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O. O. R. SCHWIDETZKY ET AL

2,086,925

SYRINGE

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Fig. 1.

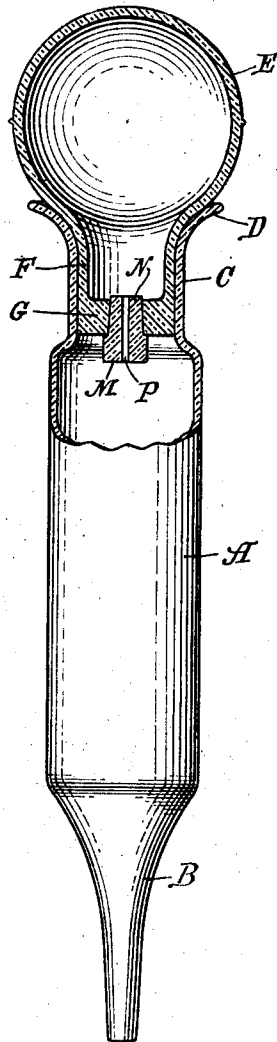


Fig. 2.

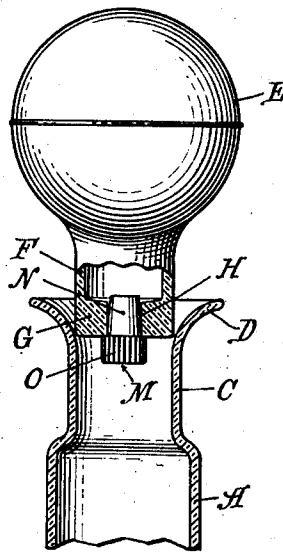
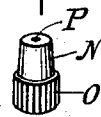


Fig. 3.



WITNESS

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2,086,925

SYRINGE

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4 Claims. (Cl. 128—231)

The invention relates to syringes of the plungerless type which comprise a glass or other transparent barrel for receiving fluids or medicaments, a compressible air bulb of less air content than the fluid-containing capacity of the barrel and associated with the barrel by frictional contact of an extension of the bulb therewith, and one or more small air passages through this extension establishing pressure air connection between the barrel and the interior of the bulb. It is the object of the present invention to provide an improved plungerless syringe construction which is capable of being easily and readily manipulated to provide adequate access to the interior of the bulb, permitting the bulb to be satisfactorily and thoroughly flushed, cleaned, and drained, and which nevertheless, when in use, will present an air passage or passages of such limited dimensions as not to permit the fluid in the barrel to flow into the bulb on holding the syringe with the nozzle upward.

Syringes of the plungerless type, cf. Duggan's Patent No. 1,166,338, are and have been in wide use for many years. This construction, however, is open to the objection, due to the smallness of the air passage or passages and to the fact that the inner surface of the bulb adjacent to the air passage or passages is a relatively large, irregular, transverse surface, that the bulb cannot be satisfactorily flushed, cleaned, and drained because the only means of access to the interior of the bulb for these purposes is through the relatively small air passage which extends through the end wall of the bulb and which is purposely kept small for the reasons above stated. This unsatisfactory condition has caused syringe manufacturers to improvise several expedients whereby the interior of the syringe bulb may be easily and readily flushed, cleaned, and drained. Adequate drainage and periodic flushing are important considerations for two main reasons. The first reason is that whenever a medicament is accidentally drawn into the bulb and the syringe is subsequently to be used for a different type of medicament, it is essential that the bulb be first thoroughly cleaned and flushed out. The second reason is that in the vulcanizing process employed in the manufacture of the bulbs, a fine powder is produced on the inner surfaces of the rubber bulbs, some of which especially such as is located in crevices or pockets on the inner face of the wall through which the air passage is formed, might in time find its way into the medicinal liquids contained in the barrel and introduce an undesirable impurity into such liquids.

