Oct. 3, 1967 R. H. BERG ET AL 3,344,786

SYRINGE STRUCTURE

Filed May 2, 1963

FIG. 1

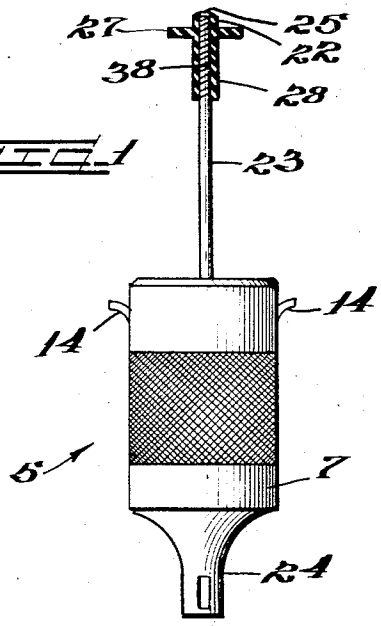


FIG. 3

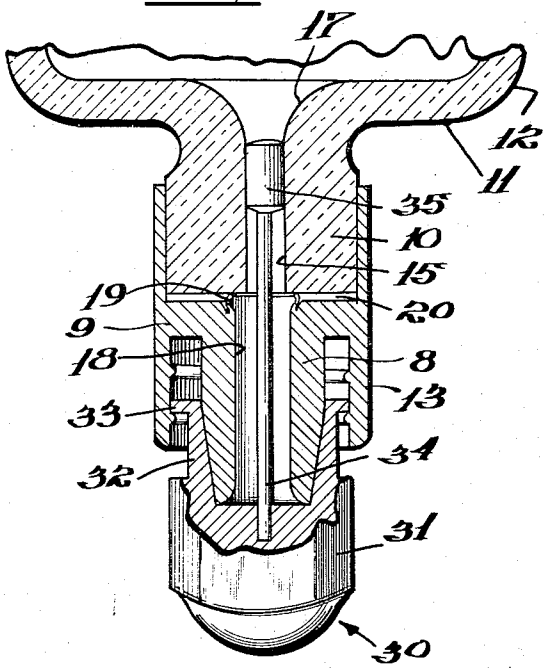


FIG. 2

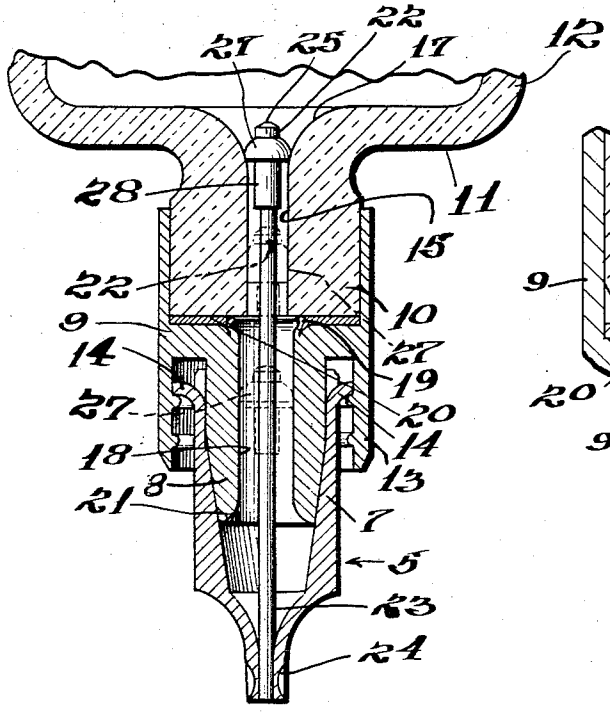
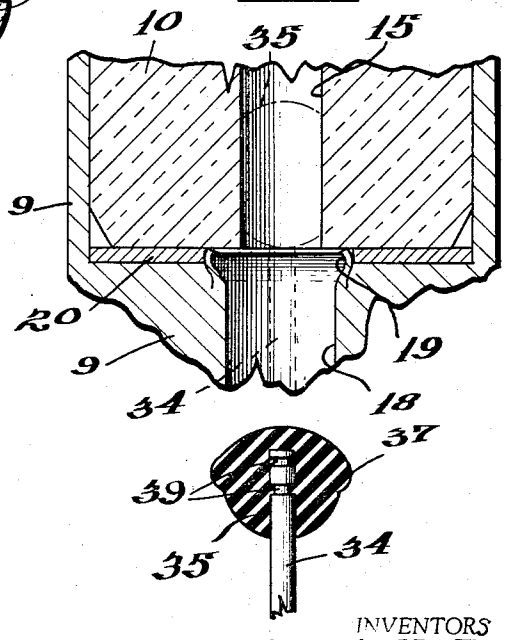


FIG. 4



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United States Patent Office 3,344,786 Patented Oct. 3, 1967

3,344,786

SYRINGE STRUCTURE

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Filed May 2, 1963, Ser. No. 277,656
1 Claim. (Cl. 128—215)

This application is a continuation-in-part of our pending application Ser. No. 170,749, filed Feb. 2, 1962.

