Sept. 17, 1929. E. H. MARCY 1,728,260

HYPODERMIC INSTRUMENT

Filed May 12, 1924

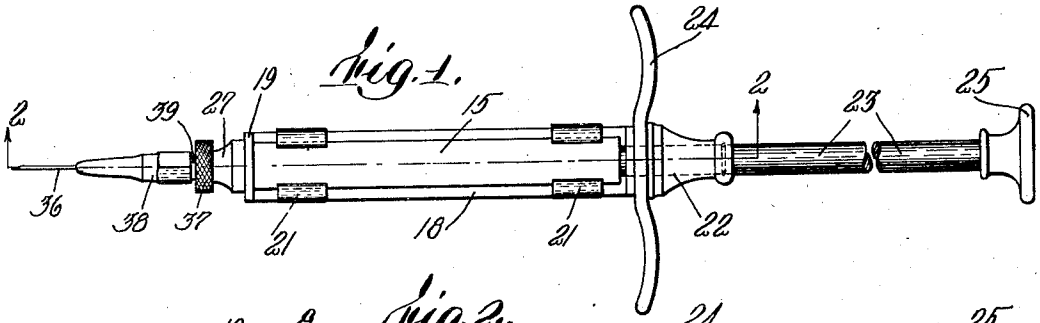

Fig. 1.

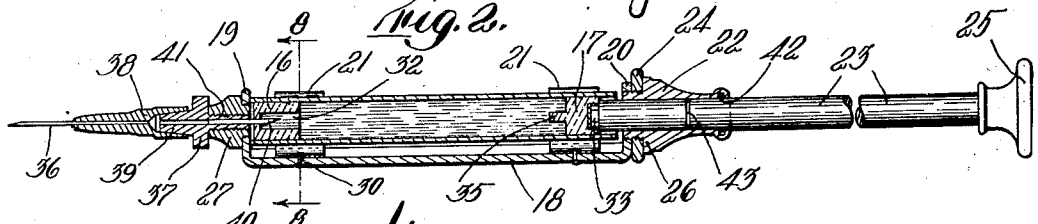

Fig. 2.

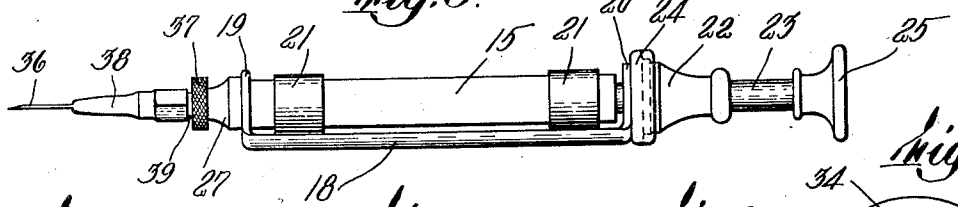

Fig. 3.

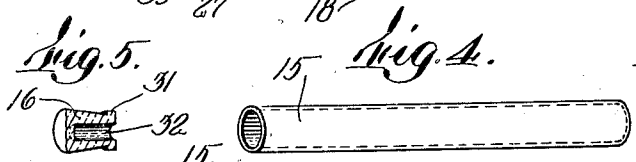

Fig. 4.

Fig. 5.

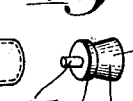

Fig. 6.

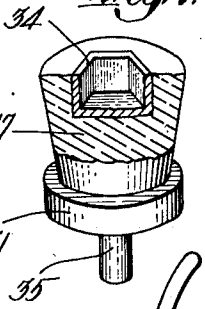

Fig. 7.

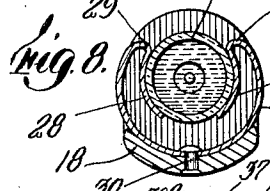

Fig. 8.

Fig. 9.

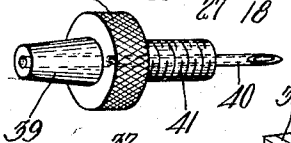

Fig. 10.