Thus far every attempt to provide for satisfactory drainage of the bulbs while retaining the basic principle of using an air duct or ducts of such limited diameters as to prevent liquid from flowing into the bulb when the syringe bowl is filled and the syringe is held bulb down, has led to a development of some unsatisfactory condition which out-weighed the expected benefits of the improvement so that as a practical matter the standard commercial syringe of today is still, generally speaking, the syringe of the last twenty years.

The nearest approach to a satisfactory solution of the problem was the device described in the patent application of Oscar O. R. Schwidetzky, Serial No. 644,432, filed November 26, 1932, which issued as Patent No. 1,972,167 on September 4, 1934. The device of that application was, however, attended with certain drawbacks so that it became desirable to continue investigations and experiments to see if a more perfect and satisfactory solution might not be found. The present application represents the result of these efforts and presents a structure which is free from all defects, is thoroughly practical, and instantly manifests its value to a user. In the structure which constitutes the subject matter of this application it is believed that for the first time a complete, faultless, reliable, and perfect answer has been given to the problem.

According to the present invention, the end wall of the bulb is initially provided with a passage sufficiently large to assure adequate flushing and drainage. The end wall is of such width and thickness that notwithstanding the presence of said passage and a rigid plug in said passage it retains a cushioning compressibility in all radial directions comparable with a corresponding end wall without any passage therethrough. These results are obtained by making the ratio of the diameter of the end wall to the diameter of the passage approximately 3 (or more) to 1. These combined features of a relatively large flushing passage and wide and thick resilient end walls make it possible not only to use the forward face of the bulb neck as a flushing inlet and outlet, but to employ a relatively large plug (corresponding to the large passage) and to hold such plug in said passage free from axial movements and still to have the neck capable of seating itself properly under circumferential compression on the glass walls of the bulb neck receiving end of the syringe barrel, irrespective of the normal and unavoidable variations in the diameters of the bulb neck receiving ends of the glass barrels.

Such diameters vary considerably, within normal limits, and if the rubber wall of the bulb neck is as thick only as the wall of the bulb proper it is impossible in many instances to fit the neck with the aperture when plugged, into the neck receiving end of the glass syringe since there is not sufficient resilient wall thickening to provide the required compression. It is only, therefore, by combining the feature of a relatively large flushing passage through the forward thickened wall of the bulb neck, with the feature of providing a large radial compressive wall of rubber around such passage that the desired results can be obtained. With the above described relation of the parts a plug slightly wider than the passage at some part can be easily set into the passage and be manually removed therefrom but upon being inserted will be adequately held in place in the passage for all purposes of the manipulations which involve uniting and disuniting the bulb with or from the syringe barrel. Such a plug so positioned will however when the bulb neck is seated in the syringe barrel be securely held in position against all possible displacement by the compressive strain between the inner walls of the rigid syringe barrel and the outer wall of the resilient neck of the bulb. The plugs referred to have one or more passages therethrough of such limited aggregate dimensions that upon inversion of this syringe after filling, the liquid will not run into the bulb. The plugs are made of a material which is not subject to attack by the medicaments customarily employed in such syringes, and we have found that the phenol condensation products, such as "Bakelite" meet the necessary requirements where other materials do not work out so well. For example, glass not only tends to chip and to break, but also, when allowed to remain in place in contact with rubber under compression, seems to develop an undesirable tenacious adhesion with the rubber, whereas the plug must be one which should be removable with the greatest of ease when flushing is desired, since otherwise the user will try to flush without removing the perforated plug. A similar condition exists in the case of available metals such as corrosion-resisting steel alloys. If, to avoid such adhesion, the glass or metal tubes are more loosely set in the end of the rubber bulb, they will not retain their position in the assembled structure with sufficient reliability to prevent their falling out and possibly injuring the patient. Applicants' plug includes a portion approximately as long as the thickness of the forward wall of the rubber bulb and a slightly wider portion having an under face adapted to seat itself against the outer, forward wall of the bulb and to limit the extent to which the plug can be inserted into the bulb. The outer surface of this outer portion of the plug is preferably roughened and made just large enough to be conveniently manipulated by a man's fingers.

