but more particularly in closures for that type of test tube which is quite generally used in bacteriological work, as met with in teaching, diagnostic, commercial and research laboratories, and is characterized by the fact that its free open edge portion is devoid of the outwardly directed flange that is commonly found upon the well known type of tube employed in chemical laboratories.

Heretofore, it has long been the general practice to manually prepare closures of cotton for use in such tubes or vessels as are employed in bacteriological work, for the purpose of preventing the entrance of micro-organisms from the surrounding atmosphere during the entrance of air or gases into said culture tubes or vessels, while permitting the passage of air or other gases. Although it has long been recognized that closures of this type have very definite drawbacks, one or two attempts to produce a metal closure have not been successful commercially, due to their designers having failed to appreciate the full significance of many of the controlling factors present.

A more specific object, therefore, is to provide an improved metallic closure, comprising a cap formed of metal and provided with resilient fingers, preferably connected at one end only to the body portion of the said cap, and operative to yieldingly and slidably engage the outer surface only of the tube or vessel upon which it is detachably mounted.

Still another object is to provide in such a closure means to positively prevent the same from completely sealing the contents of the tube while operatively applied thereto, but instead to provide a substantially uniformly cylindrical capillary passageway between closure and tube, for the reason that aerobic bacteria, as their name implies, require free access to the air both for their existence and propagation, and the majority of micro-organisms encountered in the usual teaching, diagnostic or research laboratory fall in this broad class. For the propagation of the anaerobic type of bacteria, the free access of atmospheric oxygen is not necessary, often the nature of the anaerobic micro-organism being such as to require the complete absence of free atmospheric oxygen, and in such cases the closure must allow the escape of the air from within the culture vessel and the entrance, usually, of another gas such as hydrogen or nitrogen. It is imperative that no contaminating micro-organ-

isms be introduced into the interior of the tube or vessel from the outside during the exchange of the gases.

With the objects thus briefly stated, the invention comprises further details of construction and operation, which are hereinafter fully set forth in the following specification, when read in conjunction with the accompanying drawing, in which Fig. 1 is a perspective view of a closure cap comprising one embodiment of the invention; Fig. 2 is a vertical sectional view taken through the same, as indicated by the line 2—2, and with the said cap in operative association with the upper open end portion of a test tube; Fig. 3 is a top plan view of the said cap; and Fig. 4 is a bottom plan view of the same.

Referring to the drawing, one embodiment of the invention is here shown as comprising a preferably cylindrical body portion 1, closed at one end by an imperforate wall 2, said cylindrical wall being adapted to slide telescopically upon the otherwise open end 3 of a cylindrically walled test tube 4, or other vessel having a similarly shaped opening, while it will be noted from Fig. 2 that the internal diameter of the improved closure cap is substantially larger than that of the outside diameter of the adjacent portion of said test tube or other vessel.

This pronounced difference between the sizes of the two elements is purposely due to the provision of the cap of a sufficiently large diameter, to receive and efficiently accommodate a rather wide variation in the sizes of test tubes, and to additionally insure at all times a free air passage between said cap and even the largest size of tube for which said cap may be designed. This definite provision of a free air passage is for the purpose of permitting the relatively free access of air or other gases to the interior of the said tube and to the bacteria or other micro-organisms which may be contained therein, for the reasons hereinbefore pointed out.

The dimensions of the air passage allowed by the metal closure are such as to prevent the passage of contaminating micro-organisms during the entrance of air or other gases.

At preferably three or more locations about the periphery of the free edge portion of the improved cap, the same is provided with a pair of spaced slits or sheared severances 5, which provide between them radially resilient fingers 6, integrally connected at 7 to the body portion of the cap, while their free ends 8 are adapted to be oscillated substantially in the same plane, as the periphery of said adjacent end portion. Each of

these so-called fingers is furthermore provided with an inwardly deflected protuberance 9, which is adapted to normally engage frictionally the adjacent outer surface of the tube or other type of vessel 4. These protuberances are preferably spaced slightly from the free end portions of the respective supporting fingers and are characterized by oppositely directed, diagonally extending cam-like surfaces 10 for initially engaging the free edge portion 3 of said tube and causing the otherwise inwardly positioned fingers to yield outwardly as said protuberances ride over the outer surfaces of said tube.

As shown in Fig. 2, it will be seen that the improved closure cap might completely close the open end of said test tube or other vessel, but to prevent such possible closing of said tube, that annular portion 11 of said cap, which is defined by the union of the body portion 1 with said end wall 2, is provided with three or more, preferably equally spaced, radially inwardly extending indentations 12, the inner surfaces 13 of which are directed angularly with respect to said cap and to the tube to which said cap may be attached, with the result that there is always an air passage between the inner surface of the closed end of the metal closure and the open end of the test tube or other vessel.