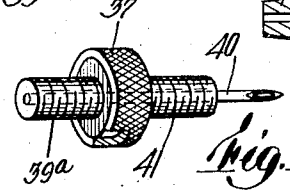

Fig. 11.

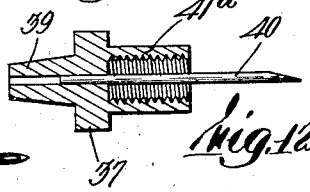

Fig. 12.

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Attys.

Patented Sept. 17, 1929 1,728,260

UNITED STATES PATENT OFFICE

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HYPODERMIC INSTRUMENT

Application filed May 12, 1924. Serial No. 712,604.

This invention relates to instruments for hypodermically injecting medicine, and is particularly concerned with an appliance capable of holding a filled glass ampoule and discharging the contents of the same through a hypodermic needle. My objects are to produce an ampoule holder capable of receiving a full glass ampoule and of relinquishing an empty one with the greatest ease and simplicity of manipulation on the part of the operator; one with which needles of the standard characters and dimensions now in general use may be used; and finally one which can be manufactured at a much less cost than any hypodermic syringe yet made. My improved ampoule holder or syringe can be put out with the proportions and characteristics suitable either for surgical use in which only comparatively little force is needed to inject the liquid into the muscles or veins of the patient, and to withdraw the needle, or for dental use which requires a strong and secure connection with the needle and ability to apply great pressure to the liquid, in order to discharge the liquid into the resistant textures of the gums and processes around the roots of teeth, and afterwards to withdraw the needle.

Having regard to the foregoing statement of objects, the invention consists in an improved ampoule holder, in the combination of such holder with a tubular glass ampoule and a needle, the entire combination providing a hypodermic syringe, and in certain novel forms of closing and ejecting the plugs for a tubular glass ampoule used in co-operation with the combination as a whole; all as hereinafter described and claimed.

In the drawings:

Figure 1 is a top plan view of a surgical hypodermic instrument embodying all the new features of the present invention;

Fig. 2 is a longitudinal section of the instrument taken on line 2—2 of Fig. 1;

Fig. 3 is a side elevation of the instrument;

Fig. 4 is a perspective view of a tubular glass ampoule or medicine container adapted to be received by the holder part of the instrument, and combining therewith to form the complete hypodermic instrument;

Fig. 5 is a perspective sectional view of the closing plug or stopper for one end of the instrument;

Fig. 6 is a perspective view of the closing plug for the other end of the ampoule, said plug being also a piston operable to discharge the contents of the ampoule;

Fig. 7 is a perspective view on an enlarged scale, partly broken away, of the piston plug shown in Fig. 6;

Fig. 8 is a cross section of the combined instrument taken on line 8—8 of Figure 2 but shown on a larger scale;

Fig. 9 is a view similar to Figure 2 showing the instrument as adapted for dental use;

Fig. 10 is an enlarged perspective view of the part of the instrument which I call the adapter, the particular adapter here shown being applicable to the surgical instrument;

Fig. 11 is a similar view of a similar adapter applicable to the dental instrument;

Fig. 12 is a sectional view enlarged of an adapter containing a reversed form of means for securing it to the instrument.

Like reference characters designate the same parts wherever they occur in all the figures.

This instrument is designed and intended to receive and discharge medicine containers previously sterilized and filled at the manufacturing laboratory; in other words to discharge an original medicine package without first transferring the contents of the package into the barrel of a hypodermic syringe. The particular type of container with which it is intended to cooperate is a glass tube or ampoule of substantially uniform diameter, the ends of which are closed to confine the medicine by stoppers, both of which are in the nature of plugs, and one of which is adapted to be moved through the bore of the ampoule to discharge the medicine. Such an ampoule is shown in detail in Figure 4 and is identified by the numeral 15. The stopper or plug for one end is

shown in detail in Figure 5 and is designated 16; while the stopper for the other end, which also serves as a piston, is shown in detail in Figures 6 and 7 and is designated 17. These stoppers embody novel features which are claimed as part of the present invention and will be later described in detail.