It will be observed that by the use of a plug of this type applicants accomplish the desirable object of supplying a plungerless syringe construction in which the plug will be retained reliably in its position in use of the syringe and in which in use of the syringe there would only be a relatively small air duct between the inside of the bulb and the barrel of the syringe, while whenever flushing is desired the easily removable plug will leave a passage in the bulb sufficiently large to allow complete, thorough, and perfect flushing, cleaning, and draining of the interior of the bulb. Applicants accordingly provide a relatively

large passage in the end wall of the bulb instead of the usual relatively small air passage, inserting in such passage a plug or stopper constructed so that it may be easily and readily removed when the bulb is disassembled from the barrel but which is tightly held in position in the bulb channel when the bulb is in place in the barrel. The stopper is provided with a relatively small bore or air channel through which communication is established between the barrel and the interior of the bulb, the diameter of the channel being such that while in the use of the syringe all the air used for drawing in or expelling fluid from the barrel can pass easily through such channel yet it will prevent the liquid in the barrel from flowing into the bulb when the barrel is pointed upwards. Thus with this construction, when the syringe is assembled, the parts will operate in the same manner and have all the advantages of the syringe that is provided with a relatively small air channel in the end wall of the bulb. When, however, the bulb is detached from the barrel, the stopper can be easily removed and the bulb flushed through its passage in the end wall of the bulb, the passage being of such diameter that when the flushing fluid is ejected from the bulb it readily flows out therethrough, sweeping away all the impurities contained in the interior of the bulb and then as the bulb finally drains, allows everything which was inside of the bulb to be drained away.

The invention is illustrated in the accompanying drawing in which Fig. 1 is a side view, partly broken away and in section, of the improved syringe; Fig. 2 is a similar view, partly broken away and in section, of the upper portion of the syringe showing the bulb in position for insertion in the barrel; and Fig. 3 is a perspective view of the stopper for the bulb.

Referring more particularly to Fig. 1 in the drawing, A is a glass barrel provided at its forward end with a nozzle B and at its other end with a cylindrical portion C, having a mouth D within which is seated a rubber bulb E, the air space in such bulb being preferably less than the liquid space in the barrel A. The bulb E is associated with an integral neck F which extends down into the cylindrical portion C of the barrel and is provided at its lower end with a forward section or end wall G, said end wall being preferably thicker than the walls of the bulb itself and of the neck F. This thickening of the end wall G results in increased resistance to transverse compression and therefore participates in insuring a liquid-tight fit between the exterior of the end wall G and the wall of the glass barrel with which it is in compressive contact around its entire periphery. The external diameters of the neck F and the end wall G are slightly greater than the interior diameter of the portion C of the barrel, as is clearly shown in Fig. 2, and the neck F together with the end wall G are of such length that when the bulb is in place in the barrel, as shown in Fig. 1, there will be continuous frictional engagement between the entire exterior surface of the neck F and the end wall G and substantially the entire surface of the inner wall of the portion C of the barrel.

The end wall G is provided with a relatively large passage or channel H, preferably cylindrical, which connects the interior of the bulb E with the interior of the barrel A and in which is mounted a plug or stopper M. The plug M, which is preferably composed of an integral piece of corrosion-resistant, non-metallic material,

consists of a stem portion N which is adapted to be positioned in the channel H and a head portion O which extends beyond the outer side of the wall G into the barrel of the syringe. The stem N of the plug is so formed and dimensioned that it can be easily inserted into or removed from the channel H when the bulb is disassembled from the barrel, yet when the bulb is in position on the barrel, it will be held tightly in such passage by the transverse compressive force exerted by the channel wall on the outer peripheral surface thereof. In the preferred form of our invention, the stem is tapered slightly so that its shape approximates that of the frustum of a cone, as shown in Fig. 3. The degree of taper of the stem N is preferably such that when the bulb is disassembled from the barrel, as shown in Fig. 2, the outer peripheral surface of the stem snugly engages only the outer end portion of the channel H, thus making it possible to remove the plug M therefrom with very little effort, but when the bulb is in position on the barrel the entire wall of the channel H tightly engages with the outer peripheral surface of the stem under the transverse compressive force exerted on the end wall G, thus positively and securely holding the plug M in position in the channel while the syringe is in use. The taper referred to is preferably a very slight one and less than one which would be responsive under compressive strains of the wall G to exercise a plug-ejecting force against the tapered outer surface of the plug.