The present invention relates to improvements in syringe structures and more particularly concerns novel means for closing the discharge end of a syringe barrel.

In conventional syringe structures, there is a substantial length of discharge passage or canal duct through the discharge nipple projection on the barrel and the needle receiving fitting on the nipple. Within this discharge passage stagnation of material is a problem, especially with syringes in which the contents must be thoroughly agitated, emulsified, and the like.

An important object of the present invention is to provide new and improved syringe structure having novel discharge passage closure means.

Another object of the invention is to provide a novel plug or stopper structure for medical and like syringe discharge passages.

A further object of the invention is to provide a novel plug structure for syringe discharge passages constructed and arranged for efficient wiping or squeegeeing of material from the passage into the syringe chamber.

Still another object of the invention is to provide novel means for plugging the discharge passage of a syringe closely adjacent to the lead-in or entrance into the passage from the syringe barrel chamber.

Other objects, features and advantages of the present invention will be readily apparent from the following detailed description of certain preferred embodiments thereof taken in conjunction with the accompanying drawing, in which:

FIGURE 1 is an enlarged elevational, partially sectional view of a syringe nipple closure and plug assembly according to the invention;

FIGURE 2 is a longitudinal sectional detail view showing the closure and plug assembled with a syringe barrel;

FIGURE 3 is a longitudinal sectional view similar to FIGURE 2 but showing a modification; and

FIGURE 4 is an enlarged fragmental assembly detail view of the structure of FIGURE 3.

In the exemplification of the invention depicted in FIGURES 1 and 2, a closure assembly 5 is provided including a generally cup-shaped closure cap 7 dimensioned to receive snugly a tapered nipple 8 of a fitting 9 attached to a nipple projection 10 extending centrally from a base end closure 11 of a syringe barrel 12. Threaded interengagement of the closure cap 7 with threads in a larger diameter skirt 13 of the fitting 9 is effected by means of laterally projecting lugs 14 adjacent the open end of the cap.

Centrally, the barrel nipple 10 has an exit or discharge duct or passage 15, also sometimes referred to as a canal, having at its entry a generally funnel-shaped lead-in 17 from the base wall 11. At its discharge end the passage 15 communicates coaxially with a central slightly larger diameter passage 18 through the fitting nipple 8. At its inner end, the passage 18 is defined by a grooved sealing flange 19 engaging the tip of the nipple 10 and affording a barrier within a sealing gasket 20 between the fitting and the end of the syringe barrel nipple. At its outlet end, the passage 18 is defined by a smoothly flaring mouth 21.

In order to reduce chances of stagnation of material

in the discharge passage 15 of the syringe barrel nipple, the closure assembly 5 includes an elastic plug 22 mounted on one end portion of a straight, thin rod-like stem 23, of much smaller diameter than the passage bores 15 and 18, having its opposite end portion concentrically rigidly secured in a crimped or pinched-in attachment boss projection 24 on the closed end of the cap 7. By having the stem 23 of proper length, the optimum terminal position of the plug 22 with its crown adjacent to the outer end of the flared lead-in 17 from the floor of the end wall 11 into the passage 15 is gauged when the cap 7 is in fully assembled relation with the fitting 9.

Construction of the plug 22 is such that it affords a positive wiping action of the walls defining the discharge passage 18 in the fitting 9 and also the passage 15 in the nipple 10 as an incident to thrusting of the plug into its plugging or stopper position at the inner end of the nipple passage 15. To this end, the plug 22 has a head diameter which is only slightly less than the cylindrical diameter of the passage 15, the free tip of the head having a lead-in projection nose 25 of suitably tapered shape. Integral and contiguous to the head 22 is an annular flange 27 of such thickness that when wholly or partially bent down and lapped against a tubular stem-encasing and gripping sleeve extension 28 of smaller outside diameter than the head of the plug 22, a larger diameter is described about the outside face of the collapsed flange. Through this arrangement, as the plug 22 is run up through the passage 18 of the fitting nipple 8 and the coaxial passage 15 of the syringe barrel nipple 10, it acts as a squeegee by virtue of a thorough wiping action to move adhering liquid on the passage walls ahead of the plug toward the syringe chamber to the limit of movement of the plug in the syringe passage 15.

As the plug 22 is maneuvered into position, utilizing the cap 7 as a convenient handle, the flange 27 which is of substantially greater diameter than the bore of the passage 18 contacts the flaring entry mouth 21 on the tip of the nipple 8 and is uniformly contracted and bent rearwardly, on the order of an umbrella, and serves as a centering medium for the plug as the plug progresses up the bore of the passage 18. By reason of its resilience and thus tendency to return toward normal expanded position, the flange 27 wipingly thrusts against the bore 18 as indicated in dash outline in FIGURE 2, uniformly expands into the groove of the sealing flange 19 and then as it follows the head of the plug 22 into the bore of the passage 15 is forced to contract and fold down onto the attachment sleeve 28 as shown in dot-dash outline. In this latter relationship a predetermined normal oversize diameter of the wiping surface of the wiping flange 27 backed up and cushioned against the sleeve 28 assures a firm, snug resiliently conformed wiping engagement against the wall defining the bore of the passage 15. Then, as the plug 22 advances into the flared lead-in 17, the flange 27 by virtue of its resilience expands conformably to the progressively flaring diameter adjacent to the passage bore 15 whereby to maintain the snug sealing engagement with the surrounding passage wall. The final or stopper terminal position of the plug 22 is predetermined through the length of the stem 23 to be such, when the cap 7 has been fully tightened against the nipple 8, as to maintain the lip of the plug flange 27 in the area of reduced diameter of the lead-in 17 which is at least slightly less than the flange diameter.

