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CONTROLLABLE TRANSFER ELEMENT FOR MULTIPLE COMPARTMENT AMPULES

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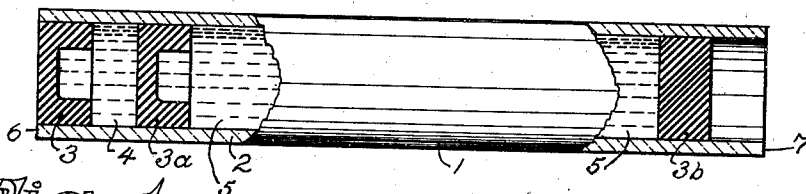


Fig. 1

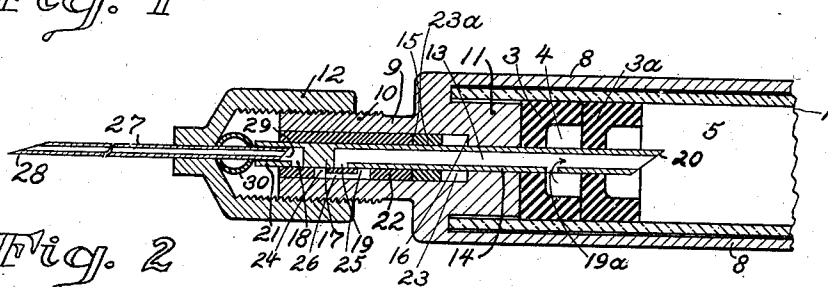


Fig. 2

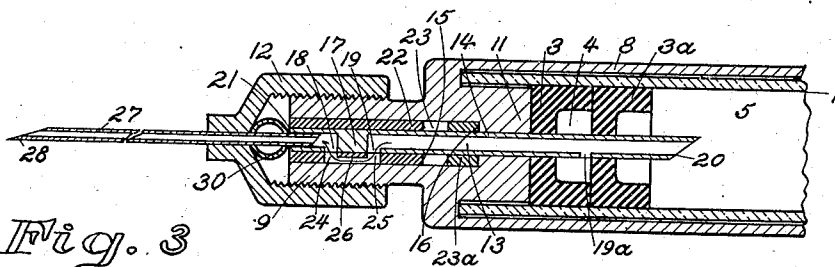


Fig. 3

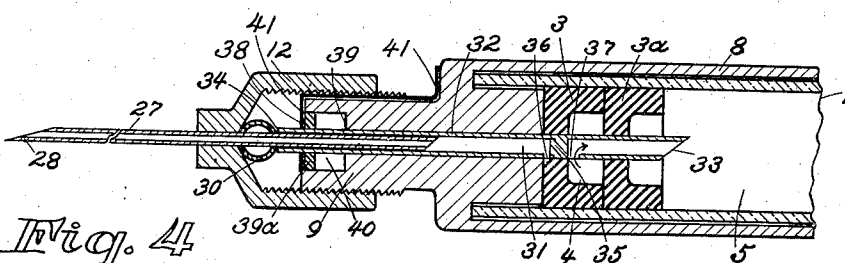


Fig. 4

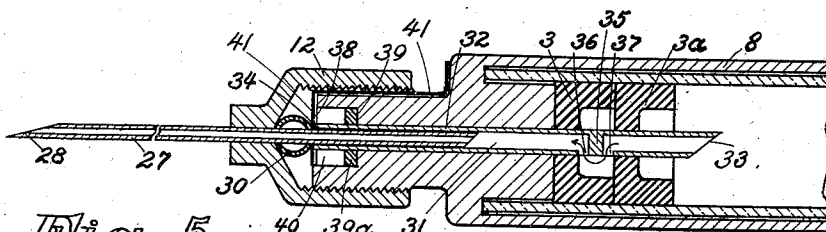


Fig. 5

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2,193,322

CONTROLLABLE TRANSFER ELEMENT FOR
MULTIPLE COMPARTMENT AMPULES

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Application April 30, 1938, Serial No. 205,170

3 Claims. (Cl. 128—215)

Our invention relates to syringes and ampules which are customarily employed for hypodermic injections.

More particularly we are concerned with ampules having separate compartments which contain dissimilar ingredients to be mixed into a desired injection solution. We contemplate solutions which are not stable in prolonged storage and which must therefore be prepared by the practitioner shortly before use through intermingling of the necessary ingredients contained in the separate compartments in a convenient sterile manner.