The holder for the ampoule and needle, the combination of which therewith comprises the complete instrument, consists of a bar 18 with wings or lugs 19 and 20 at opposite ends, and one or more clips 21 between the ends. Said lugs or wings may be formed by turning up the ends of the bar 18 at right angles, or approximately so, to the length of the bar, or they may be made as separate pieces secured in any suitable way to the ends of the bar. Various means or modes of thus securing such parts together are well known to those skilled in the art of making instruments of this character and therefore need no description here.

The lug or wing 20 is an anchorage or support for a plunger guide 22 in which is slidingly mounted a plunger 23 adapted to enter one end of the ampoule and to propel the piston plug 17 toward the other end of the ampoule. It also supports a crossbar 24 or equivalent finger-hold to sustain the reaction of the operator's fingers while his thumb or palm is employed to apply pressure to a knob 25 on the outer end of the plunger. In the construction here shown one end of the plunger guide is reduced and threaded so as to enter a threaded hole in the lug 20 and the bar 24 is placed on this reduced end and clamped between the shoulder 26 on the guide and the lug 20. The assembled parts may then be secured against accidental disassembling by upsetting or soldering them, if desired. However other modes of assembling and securing the plunger guide and finger holds to the frame may be used, as is understood by those skilled in the art.

The opposite wing or lug 19 carries a nipple 27, which may be an integral part of the lug but is preferably a separate piece screwed into the lug as shown in Figures 2 and 9, or otherwise suitably secured thereto so as to form a structural unit therewith. This part which I have called a nipple is functionally a supporting and holding member for the needle adapted presently to be described; while the lug or wing of which it is a part serves also as an abutment to prevent endwise movement of the ampoule as the piston plug 17 is pushed through it to discharge its contents.

The clips 21 are designed to hold the ampoule in line with the plunger and with the adapter, to support the ampoule resiliently so that it will not be in danger of being broken in case such alignment should not be accurate, or in being put in place, and to permit placement and displacement of the ampoule easily and with the simplest character of movement. Both of the clips here shown are alike, and their preferred form and other characteristics are best shown in Figure 8. This clip is made from a flat strip of spring metal which is thin enough to have the necessary freedom of yielding under the pressures capable of being applied through a glass tube in the manner presently described. It is bent into a curve which conforms more or less closely to a cylindrical surface substantially larger in diameter than the ampoule, and its end portions are bent within the outer curve and are reversely curved in as close conformity as is feasible to the external surface of the ampoule. These curved end portions designated 28 in Figure 8 form what may be called grippers embracing the opposite sides of the ampoule and joining the outer part of the clip at the bends 29, the distance between which bends is less than the diameter of the ampoule. The lower extremities of the grippers 28 are also nearer together than the diameter of the ampoule, and they are also spaced apart from the outer part of the clip. This outer part is secured to the bar 18 by one or more rivets 30 or other suitable means.

All parts of the clip are resilient and springy, including the outer curved part, the bends 29, and the grippers 28, and the outer parts yield so easily that the bends 29 may be spread apart by the pressure exerted laterally through an ampoule laid against them, and the ampoule may be slipped between the bends without danger of being broken. Thus the ampoule may be assembled with the holder by simply laying it parallel with the bar upon the bends 29, and then pressing it between the bends by a moderate pressure exerted by the fingers of the operator. This pressure spreads the bends apart and allows the ampoule to slip into the wider space between the grippers, whereupon the resilience of the clip as a whole causes these grippers to spring back against the ampoule, embracing and holding it firmly enough, yet with a yielding grip which allows it to accommodate itself to the movement of the pusher in discharging it. This mode of mounting and holding the ampoule is important and valuable, not only on account of the ease with which it may be put in position and removed, but also because it is resiliently supported in such a way that it may yield in any direction transversely of its length.

