April 17, 1951 F. E. BROWN 2,549,417

SYRINGE AMPOULE

Filed Aug. 10, 1949

Fig. 1

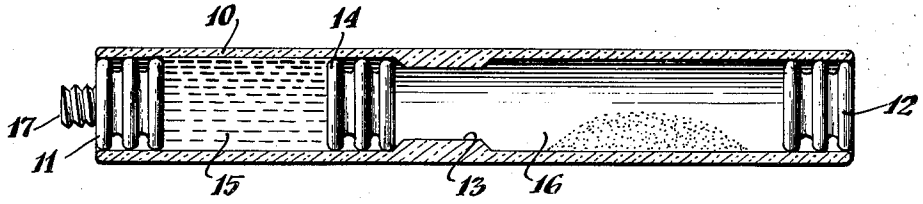


Fig. 2

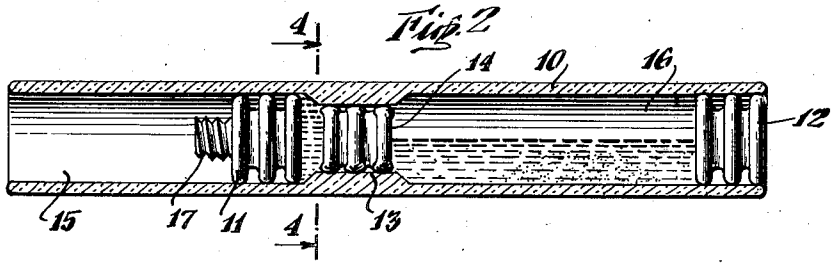


Fig. 3

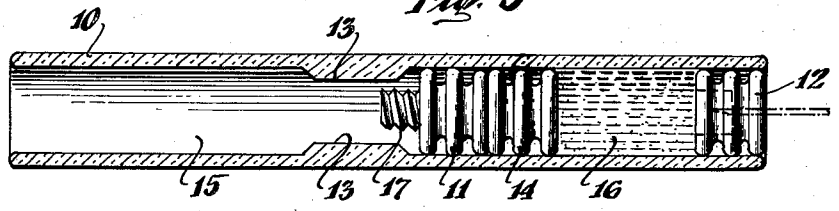


Fig. 4

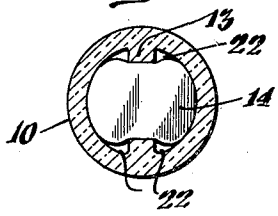


Fig. 6

Fig. 7

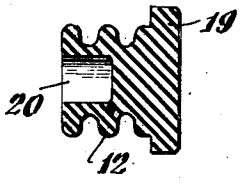
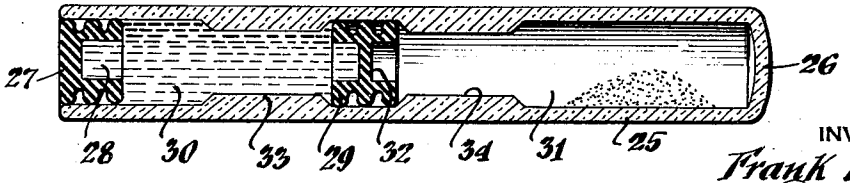


Fig. 5



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2,549,417

SYRINGE AMPOULE

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5 Claims. (Cl. 128—272)

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This invention relates to a structurally and functionally improved ampule for use as part of a hypodermic syringe assembly.

It is an object of the invention to provide an improved ampule in which diluent and medicament may be maintained in sterile condition until it is desired to perform an injection; the creation of the solution at that time being achieved with minimum effort and expenditure of time.

A further object is that of furnishing ampule structures capable of economical manufacture by quantity production methods and which ampules may be readily charged with diluent and medicament either manually or by machines.

With these and other objects in mind, reference is had to the attached sheet of drawings illustrating practical embodiments of the invention and in which:

Fig. 1 is a sectional side view of one form of ampule and showing the same in an initial and charged condition;

Fig. 2 is a view similar to Fig. 1 but illustrating the initial step in the manipulation of the ampule;

Fig. 3 shows the position which the parts assume during the final stages of their manipulation;

Fig. 4 is a transverse sectional view taken along the line 4—4 and in the direction of the arrows as indicated in Fig. 1;

Fig. 5 is a section of an alternative design;

Fig. 6 is a sectional side view of a piston stopper which may be embraced in the assembly; and

Fig. 7 is a similar view of a closure stopper which may also be included in that assembly.

In these views the numeral 10 indicates a tubular ampule body preferably formed of glass although other materials might, in certain instances, be employed. As shown in Figs. 1 to 3 one end of the ampule is closed by a piston type stopper 11, the opposite end thereof being closed by a stopper 12. Between its ends the ampule body is formed with a pair of axially extending ribs 13. These are clearly shown in Fig. 4, it being understood that a greater or lesser number of these ribs might be employed if desired. A partition stopper 14 is mounted within the bore of the ampule and in advance of the ribs 13.