In FIGURES 3 and 4, while details of the syringe itself are disclosed as identical to FIGURE 2, a slightly modified closure assembly 30 is depicted comprising a generally cup-shaped closure cap 31 of molded or cast structure of multi-sided, such as hex-headed, form, rather than the tubular essentially cylindrical and externally

knurled form of the cap **7** of the closure assembly **5**. A skirt **32** of the cap **31** has thread lug structure **33** on its free end engageable with the threads within the skirt **13** of the fitting **9** whereby to draw the skirt **32** firmly into engagement with the nipple **8** of the fitting **9**.

Firmly secured as by direct embedment in the center of the body of the cap **31** and projecting a predetermined distance from the attachment sleeve **32** is a thin, rod-like straight stem **34** having mounted on its free end portion an elastic squeegee-stopper plug **35**. By having the stem **34** of the proper length, the optimum position of the plug **35** with its crown at approximately the narrowest diameter of the flared lead-in **17** from the floor of the end wall **11** of the syringe barrel into the passage **15** is positively gauged when the cap member **31** is in its fully assembled relation with the fitting **9**, as shown in FIGURE 3.

Assurance of snug fit of the plug **35** within the passage bore **15** is attained by a sufficiently oversize diameter so as to compel its radial compression by the cylindrical wall defining the passage **15**. For positive wiping action as the plug **35** is thrust toward its stopper position, it is provided with an annular radial rib flange **37** concentric with the stem **34** and preferably of rounded cross-sectional external shape, as shown. The over-all diameter of the rib flange **37** is at least as great as the diameter within the groove in the sealing flange **19**. Thus, as the plug **35** is driven up the passage **18** in the fitting **9**, the flange **37** wipes the bore surface and drive any adhering liquid ahead of the plug. When the plug arrives within the sealing flange **19**, the rib flange **37** expands into the groove thereof and wipes it cleans and forces material ahead of the plug into the passage **15** into which the rounded crown of the plug head then leads. As the plug **35** is forced into the bore of the passage **15**, the plug takes on a substantially cylindrical conforming shape under radial compression, as shown in dash outline in FIGURE 4 and in full outline in FIGURE 3, maintaining a thorough sealing engagement with the bore wall in the stopper position of the plug.

The squeegee-stopper plugs **22** and **35** are made as by molding from any suitable plastic or rubber material compatible with intended utility e.g. in medical uses, buna-N or neoprene. Bonding of the plug in each instance onto the stem is improved by providing the plug-carrying end portion of the respective stem with a locking structure such as shallow grooving or knurling **38** as shown in FIGURE 1 or shallow annular grooves **39** as shown in FIGURE 4. A satisfactory durometer of about 40 to 50 in the material of the plugs affords sufficient elasticity to conform by compression to the surfaces of the passages through which the plugs are projected and then maintain an effective sealing engagement with the syringe barrel exit passage in the terminal position of the plug by virtue of the recovery factor or resilience or elasticity of the material.

Even though there is a shallow depression within the flaring lead-in **17** over the crown of the fully assembled or terminal position of the plug, a shaking, stirring or emulsifying turbulence within the chamber of the barrel **12** will sweep any material in the shallow depression so as to avoid any stagnation or undesirable accumulation or pocket of material.

When it is desired to apply a hypodermic needle to the fitting **9**, the closure fitting or assembly **5** or **30**, as the case may be, is detached and the stopper swab plug withdrawn from the discharge passage of the syringe.

For illustrative purposes, the structures have been shown in substantially enlarged form in the drawing and it will be appreciated that the dimensions in actual practice conform to standard or preferred practice. For example, in one practical form, the diameter of the plug flange **27** and of the plug flange **37** is about 1/10 of an inch, other diameters being substantially proportional, as shown.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention.

We claim as our invention:

A syringe havong a barrel, a reduced end portion on said barrel having a discharge passage therethrough a fitting on said reduced end portion having a passage aligned with said discharge passage and forming with said reduced end portion a discharge nipple having a plurality of different internal diameters, said fitting having threads thereon, a closure device having cooperative means removably engaged with said threads and comprising a closure cap engaged with said fitting; an elongated thin rod-like stem having one end portion firmly anchored to said cap and projecting substantially from said cap into the nipple, the opposite end portion of said stem carrying an elastomeric plug of substantially larger diameter than said stem and having an annular flange dimensioned to act in wiping engagement with the multiple internal diameters of said nipple and to provide a sealing stopper at the innermost portion of said multiple diameters by an umbrella-like folding back of the wiping flange of said plug.

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