It will be noted in Figure 8 that the bar 18 is transversely curved. This formation is given in order that it may partially embrace a clip curved in the manner shown and both support the resilient arms of the clip and prevent the clip from turning about its point of connection 30, in case it should be so con-

nected to the bar only at one point. However, wide latitude in the precise shapes and forms of these parts is permissible without affecting the results above described, and within the scope of my claims. Thus it is not essential that the outer curve of the clip should be cylindrical or that the inner parts or grippers should fit the ampoule, provided they are so shaped as to furnish supporting and holding points at opposite sides of a diameter of the ampoule.

Describing now the stoppers or plugs which close the ends of the ampoule, I would say first that these plugs are constructed to fit tightly enough, tubes which vary somewhat in diameter. That is, it is not possible commercially to produce ampoule tubing with absolute accuracy as to the diameter of its bore, but a manufacturing tolerance of about one fourth of a millimeter either way from the prescribed diameter is allowed. Thus if a tube having a bore of seven millimeters is ordered by the manufacturing chemist, the tubes received may vary in bore between 6¾ millimeters and 7¼ millimeters. My plugs are designed to fit liquid tight in tubes of all diameters within the limits of tolerance. Thus the plug 16 which is intended as a stationary stopper is formed with a flange 31 at its entering end, the diameter of which is equal to the prescribed bore of the particular tube for which it is made. In the case chosen for illustration this diameter would be 7 millimeters. This flange however is relatively short, say from one to two millimeters in length and the rest of the plug is tapered from a zone contiguous to the flange where the diameter is less than the smallest limit of tolerance, to its outer end where the diameter is approximately equal to the larger limit of tolerance. These plugs are preferably made of highly elastic vulcanized rubber, or of other compositions having equivalent capacity for resilient distortion. Thus when the flanged end of the plug is entered in the tube, the reduced diameter of the plug immediately adjacent allows it to yield and spread so that it will readily enter a tube of substantially smaller diameter. This effect is further contributed to by the presence of a recess 32 in the middle of the plug. This recess opens from the flanged end of the plug and extends toward the large end; which is imperforate. The larger diameter of the outer end of the plug causes this end to fill the tubes of largest diameter liquid-tight, and to exert such friction on the walls of the tube that it will not be displaced by the needle adapter when the latter is passed through the imperforate end of the plug. The compressibility and elasticity of the plug are great enough, however, to permit entrance of even its larger end fully into the tubes of the smallest diameter within the tolerance limit.

The piston plug 17 is similar to the other plug in its external form, proportions, and dimensions. However, it has no recess in its inner end corresponding to the recess 32, but has in its outer end a non-circular socket adapted to receive the correspondingly formed reduced end 33 of the plunger, and this socket is lined with a wear-resisting sleeve 34 of metal or other suitable material. There is formed on the inner end of the piston plug a central projection 35 both smaller in diameter and shorter than the recess 32 in the opposite plug, but adapted to enter such recess for a purpose which will be explained later.

Both plugs may be set into the tube and the spaces between their outer ends and the respectively adjacent ends of the tube filled with a sealing composition to close the tube hermetically.

The ampoule, having been assembled with the holder in the manner above described when the plunger has been retracted, is put into communication with the hypodermic needle 36 by means of a member 37 which I call an adapter. Such adapter enables my improved syringe combination to be used with standard forms of hypodermic needle, that is the forms and types of said needle now in general use by physicians and surgeons or dentists. The adapter shown in Figure 2 is of the type designed for surgical instruments, with which the so-called slip-on needles are used. These needles have a hub or body part 38 with a tapered socket adapted to be retained frictionally on the hypodermic instrument. The adapter therefore is made with an externally tapered outer end 39 which fits the tapered socket of the hub 38. For the rest, the adapter is threaded so that it may be securely but detachably connected with the nipple 27, and it has a bore or passageway from which projects, at the inner end of the adapter, a tube 40 similar to a hypodermic needle and formed with a piercing point. Such piercing point is adapted to penetrate the outer end of the stopper plug 16 and enter the recess 32 in the latter, but not protrude from the open end of such recess, when the adapter is screwed home. It must also enter the recess far enough to open its bore to the entrance of the medicine. Hence the piercing tube projects from the adapter far enough for these purposes, but not so far as the length of the threaded bore of the nipple into which the adapter enters. That is, the complementally threaded parts of the adapter and nipple 27 are long enough to cause the adapter to be centered and aligned before the tubular needle 40 enters the plug.