An object of our invention is an ampule having multiple separate compartments containing dissimilar ingredients.

Another object is an improved controllable transfer element having a piercing body provided with a channel and designed to establish communication between the compartments in the ampule, said transfer element being provided with means to prevent escape of the mixed fluids through the outer end of the channel and the hypodermic needle of the syringe during transference, but permitting discharge through the needle after transference.

A further object is an improved syringe in combination with the multiple compartment ampule and the controllable transfer element which is designed to discharge the injection solution from the ampule after transfer.

Further objects will be seen from the following description.

In our earliest disclosure Ser. No. 124,010, now matured into Patent No. 2,115,731, dated May 3, 1938, we define two separate compartments in the ampule by three spaced discs of pierceable material, the outer discs closing the opposite open ends of the ampule, and the intermediate disc being spaced from the outer discs in accordance with the desired size of the two compartments. For the purpose of the invention, all three stoppers are positioned entirely inside and frictionally slidable in the ampule. It is necessary to move the intermediate disc during the operation of the expulsion of the mixed liquids into the patient's tissues and to lubricate the outer peripheries of the discs in order to facilitate the movement of all the discs.

This lubrication together with the ever present possibility of expansion and contraction of the glass container, due to variation in temperature as well as to the slight variation in the internal diameter of the container, presents a possibility of seepage around the intermediate disc from

one compartment to the other, which is detrimental to the use of the ampule, since it is essential to maintain the two dissimilar liquids in hermetic separation until the moment of intermixture of the liquids by the aid of a transfer element.

To prevent the possibility of seepage, we provide in our application Ser. No. 172,892, now matured into Patent No. 2,159,217, dated May 23, 1939, a new method of expulsion of the liquid contents of the ampule which does not require the movement of the intermediate disc and makes it unnecessary, therefore, to lubricate the outer periphery of said disc, whereby the disc remains practically immovable.

We describe the transfer element in our Patent No. 2,115,731 which moves the intermediate disc as being secured to the plunger of the syringe and consisting of a hollow piercing element having a sharp and tapering end portion and an axially positioned channel adapted to communicate with an aperture in the side of the element.

In our Patent No. 2,159,217 which does not require movement of the intermediate disc, we suggest an improved controllable modification of our transfer element which has the piercing body attached to the discharge end of the syringe. The improved element makes it possible to combine dissimilar liquids as well as to expel the combined liquid from the ampule directly through a hypodermic needle into the tissue without removing the ampule from the syringe, and without seepage.

We have now designed further improved controllable transfer elements which are simpler in construction and much safer in operation than the transfer element in application Ser. No. 172, 892.

Reference is made to the accompanying sheet of drawings which illustrates the new transfer elements, and their operative combination with the syringe and multiple compartment ampule.

Fig. 1 shows a longitudinal cross sectional view of our multiple compartment ampule having three discs in predetermined spaced relation therein.

Fig. 2 is an enlarged fragmentary view of one modification of our transfer element and multiple compartment ampule in transferred position.

Fig. 3 is the same in discharge position.

Fig. 4 is an enlarged fragmentary view of another modification of our transferred element and ampule in transfer position.

Fig. 5 is the same in discharge position.

In Fig. 1 the numeral 1 indicates a view, partly in cross section, of our double compartment ampule comprising a tubular outer member 2 preferably made of glass and having three discs 3, 3a and 3b inserted therein. The discs are preferably made of a yieldable material, such as rubber, and are of sufficiently large external diameter to frictionally engage the internal diameter of the member 2 in sealing relation.

Fig. 1 shows the ampule 1 with the discs positioned therein in spaced relation so as to form the compartments 4 and 5 which may contain dissimilar liquids. The compartments 4 and 5 are hermetically sealed from each other by the disc 3a due to its frictional sealing engagement in the tubular member 2. It will be noted that in Fig. 1, the disc 3 is positioned at or near one end 6 of the tubular member 2, and that the disc 3a is spaced at a predetermined distance therefrom to form the compartment 4, while the disc 3b has been positioned inwardly from the end 7 of the tubular member 2 so as to form the closed compartment 5. This position of the disc 3b between the end 7 and stopper 3a is governed by the length of the compartment 5. The length of the open end space is substantially the same as the length of the compartment 4. The end space is essential to permit the movement of the disc 3b when the liquid in compartment 4 is transferred into compartment 5.