The head portion O in the embodiment shown in the drawing is preferably cylindrically shaped and slightly larger in diameter than the base portion of the stem N so that the outer portion of the inner side thereof seats against the outer side of the end wall G, thus limiting the inward movement of the stem N and forming a seal at this point and preventing the plug from falling into the bulb. The annular surface of the head O is preferably roughened or knurled so as to provide a grip for easy removal of the plug.

Extending through the plug M is a minute channel P which is of such diameter that it reduces to a minimum the possibility of leakage of fluid into the bulb through such passage under any properly conducted conditions of use. The preferred dimension of the diameter of the passage P which establishes communication between the interior of the air bulb E and the barrel A is such as to represent minimum requirements with respect to the proper expulsion of air from the bulb through such passage into the syringe barrel. The selection of this minimum requirement cooperates with the other parts of the structure to prevent entry of the fluid from the barrel into the interior of the bulb when the syringe is held bulb down. When the plug is made of a rigid material the passage will not be compressed or altered by reason of compression of the rubber portions of the neck as the neck is inserted in the barrel. There is thus maintained a fixed diameter of the air passage through which communication is established between the air of the bulb and the barrel of the syringe which in turn makes it possible, after adopting the preferred minimum diameter of the passage, to maintain that diameter in all future uses of the syringe or its parts.

It is understood that when using the syringe, the nozzle B is immersed in the liquid to be used after the bulb E has been squeezed, and then on releasing the bulb the liquid is drawn into the

barrel A. The user can now turn the syringe upside down or into any inclined position without danger of the liquid flowing through the small channel P into the bulb E. However, should liquid from the barrel A be accidentally drawn into the bulb E, as for example when the syringe is held bulb down and the bulb is then compressed and the pressure released, the major part of such liquid is ejectable from the interior of the bulb by merely inverting the syringe and compressing the bulb. The bulb may then be detached from the barrel and the plug M removed and the bulb can now be thoroughly, completely, and reliably flushed out and drained through the passage H. This passage being relatively large, the flushing or cleansing fluids will readily enter into and flush and drain out any liquid which might have accumulated in the interior of the bulb, such fluid being readily forced out through the passage H by pressing the bulb.

It is apparent that numerous modifications may be made without departing from the scope of the invention as covered by the appended claims whose purpose it is to include and embrace any such modifications or equivalents.

Thus it is possible to line the aperture P with a metallic tubular section or to make the plug M of elastic or hard rubber, glass, metal, or other material, or to have the wall F no thinner than the wall G, especially in the smaller sizes of syringes, or to make the tapered section N more nearly cylindrical, or to leave the plug unperforated but to perforate the end wall G, or to place the air outlet of the air duct P at any point located upon the exterior of the stem N or the plug M said point being of course in each case positioned for communication with the interior of the syringe barrel. In other words, the arrangement with respect to the several components of the structure can be of various types within the ambit of the general principle that communication must be established between the interior of the bulb E and the interior of the barrel A and that the aggregate dimensions of the apertures must be such as to resist seepage of fluid from the barrel into the bulb when the plug M is in place, but to provide a large flushing opening into the bulb when the plug is removed.