The adapter for the dental instrument is generally similar to that described for the

surgical instrument, but differs in that the protruding end 39ª is threaded to fit the internal threads of the dental needle socket 38ª, as shown in Figure 9. The latter figure illustrates a design of my invention adapted for dental use, which differs from the surgical instrument only in that a form of knob or handle 25ª is applied to the outer end of the pusher which is of a sort used with dental syringes to enable a powerful pressure to be applied by means of the base or heel of the operator's palm. The difference between the two forms of adapter above described is more graphically shown in the enlarged perspective views, Figures 10 and 11.

It is not essential however that the threaded part of the adapter should be externally threaded to fit an internal thread in the holder, for the adapter may be made with an internally threaded tubular part 41ª as shown in Figure 12 adapted to fit external threads on the nipple 27 or an equivalent part of the holder. This internally threaded adapter may be formed at its outer end to take either the slip-on needle or the screw socket needle.

When the needle has been connected with the interior of the ampoule, as described, the contents of the ampoule may be expelled through the needle by forcing the pusher 23 inward. If the piston plug should stick, it may be released by entering the end 33 of the pusher into the complemental socket 34 of the piston and turning it. The recess 32 in the stopper 16 allows all of the medicine between the ends of the two plugs to be expelled, because the inner needle point terminates within the mouth of the recess. And even a part of the liquid in the recess is expelled by the projection 35 of the piston entering this recess. However the projection does not completely fill the recess and it leaves a space in the recess, both at the inner end of the latter and around the projection, in which air not expelled previous to the injection may collect. As far as possible when filling ampoules at the laboratory all of the air is displaced by the medicine, but sometimes it is not, and a small bubble of air is left. The careful operator endeavors to expel this air before making the injection, but occasionally he may fail to do so. In such cases the recess 30 and the spaces left between its walls and the projection 35 provide a receiving place for the small amount of air which may remain in the ampoule and ensure that it will not be injected into the patient. At the termination of the pushing stroke, the end of the projection 35 envelops the point of the needle 40 and closes its bore, thus positively ensuring that air cannot be passed into the blood stream or tissues of the patient.

Preferably the pusher is made with no part, except the outer knob, of greater diameter than the bore in the guide 22, so that it can be withdrawn entirely at need; but I have provided a yielding lock which prevents it falling out and limits its normal withdrawal. For this purpose I have provided a split ring 42, preferably made of round wire, which surrounds and bears upon the pusher, and is confined in a groove within the guide 22. A shallow encircling groove 43 is formed in the plunger, the latter groove being either not wide enough or not deep enough to admit the ring 42 far enough to make a positive lock, but enabling it to exert a yielding resistance to movement of the pusher when occupying the groove.

The instrument thus described is of simple construction, but strong and rugged. Hence it is not subject to breakage like glass syringes, and can be made and sold at lower prices than the metal syringes, even those designed to take and discharge filled glass ampoules heretofore produced. It is more convenient to use than instruments of the latter class heretofore made, because of the ease with which the filled ampoules can be put in place and the discharged ampoules removed, and also because it will take standard needles which are obtainable from all surgical and dental supply houses. Finally it is safe and secure to use because the ampoule is supported and restrained in a resilient manner which ensures correct placing initially and protects against breakage from careless handling afterwards.

I claim:

1. An instrument for hypodermically discharging glass tubular ampoules, comprising a holder bar having end lugs arranged to embrace the ends of the ampoule and parts arranged to embrace the ampoule laterally, a pusher guide directed lengthwise of the bar in one of said lugs and spaced apart from the other lug by a distance at least as great as the length of such ampoule, and a hypodermic needle secured to the other of said lugs.