In this manner compartments 15 and 16 are provided between stoppers 11 and 14 and 14 and 12. Compartment 15 receives a diluent and compartment 16 the medicament which will ordinarily be in the form of a dry powder, crystals, tablets, etc., etc. Compartment 15 should be of smaller capacity than compartment 16. In fact,

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the central zones of ribs 13 may be to the left of the center of the device as shown in Figs. 1 to 3.

Stoppers 11, 12 and 14 are conveniently formed of rubber and ridged. Obviously where permissible they might be formed of other material. Stopper 14 may be solid. Stopper 11 may be provided with an outwardly extending protuberance 17. This may be screwthreaded for engagement with a correspondingly threaded end of an actuating stem (not shown). If desired, the threads might be eliminated to provide for a slip fit between these parts. Otherwise as shown in Fig. 6 the stopper might be formed with a threaded recess 18 to engage the threaded end of the actuating stem. Stopper 12 may, as shown in Fig. 7, be formed with a head 19. In any event, it should be provided with a recess 20 or be otherwise constructed so as to be capable of being readily penetrated by the inner end of a needle.

An ampule of this type may be used with syringes or barrels of various designs. For example, a holder mounting a double pointed needle may be employed as shown in United States Patent to Steuer 1,709,691 of April 16, 1929. Under certain circumstances the ampule may be employed in connection with a barrel having a thrust or post portion as shown in United States Patent to Hall 1,848,711 of March 8, 1932. However, it is contemplated that ordinarily an ampule embodying the present teachings will not be utilized with an assembly of the latter type. For this reason the operation of the unit will be described in conjunction with the structure of a barrel similar to that of Steuer. In any event an actuator which may take one of numerous different forms is preferably employed.

Thus, a physician desiring to use the unit will apply an actuator to stopper 11. Thereupon he will exert a thrust upon that stopper. Compartment 15 being filled with liquid diluent, it follows that such thrust will be imparted to stopper 14 which will therefore shift to the right as in Fig. 1 in substantial synchronism with the corresponding movements of stopper 11. The length of the by-pass ribs 13 being greater than the width of stopper 14, it follows that, that stopper will shift to the right to a distance where the entrance and exit ends of these ribs extend beyond opposite stopper faces. Such shifting will have been facilitated by the inclined rib ends. So shifted passages 22 for the flow of liquid are provided as in Fig. 4. When this occurs, stopper 11, under continued thrust, will project to displace

the liquid through the ribs 13 into compartment 16.

Such movement of the parts has been shown in Fig. 2. When stoppers 11 and 14 are moved into contact substantially all of the diluent will have been displaced to the medicament compartment. The ampule should now be agitated so that a proper solution is established within compartment 16. With continued thrust against stopper 11, stopper 14 will move into this compartment. Prior to such shifting of the parts, the inner pointed cannula end will have pierced stopper 12. Accordingly any air may be vented. Thereupon the needle may be caused to penetrate the epidermis. Continued thrust upon stopper 11 will cause this stopper as well as 14 to move as a unit in the manner shown in Fig. 3 to expel the solution through the cannula which has pierced stopper 12. The first named stoppers will continue to move until the entire solution has been expelled from compartment 16.

Now referring to the alternative form of structure shown in Fig. 5 it is to be understood that an ampule of this type may be used with a holder or barrel having a thrust or post portion. Under proper manipulation ampules of the type heretofore described may be employed with such a barrel. However, the structure shown in Fig. 5 is preferred in this connection.

Thus, in this view the numeral 25 indicates the ampule body preferably formed of glass and having a closed rear end 26. The outer or open end of the ampule is closed by a stopper 27 which is preferably of the piston type and conveniently formed with an inwardly extending recess 28. A stopper 29 is disposed between the ends of the ampule within the bore of the same and provides a partition dividing that bore into compartments 30 and 31. As illustrated compartment 31 has greater capacity than compartment 30 and stopper 29 has both of its faces recessed to furnish a central diaphragm portion 32.

Between stoppers 27 and 29 a suitable number of inwardly extending ribs 33 are provided. Inward of stopper 29 a similar number of ribs 34 are furnished. These ribs are integral with body 25 and in common with the ribs 13 described in connection with Fig. 4, preferably have inclined end portions. Ribs 33 and 34 are disposed in substantially immediate proximity to stopper 29 and have lengths in excess of the widths of stopper 27 and stopper 29. The forward ends of ribs 33 are spaced from stopper 27 a distance substantially equal to or slightly in excess of the width of stopper 27. Diluent is arranged within compartment 30 and a suitable quantity of dry medicament is disposed in compartment 31.