What we claim is:

1. A syringe comprising a barrel provided at one end with a nozzle and at its opposite end with an inner surface adapted to frictionally engage the neck of a bulb, a compressible bulb provided with a neck and an end wall having external diameters slightly greater than the interior diameter of that portion of the barrel with which they engage, said end wall being thicker than the walls of said bulb and neck and having such resistance to transverse compression that it insures a liquid-tight fit between the exterior thereof and that portion of the barrel wall with which it is in compressive contact, a sufficiently large passage extending through said end wall adapted to permit ready flushing of the interior of the bulb but not materially exceeding one-third of the diameter of said end wall so as to leave in said end wall sufficient elastic material to yield approximately as readily to radial compression strains as a solid end wall of corresponding size, a removable member mounted in said passage, said member comprising a tapered stem portion positioned in said passage and extending into communication with the interior of the bulb, the rate of taper of said stem portion being such

that when the bulb is disassembled from the barrel, the outer peripheral surface of the stem portion snugly engages only the outer end portion of the channel whereby said member may be removed therefrom with very little effort, but when the bulb is in position in the barrel the entire wall of the channel tightly engages with the peripheral surface of the stem portion under the transverse compressive forces exerted on such end wall thereby holding such member positively and securely in the channel, a head portion integral with said stem portion and positioned exteriorly of said passage adjacent the outer face of the end wall, and one or more relatively minute air passageways extending longitudinally through the head and stem portions of said member and connecting the interior of the bulb with the interior of the syringe barrel.

2. A syringe comprising a barrel provided at one end with a nozzle and at its opposite end with an inner surface adapted to frictionally engage the neck of a bulb, a compressible bulb provided with a neck and an end wall having external diameters slightly greater than the interior diameter of that portion of the barrel with which they engage, said end wall being thicker than the walls of said bulb and neck and having such resistance to transverse compression that it insures a liquid-tight fit between the exterior thereof and that portion of the barrel wall with which it is in compressive contact, a sufficiently large passage extending through said end wall adapted to permit ready flushing of the interior of the bulb but not materially exceeding one-third of the diameter of said end wall so as to leave in said end wall sufficient elastic material to yield approximately as readily to radial compression strains as a solid end wall of corresponding size, a removable member composed of an integral piece of rigid non-metallic material mounted in said passage, said member comprising a tapered stem portion positioned in said passage and extending into communication with the interior of the bulb, the rate of taper of said stem portion being such that when the bulb is disassembled from the barrel, the outer peripheral surface of the stem portion snugly engages only the outer end portion of the channel whereby said member may be removed therefrom with very little effort, but when the bulb is in position in the barrel the entire wall of the channel tightly engages with the peripheral surface of the stem portion under the transverse compressive forces exerted on such end wall thereby holding such member positively and securely in the chan-

nel, a head portion positioned exteriorly of said passage and abutting against the outer face of the end wall, the outer edge of said head portion being indented to afford a positive grasp for removal of said member, and one or more relatively minute air passageways connecting the interior of the bulb with the interior of the syringe barrel.

3. A syringe comprising a barrel provided at one end with a nozzle and at its opposite end with an inner surface adapted to frictionally engage the neck of a bulb, a compressible bulb provided with a neck and an end wall having external diameters slightly greater than the interior diameter of that portion of the barrel with which they engage, said end wall being thicker than the walls of said bulb and neck and having such resistance to transverse compression that it insures a liquid-tight fit between the exterior thereof and that portion of the barrel wall with which it is in compressive contact, a passage extending through said end wall and being sufficiently large to permit ready flushing of the interior of the bulb but not materially exceeding one-third of the diameter of said end wall so as to leave in said end wall sufficient elastic material to yield approximately as readily to radial compression strains as a solid end wall of corresponding size, a removable member mounted in said passage, said member comprising a stem portion positioned in said passage and extending into communication with the interior of the bulb, said stem portion being so formed with relation to said passage that when the bulb is disassembled from the barrel, said member can be easily set into the passage or removed therefrom but when the bulb is in position in the barrel the wall of the channel engages the peripheral surface of said stem portion with sufficient frictional contact under the transverse compressive forces exerted on said end wall to hold said member positively and securely in position against all possible displacement during use of the syringe, a head portion integral with said stem portion and configured so as to be easily manipulatable by the fingers of the human hand, and one or more relatively minute air passageways connecting the interior of the bulb with the interior of the syringe barrel.

4. A syringe structure such as described in claim 3 in which the stem portion of the removable member is tapered, the taper extending in the direction of the interior of the bulb.

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