2. A holder for a tubular glass ampoule comprising a bar, lugs on said bar extending laterally thereof arranged with an open space between them long and wide enough to permit free insertion of an ampoule in parallel with the bar, and spring clips on said holder arranged to grasp the sides of the ampoule between them.

3. A holder for a tubular glass ampoule comprising a bar, lugs on said bar extending laterally thereof arranged with an open space between them long and wide enough to permit free insertion of an ampoule in parallel with the bar, and spring clips on said holder arranged to embrace the sides of the ampoule, the ends of said clips being spaced apart from one another by a distance less than the diameter of the ampoule,

and being movable further apart in a manner permitting lateral insertion of the ampoule between them.

4. A holder for a tubular glass ampoule comprising a bar, lugs on said bar extending laterally thereof arranged with an open space between them long and wide enough to permit free insertion of an ampoule in parallel with the bar, and spring grippers supported on said bar between the lugs with a space between them permitting lateral insertion of the ampoule.

5. A holder for a tubular glass ampoule comprising a bar, lugs on said bar extending laterally thereof arranged with an open space between them long and wide enough to permit free insertion of an ampoule in parallel with the bar, and a spring clip mounted on said bar between the lugs, having side members separated, and resiliently separable from one another arranged to receive the ampoule by lateral insertion between them.

6. A holder for a tubular glass ampoule comprising a bar, lugs on said bar extending laterally thereof arranged with an open space between them long and wide enough to permit free insertion of an ampoule in parallel with the bar, and a spring clip mounted on said bar between the lugs, having side members separated and resiliently separable from one another arranged to receive the ampoule by lateral insertion between them, the ends of said side members being bent inward, forming grippers adapted to grasp the ampoule yieldingly.

7. A holder for a tubular glass ampoule comprising a bar, lugs on said bar extending laterally thereof arranged with an open space between them long and wide enough to permit free insertion of an ampoule in parallel with the bar, and a spring clip mounted on said bar between the lugs, having side members separated and resiliently separable from one another arranged to receive the ampoule by lateral insertion between them, each of the side members being bent into the space between their outermost parts, and there formed as recessed grippers spaced apart both from said outermost parts and from the bar.

8. A holder for a tubular glass ampoule comprising a bar, lugs on said bar extending laterally thereof arranged with an open space between them long and wide enough to permit free insertion of an ampoule in parallel with the bar, and a spring clip mounted on said bar between the lugs, having side members separated and resiliently separable from one another arranged to receive the ampoule by lateral insertion between them, the ends of said side members being bent inward, forming grippers adapted to grasp the ampoule yieldingly and the junctions between said grippers and side members being separated from one another at their nearest points by a distance less than the diameter of the ampoule.

9. An ampoule holder for hypodermically discharging the contents of a tubular ampoule comprising a holder having separated lugs and a connecting bar arranged to embrace an open space adapted to receive an ampoule by lateral insertion, said holder having positioning and gripping means for grasping the sides of the ampoule, a pusher movable longitudinally through one of said lugs and an adapter removably secured to the other lug, having means on its outer end to receive a hypodermic needle and being formed with a through passageway and with a tubular needle projecting from its inner end in continuation of said passageway and adapted to pierce a stopper on the adjacent end of the ampoule.

10. An ampoule holder of the character set forth having an apertured lug at one end and adapted to receive a tubular ampoule with one end adjacent to said lug, and a tubular adapter constructed with means for detachable connection to said lug and having a tubular needle in continuation of its bore extending and arranged to penetrate the adjacent end closure of an ampoule when the adapter is so connected to the lug; the outer end of said adapter being formed to mount a standard hypodermic needle.

11. An instrument for hypodermically discharging a medicine ampoule comprising a bar having a laterally projecting lug at one end adjacent to which the stopped end of an ampoule may be placed, a needle adapter detachably screw-threaded to said lug and having an inwardly directed tubular needle adapted to pierce the adjacent closure of such ampoule, said adapter having a bore extending from said needle to its outer end and being formed at its outer end to enter the socketed hub of a standard hypodermic needle.

