

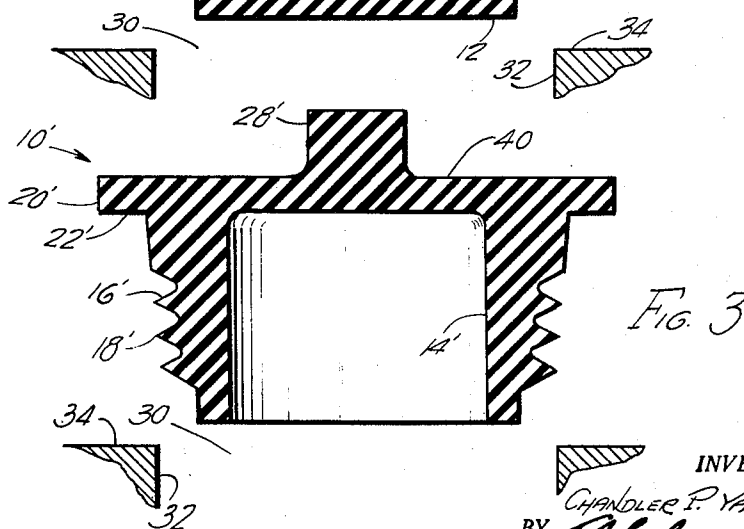
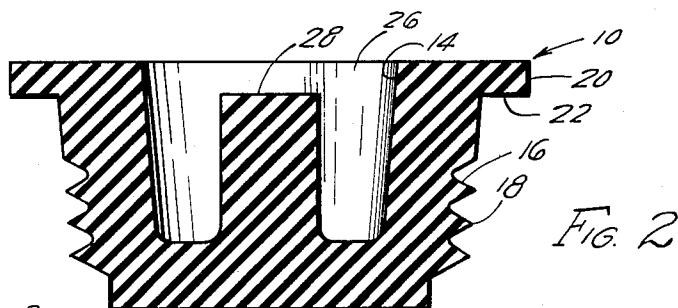
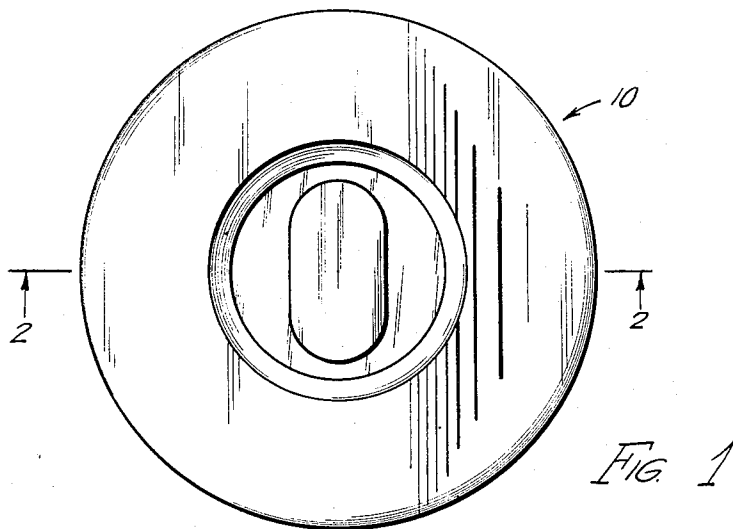
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CLOSURE PLUG

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CLOSURE PLUG

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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to closure plugs and more particularly to closure plugs which are capable of effecting a positive moisture- and vaporproof seal. More specifically, the present invention is concerned with flexible rubber closure plugs for ports, breather openings, tubes and similar orifices in engines and like equipment to effect a positive and lasting seal against the entrance of moisture or the leakage of preserving compound or oil within such equipment and to remain in effective sealing position without damaging or distorting the port or opening until the removal thereof is desired.

Heretofore, closure plugs intended for such purposes have been made of wood, metal, or plastics, or various combinations thereof but have been found to be unsuitable for several reasons. A positive sealing effect was not obtained in many instances with the result that moisture entered the interior of the equipment or the preserving compound or oil escaped therefrom with the result that parts rusted or oxidized. This was especially noted whenever the contour of the port or opening was not perfectly regular and the plug could not adapt itself sufficiently to assume that contour to prevent leakage. In many cases, the plugs were used with openings which had been carefully machined and finished to extremely close allowances and tolerances and have caused distortion or other damage thereto because of the poor fit therein. Another consequence of such poor fits developed when the equipment was subjected to the jolting and jouncing in transit when the plugs would fall completely out of the openings to permit foreign or other extraneous matter to enter therein whereby close inspection and perhaps repair of the equipment would be required after transit. It has also been determined that the closure plugs presently in use are unsuitable for many of the operations to which such equipment is subjected, such as sand blast cleaning, for example, wherein a rapid erosion and wearing of the closure plug was noted. As a result, the plugs now in use have not been found to be completely satisfactory and their performance leaves much to be desired.