In using a unit of this type a suitable actuator is employed to force stopper 27 inwardly. Due to the fact that compartment 30 is filled with liquid diluent such inward movement of the stopper will cause stopper 29 to simultaneously move in a similar direction. As stopper 29 moves it will ride onto ribs 34 and thus by-pass passages will be furnished through which the liquid may flow into compartment 31. During this operation of the parts, the ampule should be disposed in a substantially vertical direction. Such compression of the air within compartment 31 as may occur will be readily overcome by exerting suitable pressure against the outer face of stopper 27. Therefore the diluent will be totally expressed into compartment 31 when stopper 27 occupies the position initially occupied by stopper 29.

The ampule may now be agitated so that a suitable solution is provided. The space beyond the inner ends of ribs 34 and the end 26 of the ampule should preferably be in excess of the capacity of compartment 30. Therefore it is apparent that after the solution has been completed, stopper 29 may have shifted to a point where it begins to over-ride the rear ends of ribs 34 while stopper 27 is over-riding the forward ends of these ribs. Due to the elastic nature of these elements they will, of course, be somewhat compressed to present a lesser width than in their normal condition. As the stoppers occupy positions upon the ribs 34, passages by-passing both of these stoppers will be provided. Such passages will permit of a venting of the compressed air.

If now the upper end of the ampule is introduced into a barrel or holder having a thrust portion it is apparent that upon the parts telescoping this thrust portion will bear against the outer face of stopper 27. The exposed inner end of the cannula or needle extending beyond the post or thrust portion should be relatively long. Therefore, this needle will penetrate both stopper 27 and the diaphragm 32 of stopper 29. Accordingly, continued telescopic movement of the ampule with respect to the barrel will first permit any entrapped air to be vented through the bore of the needle. Second, continued movement of the parts will cause stoppers 27 and 29 to shift as a unit and function as the pistons. With such functioning they will displace the liquid solution within compartment 31 through the needle bore so that a hypodermic injection may be achieved in the usual manner. As afore brought out any desired number of ribs may be employed.

Thus, among others, the several objects of the invention as specifically afore noted are accomplished. Obviously numerous changes in construction and rearrangement of the parts might be resorted to without departing from the spirit of the invention as defined by the claims.

I claim:

1. An ampule including a tubular body, the bore of said body at a zone intermediate its ends being formed with an axially extending rib projecting inwardly within the bore in the direction of the tube axis, said rib—in conjunction with adjacent bore surfaces—providing a by-pass for liquid normally confined within the bore and to the rear of a resilient stopper as the latter is shifted axially of the bore in the zone of said rib.

2. An ampule including a tubular body, the bore of said body at a zone intervening its ends being formed with a longitudinally extending rib projecting inwardly within the bore in the direction of the tube axis, said rib—in conjunction with adjacent bore surfaces—providing a by-pass, a stopper disposed adjacent said rib and providing a partition intermediate the ends of said body, a further stopper adjacent one end of said body and spaced from said first named stopper to furnish a compartment between the same, diluent within said compartment, said diluent flowing through said by-pass as said further stopper is shifted axially of the bore to cause similar shifting of said first named stopper in the zone of said rib and said ampule beyond said rib providing a medicament compartment to receive the diluent flowing through said by-pass.

3. An ampule including a tubular imperforate body having one closed end portion, an opposite

open end, a construction in its bore intermediate such ends and a substantially uniform cylindrical bore portion inwardly of said open end, a stopper within such bore at a point adjacent said constriction to provide between said stopper and the closed end portion a medicament compartment, a further stopper within the tube and adjacent the open end thereof to provide a second compartment between it and said first named compartment and diluent within said second compartment, whereby when pressure is exerted upon said further stopper such pressure will be transmitted to said first named stopper to shift the same relative to said constriction and permit diluent to enter said medicament compartment.

4. An ampule including a tubular imperforate body formed with an integral closed end portion, an opposite open end, a constriction in its bore intermediate such ends and a substantially uniform cylindrical bore portion inwardly of said open end, an imperforate stopper within such bore at a point adjacent said constriction to provide between said stopper and closed end portion a medicament compartment, a piston type stopper having a recess in its inner face, said piston-stopper being disposed within the tube and adjacent the open end thereof to provide a second compartment between it and said medicament compartment and diluent within said second compartment, whereby when pressure is exerted upon said piston-stopper to shift the same within said cylindrical bore towards said constriction such pressure will be transmitted to said

first named stopper to shift the same relative to said constriction and permit diluent to enter said medicament compartment.

5. As an article of manufacture an ampule comprising an imperforate tubular body, an integral closing portion at one end of said body, the opposite end thereof being open and presenting adjacent such end a substantially uniform cylindrical bore portion, an inward extension forming a part of said body to provide a constriction within the bore of the same at a point between said uniform bore portion and said closing portion, said ampule providing in its bore a stopper-supporting surface adjacent said constriction and a further stopper-supporting surface adjacent its outer end within the area of uniform bore portion to thus furnish a compartment zone to contain medicament between the constriction and closed end portion and a diluent-receiving compartment zone between said constriction and the open end portion.

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