From the foregoing, taken in conjunction with the accompanying drawing, it will be evident that there has been provided an improved closure, which fulfills all of the requirements of an efficient closure for a tube or a vessel of the type shown, and especially when employed in the bacteriological work herein referred to. The advantages of a properly constructed metallic cap, as compared with the cotton plugs now generally in use, are briefly set forth as follows:

The cotton plug can be used but once, whereas a metal cap can be used repeatedly; considerable time is required by specially trained workers to make the cotton plugs, as well as to properly insert them within the mouth of the tube, whereas metallic caps are uniform and, therefore, interchangeable, and can be attached to and detached from tubes with the utmost ease; cotton plugs not being uniform tend to vary greatly in length, thickness and the tightness with which they are rolled, whereas the metallic caps are at all times uniform; cotton is easily charred during sterilization, whereas metal caps are unaffected during such treatment; cheaper grades of cotton containing cottonseed and perhaps other oils, tend to cause a fouling of the inner surface of the tubes, due to depositing thereupon oil coatings and additionally tend to foul the interior of the sterilizer, whereas no such trouble arises from the use of a metal cap; even when using long fibred cotton, the lint that is frequently deposited in the tubes is a disadvantage in some work, whereas there is no lint in the case of a metal cap; to prevent the detachment of fibres from a cotton plug, the plug must be wrapped with gauze, all of which, including the cutting and preparation of the gauze, is eliminated by using a metal cap; to expose the contents of a tube for purposes of inoculation, or for removing inocula, it is much more easy to remove a metal cap than a cotton plug, for among other reasons, the cotton plug frequently becomes pushed down into the tube and requires tweezers or forceps to remove the same, whereas there is obviously a positive limit to the extent to which a metal cap can be placed upon a tube; a cotton plug may easily become soiled with media, in which case the plug adheres

to the tube, leaving the mouth of the tube fouled with cotton fibres, and similarly during inoculation of the tube, the cotton fibres frequently become contaminated from the inoculating loop, thereby infecting the handle of said loop (or needle) and spread the contamination to the hands of the worker, whereas there is no such risk with the metal cap; cotton plugs, if wetted by the media, as during sterilization, become a solid mass and no longer serve as an efficient filter when the media cools and hardens, whereas a metal cap is not thus affected. Similarly, the cotton plugs, if wetted upon removal from the autoclave and permitted to remain wet, tend to become contaminated with molds and thereby contaminate the medium, wherefore again a metal cap is not thus affected. Cotton plugs, furthermore, are susceptible to become wetted, while within certain types of autoclaves in particular, with the result that as the pressure decreases within the tube, water is drawn thereinto and results in diluting, and frequently making the medium unfit for use, often causing as much as at least 1% loss, whereas water dropping upon the improved metal cap could not penetrate into the tube; tubes stoppered with cotton plugs, while stored, tend to become covered with dust-carried spores of bacteria and molds, and thereby tend to contaminate the contents of tubes to which such plugs are attached, whereas metallic caps more nearly serve as a positive prevention from media contamination; cotton plugs permit a substantially increased rate of evaporation over that experienced by metal caps, wherefore metal caps effect a definite saving in media during storage; cotton plugs must be secured by rubber bands, pins, or other extraneous means, before placing tubes containing them in a centrifuge, thus involving a waste of time and frequently an insufficient prevention against the plug slipping into the tube results in the ruining of the contents in said tube, no manipulation being necessary in the case of a metal closure; cotton plugs permit of no reasonable form of identification, either as to themselves or as to the tubes and contents thereof to which such plugs may be attached, whereas metallic tubes may be provided with any desired form of identifying indicia, such as name of owner, institution, department, et cetera; it would be difficult to adapt cotton plugs to oval shaped culture tubes, whereas metallic caps may be readily shaped for such a tube; cotton plugs occupy a considerable portion of the interior of a tube, whereas the improved metal cap herein described occupies no portion of such internal space; together with additional advantages of the improved metal tube which might be enumerated at greater length.

Having thus described my invention, what I claim as new and desire to protect by Letters Patent of the United States is:

1. The combination of a test tube for use in microbiological work, having an open end portion of uniform diameter, with an elongated cap comprising a cylindrical wall, slightly larger than the end portion of said tube over which said cap telescopes, and an end wall in slightly spaced relation with respect to the open end of said tube, circumferentially spaced resilient means carried by said cap to uniformly space and prevent tilting of said cap with respect to said tube, and circumferentially spaced ribs extending at an angle of substantially 45° with and connecting said cylindrical and end walls of said cap and

engaging the circular edge of the open end of said tube, to positively center and provide a substantially uniform capillary space between said cap and both the sides and the end of said tube, and through which space gasses are free to pass into and from said tube.

2. A cap for test tubes and equivalent vessels of slightly varying diameters, comprising a tubular side wall of larger diameter than the vessel and an imperforate end wall, and circumferentially spaced ribs extending at an angle of sub-

stantially 45° with and connecting said side and end walls, said ribs being engageable with the outer edge of the otherwise open end of the vessel, to center said cap with respect to the vessel, the distance between the end wall of said cap and the ends of the vessel varying with the diameter of the vessel, to thereby permit the free flow of gasses into and from the vessel through a substantially predetermined size of passageway.

HARRY E. MORTON.