It is a purpose of the present invention to provide closure plugs for ports and openings which will be capable of effecting a positive and lasting moisture- and vaporproof seal.

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It is a further purpose of the present invention to provide closure plugs for ports or openings which can be easily inserted therein and easily removed therefrom when desired.

It is a still further purpose of the present invention to provide closure plugs for ports or openings which will fit firmly in position without distorting or otherwise damaging the port or opening and which will remain in such position during the jolting and jouncing incident to transit.

Another purpose of the present invention is to provide closure plugs which are sufficiently flexible and yieldable to conform to ports and openings which are not perfectly regular.

Still another purpose of the present invention is to provide closure plugs capable of resisting oil, fuel and moisture and which will not be harmfully affected by the operations to which the equipment is subjected.

Other purposes, as well as features and advantages of the present invention will become apparent from a consideration of the following specification and the accompanying drawing wherein I have described and illustrated a preferred embodiment of my invention but it is to be understood that my invention and inventive concept is not to be construed as limited to the specific constructions described or shown therein, except as determined by the scope of the appended claims.

With reference to the accompanying drawing:

Figure 1 is a plan view of a closure plug of the present invention.

Figure 2 is a cross-sectional view of the closure plug of the present invention, taken on the line 2—2 of Figure 1.

Figure 3 is a cross-sectional view of a modification of the closure plug of the present invention taken on a line similar to that used for Figure 2.

Referring to the accompanying drawing wherein is set forth preferred embodiments of the present invention, the closure plug 10 possesses a shallow bowl or cup-like configuration and comprises a relatively thin circular base or bottom wall 12 and a circumferential side wall 14 extending longitudinally upwardly therefrom. This side wall 14 is conically flared outwardly from the base 12, and in the embodiments set forth herein, have been flared to a preferred angle of five degrees (5) to the vertical. This, however, is not to be considered as limitative of the angle of flare inasmuch as such may be varied more

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or less depending upon the necessities of the particular circumstances.

A series of longitudinally spaced circumferential flanges 16 are formed on the exterior of the side wall in the form of tapering fins extending outwardly therefrom. Three of such fins have been illustrated but it is to be appreciated that more or less may be employed, as desired or necessary. The fins 16 terminate in sharply defined edge portions 18 which, due to their relative acuteness and thinness have considerable flexibility and yieldability under applied pressure.

A radially extending annular flange or lip 20 is formed on the upper portion of the side wall 14 and possesses a flat underhead portion 22 which forms the plug seat for a purpose to be described hereinafter.

A cored-out recess 26 is thus formed within the side walls 14 and the annular flange 20 whereby considerable flexibility is given to the thin circular base 12 and to the side walls 14. A removing tab or stub 28 is provided substantially at the center of the upper surface of the circular base 12 and extends longitudinally upwardly sufficiently to be gripped by the fingers or by any appropriate tool or device whereby the plug 10 may be inserted into or removed from the opening or port. Such removing tab 28 has been shown as having an oval transverse cross-section but it is apparent that any other conformation may be used provided sufficient gripping surface is presented.

The closure plug 10 is intended to be used in conjunction with engines or similar equipment having a port or opening such as, for example, orifice 30 having internal walls 32 and an outer surface 34 adjacent the orifice 30 so that the minimum diameter of the extremities or tip 18 of the lowermost fin 16 is substantially equal to or preferably slightly greater than the diameter of the orifice 30. The closure plugs 10 could be made up in a series or set of successively increasing diameters whereby a proper selection could be made of the desired closure plug. However, where the plugs are to be used with carefully machined and finished parts, it may be advisable to make the plugs specially therefor.

When the closure plug, Figure 2, is inserted into the orifice 30, it enters very easily therein with the sharply defined edges of the fins 16 yielding slightly to permit such entry. Simultaneously when inserting pressure is applied thereto on said removing tab 28, which in turn is transmitted to the circular base or diaphragm 12, this circular base no longer remains straight as illustrated, Figure 2, but assumes a convex nature. The potential tendency of the distorted convex circular base 12 resiliently acts upon the fins as they have slightly yielded upon entry heretofore described. In yielding thereof these line contact concentric fins 16 offer the maximum resistance to removal and the most efficient seal. The direct result is that the closure plug will not fall out under vibration or the numerous and varied conditions common to motor, rail, air and steamship transportation. When removal of the closure plug is desired an exact opposite reaction occurs thereby affording easy removal therefrom. As the closure plug 10 enters the orifice 30 more and more, the resistance to such entry increases gradually until ultimately the plug seat 22 rests firmly upon the upper surfaces 34 adjacent the orifice 30. This increasing resistance to the entry of the closure plug 10 is, of course, a direct result of the taper-

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ing of the side walls 14 and is controlled and predetermined by the selected angle of flare thereof.