For the purpose of our invention, all the discs are positioned entirely inside the casing 2. The end discs 3 and 3b have their outer peripheries lubricated and are frictionally slidable in the casing tube.

Fig. 1 shows the ampule 1 with the three discs of the same diameter throughout their length in the positions they occupy before the liquid in compartment 4 has been transferred into compartment 5.

Fig. 2 shows the same arrangement during transfer and indicates so much of the body of the syringe to which the transfer element is attached as is necessary to explain the operation of the transfer.

The syringe consists of a barrel 8, a solid head 9 with a threaded portion 10, and the knurled nut 12, and collar 11. The plunger head and the plunger of the syringe are not shown. They may be of any design customary in this art.

27 is a hypodermic needle provided with a sharply beveled outer end 28, a sharply beveled inner end 29, and a soft metal collar 30 near the latter.

13 is the controllable transfer element. It is mounted in the syringe head 9 slidably along its longitudinal axis, and consists substantially of a hollow tube 14. It is surrounded by the concentric sleeve 22. Its inner end 20 is sharply beveled, while the outer end 21 is cut off squarely. Near the outer end 21 there is provided a plug 17 and ports 18 and 19 at the end of plug 17 in the wall of tube 14. Close to the sharply beveled inner end 20 there is cut out from the tube a lateral inlet at 19a. The transfer element is controlled in its longitudinal movements in either direction by the stops 15 and 16 positioned in the cavity 23 which is surrounded by the concentric sleeve 22. Rigidly attached to the tube 14 is a collar 23a, located within the cavity 23. Ports 24 and 25, which open into the channel 26, complete the structure of the concentric sleeve 22.

Fig. 2 also shows the hypodermic needle 27 mounted in the syringe 9 and combined with the

transfer element 13. The inner needle end 29 connects with the outer end 21 of the transfer element 13 as illustrated. The needle 27 is held in position by the knurled nut 12 which is joined to the threaded head 9.

To accomplish transfer of the liquid from compartment 4 into compartment 5, the ampule is inserted into the syringe barrel 8 so that disc 3 faces the sharply beveled inner end 20 of the transfer element 13. Continued motion in the same direction causes the inner end 20 to successively pierce discs 3 and 3a and then presses disc 3 against collar 11 which forces the disc inwardly of the ampule 1 in the direction of the stationary disc 3a. The stoppers 3 and 3a are now in contacting position; when the compartments 4 and 5 contain liquids, due to the incompressibility of the liquids, the liquid in compartment 4 will be transferred to the compartment 5 by way of port 19a and through the channel of the hollow tube 14. By this action it is to be noted that both end discs 3 and 3b are movable simultaneously and equally, while disc 3a remains fixed during liquid transference. The disc 3b will move to the end 7 of the ampule 1. At the same time, outer motion is imposed on the readily slidable transfer element 13 by the resistance of disc 3 to penetration of the inner end 20, which causes the plug and ports to register as shown in Fig. 2. This outer motion causes the plug 17 to register with port 24 in the concentric sleeve 22, thereby closing the port and preventing the escape of the liquid, contained in the ampule, through the outer end 21 of the transfer element, and the hypodermic needle 27, as the channel 26 in the sleeve 22 is blocked by the plug 17.

Fig. 3 shows the operation of the transfer element as a conductor of the liquid from the ampule to the hypodermic needle during discharge. Proceeding from the arrangement shown in Fig. 2, the knurled nut 12 is turned inwardly whereby the needle 27 and its collar 30 are advanced, the latter developing pressure on the outer end 21 of the transfer element 13 and moving it inward, until it comes to a halt when the collar 23a has reached its extreme inward position in the cavity 23. The ports 18 and 19 are now registered with the plug 17 between the ports 24 and 25 of the concentric sleeve 22, thereby forming a continuous open passage from the interior of the ampule through end 20 to the hypodermic needle 27. At the same time, the joint between the metal collar 30 on the hypodermic needle 27 and the outer end 21 of the transfer element 13 is now sealed and prevents leakage flowing through the transfer element into the hypodermic needle, during ejection of the contents of the multiple ampule contained in the syringe.

Figs. 4 and 5 demonstrate another modification of the transfer element. The parts of the syringe and ampule and the numerals designating those parts are the same as in Figs. 1, 2 and 3.

31 is the controllable transfer element. It is mounted in the syringe head 9 slidably along its longitudinal axis and consists substantially of a hollow tube 32. Its inner end 33 is sharply beveled, while the outer end 34 is squarely cut. Near its inner end, the element 31 is provided with a plug 35 and ports 36 and 37 at the end of plug 35 in the wall of tube 32. The transfer element is controlled in its movements in either direction by stops 38 and 39 and collar 39a which is rigidly attached to the tube 32 and slidably positioned in the cavity 40 of the syringe head 9.

To accomplish transfer of liquid from compartment 4 into compartment 5, the ampule is inserted into the syringe and manipulated as described for the transfer in Fig. 2. Outer motion is thereby imposed on the transfer element 31 by the resistance of the disc 3 to penetration by the sharply beveled end 33 which causes the plug 35 and ports 36 and 37 to register as indicated in Fig. 4. Discs 3 and 3a are now in contacting position. Again the liquid which is contained in compartment 4, due to its incompressibility, will be transferred to compartment 5 by way of port 37 and through the channel of the hollow tube 32, but it cannot escape through the transfer element in the direction of the needle 27 since passage is closed by the plug 35 now located in the wall of the disc 3. The disc 3b will move simultaneously and equally to the end 7 of the ampule 1.

Fig. 5 shows the operation of the transfer element as a conductor of the liquid from the ampule to the hypodermic needle during discharge. Inward motion of the transfer element for the purpose of ejection of the liquid from the ampule to the hypodermic needle is accomplished by the inward movement of the needle nut 12 against the metal collar 30 on the hypodermic needle 27 on the square end 34 of the transfer element 31. This inward movement causes both ports 36 and 37 of the transfer element to register within the cavity of the disc 3, thereby forming an open passage from the ampule to the hypodermic needle. The spring-like attachment 41 prevents further outer movement of the collar 39a in the cavity 40 beyond the stop 38 when our device is in transfer position as shown in Fig. 4. On the other hand, when the knurled nut 12 is removed from the threaded portion 10 of the syringe head 9, the attachment 41 may be lifted away from the cavity 40, thus enabling removal from or the insertion into the syringe head 9 of the transfer element 31, the attachment 41 then automatically returning into position as shown in Fig. 4 by virtue of the spring action.

We prefer the transfer element of Figures 4 and 5 because of the simplicity of its construction and the ease of operation. It will be seen that the various parts of the combination can readily be separated for purposes of cleaning and repair and may be assembled just as conveniently.

We claim:

1. In combination with a hypodermic syringe

and multiple compartment ampule having two chambers formed therein by two movable end discs and a permanently fixed intermediate disc, a transfer and discharge system for transferring the contents of one compartment to the other and discharging the mixed contents through the hypodermic needle, which system comprises a syringe head provided with an annular protrusion facing inwardly of the syringe barrel, a central bore penetrating the entire length of said head and protrusion, a hollow tube slidably mounted in said bore and sharply beveled at its end extending ahead of said protrusion but squarely cut at its other end extending through the head, a collar rigidly attached to the tube, a cavity in said head slidably embracing said collar and controlling its movements, said hollow tube being partitioned by a plug and being provided with a plurality of lateral ports, said plug and said ports so registering with said cavity and said end disc of the ampule facing said annular protrusion as to close passage of the liquid from the ampule to the hypodermic needle in transfer position and to form an open passage from the ampule to the hypodermic needle during discharge position.

2. The transfer and discharge system in accordance with claim 1, in which the plurality of ports and channels comprises a plug positioned near the squarely cut end of the hollow tube, ports at the end of the plug in the walls of said tube, a concentric sleeve surrounding said tube adjacent to said end and provided with a channel having slots registering with said ports in discharge position but registering with the plug in transfer position, and a lateral inlet cut out from the tube close to its sharply beveled inner end.

3. The transfer and discharge system in accordance with claim 1, in which the plurality of ports and channels comprises a plug positioned near the sharply beveled inner end of the hollow tube, ports at the end of said plug in the wall of the tube, said plug in combination with one end disc of the ampule closing passage of the liquid from the ampule to the hypodermic needle in transfer position, and said ports registering with the cavity of said end disc thereby forming an open passage from the ampule to the hypodermic needle during discharge position.

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