The flexibility of the multiple finned side walls 14 permit the yielding thereof so that there is considerable tendency thereof to assume the contour of the orifice 30 and to compensate for any slight irregularities therein. In this way, a lasting and positive seal may be obtained with orifices having wall surfaces which are not completely regular. The flexibility of the thin bottom wall 12 permits a slight yielding thereof when pressure is applied thereto during the seating of the plug 10 in the orifice. When this pressure is released, the bottom wall 12 will resiliently attempt to spring back into its normal position. As a result, the closure plug firmly grips the internal walls of the orifice in a side sealing effect and the plug seat adheres to the surfaces adjacent the orifice in a top sealing effect whereby the closure plug tenaciously resists any efforts to remove the same due to mishandling of the equipment or due to the jolting and jouncing inherent in transit. Such gripping action is aided to a great extent by the suction exerted by the closure plug in such an orifice. When it is desired to remove the closure plug, it may be gripped by the removing tab and pulled upwardly out of the orifice. If necessary, the closure plug 10 may have its annular flange 20 urged slightly inwardly whereby the suction or vacuum effect is destroyed and the plug removed very simply thereby.

A modification of the closure plug 10 is shown in Figure 3 illustrating a closure plug 10' wherein the principal change is noted in that a thin circular top or upper wall 40 has replaced the bottom wall 12 of the species shown in Figures 1 and 2. It is to be immediately observed that the lowermost portion of the plug 10' which enters the orifice first is open with a cored-out recess directly facing into the orifice. Greater flexibility and yieldability is thus afforded to this entering portion whereby a smoother and easier entry is possible. Sidewalls 14' with tapering fins 18' and an upper radially projecting annular flange 20' with a plug seat 22' are similarly provided, along with a removing tab 28' on the top surface of the upper wall 40.

When the plug 10' is inserted in its port or opening, the fins 18' readily and resiliently yield and form a tenacious side seal, as described above in connection with plug 10. Similarly, the plug seat 22' effects an adhering top seal which is moisture- and vaporproof and which will remain in sealing position until desired to be removed.

The closure plug may be made of any rubber or rubber-like material, either synthetic or natural or a mixture of both, depending on the specific requirements of the particular situation. It is essential that the material be sufficiently flexible that the walls and surfaces thereof yield to the contours of the openings in which they are to be placed. For use with engines or similar equipment, such as for breather openings, exhaust ports, tubes or similar orifices, wherein contact with preserving compounds, oils or fuels is to be expected, it is necessary that the material be resistant to such chemical action. Additionally, the material should have sufficient hardness to maintain its configuration during its sealing action. A Shore hardness of 40 to 50 has been found to be acceptable in the majority of cases but such may be varied depending upon the circumstances. For the majority of situations, a synthetic rubber is, of course, preferred as its

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properties and characteristics lend themselves more readily to such requirements.

While I have shown and described what I believe to be a preferred embodiment of my invention in the matter of simplicity and durability of construction, ease of operation and use, etc., it will be obvious that the details of such construction may be more or less modified within the scope of the appended claims without departure from the principles of construction or material sacrifice of the advantages of the preferred design.

I claim:

1. A hollow, resilient closure plug having a frustro conical form and providing a tapered body consisting of a resilient annular wall tapering throughout its axial length and defining a cavity, said cavity extending axially from the wide end of said tapered body and terminating in a substantially flat, resilient closure wall at the narrow end of said body, said closure wall having a pull tab extending therefrom, said pull tab being positioned wholly within said cavity, there, further, being a radially outwardly extending, resilient, annular flange at the wide end of said body, said annular wall being provided adjacent the narrow end of said body with a plurality of annular fins, each of said fins, having a cross-sectional shape of the form of an isosceles triangle with the base thereof being adjacent said annular wall, with the perpendicular bisector thereof being perpendicular to said annular wall, and with the peripheral edges of said fins conforming to the taper of said body.

2. A hollow, resilient closure plug having a frustro conical form and providing a tapered body

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consisting of a resilient annular wall tapering throughout its axial length and defining a cavity, said annular wall being substantially uniform in thickness, said cavity extending axially from the wide end of said tapered body and terminating in a substantially flat, resilient closure wall, integral with said annular wall, at the narrow end of said body, there being a radially outwardly extending, resilient, annular flange at the wide end of said body, said annular wall having a plurality of tapering, resilient, annular fins integral with and projecting radially outward from that portion of said annular wall which is adjacent the narrow end of said body, said fins being similar to one another and each having the cross-sectional shape of an isosceles triangle with the base of the triangle being adjacent said annular wall and with the peripheral edges of said fins conforming to the taper of said body.

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