12. A hypodermic instrument comprising in combination an ampoule holder having separated lugs arranged to embrace the ends of a tubular ampoule, a medicine container or ampoule of tubular form mounted in said holder between said lugs, resilient compressible and impervious plugs inserted in the opposite ends of said ampoule each of said plugs having a relatively short flange of a diameter approximately equal to the prescribed bore of a given tube and a diameter less than such bore at a zone immediately adjacent to the flange, the plugs being tapered with an increasing taper from the zone of small diameter toward the outer end.

13. A hypodermic instrument comprising in combination an ampoule holder having separated lugs arranged to embrace the ends of a tubular ampoule, a medicine container or ampoule of tubular form mounted in said

holder between said lugs, resilient compressible and impervious plugs inserted in the opposite ends of said ampoule each of said plugs having a relatively short flange of a diameter approximately equal to the prescribed bore of a given tube and a diameter less than such bore at a zone immediately adjacent to the flange, the plugs being tapered with an increasing taper from the said zone of small diameter toward the outer end; the outer ends of said plugs being adapted to enter the tube and to close liquid-tight a bore somewhat greater than such prescribed diameter.

14. A hypodermic instrument comprising in combination an ampoule holder having separated lugs arranged to embrace the ends of a tubular ampoule, a medicine container or ampoule of tubular form mounted in said holder between said lugs, resilient compressible and impervious plugs inserted in the opposite ends of said ampoule each of said plugs having a relatively short flange of a diameter approximately equal to the prescribed bore of a given tube and a diameter less than such bore at a zone immediately adjacent to the flange, the plugs being tapered with an increasing taper from the said zone of small diameter toward the outer end; the outer ends of said plugs being large enough to fill liquid-tight a bore somewhat larger than said prescribed bore, and one of them serving as a piston, a needle adapter mounted on one of said lugs and having an inwardly projecting tubular piercing needle adapted to penetrate the adjacent plug, a hypodermic needle on the outer end of said adapter, and a pusher guided to move in the other lug and to propel the piston plug.

15. A medicine ampoule consisting of a tube, the diameter of the bore of which is between prescribed limits of tolerance, and a closing plug adapted to be inserted in the end of said tube, the inner end of said plug being of a diameter approximating the mean between said limits and having a zone adjacent thereto of which the diameter is less than the smaller limit of tolerance, the plug being also tapered from said zone of small diameter with an increasing taper to its outer end, where its diameter approximates the said larger limit of tolerance.

16. A medicine ampoule consisting of a tube, the diameter of the bore of which is between prescribed limits of tolerance, and a piston plug made of compressible resilient and impervious material inserted into one of the ends of said tube and adapted to be propelled through the tube; said plug at one end being of a diameter when in uncompressed condition approximating the mean between said limits of tolerance of the tube, and having an immediately adjacent zone of smaller diameter than the smaller limit of tolerance.

17. A medicine ampoule consisting of a tube, the diameter of the bore of which is between prescribed limits of tolerance, and a piston plug the inner end of which for a relatively short distance is of a diameter approximating the mean between said limits of tolerance of the tube, and the zone immediately adjacent the said end is of a diameter less than the smaller limit of tolerance, while from the said zone of small diameter to its outer end the plug has a gradually enlarging taper to a diameter approximating the larger limit; the outer end of the plug being sufficiently compressible to pass through a bore of any diameter between said limits.

18. A syringe ampule embodying a tube and a resilient imperforate sealing stopper, said stopper being at its inner end of a diameter approximating the prescribed bore of such tube and having an adjacent zone of smaller diameter and being at its outer end of sufficiently larger diameter than at its inner end to insure sealing the tube notwithstanding permissible variations in the bore thereof within prescribed limits of tolerance.

19. A syringe ampule embodying a tube and a resilient sealing stopper; said stopper being at its inner end of a diameter approximating the mean between prescribed limits of tolerance of variation of bore of the tube, and having an adjacent zone of lesser diameter, and the stopper increasing in diameter from said zone towards its outer end and having thereat a diameter at least as great as the maximum limit of tolerance.

In testimony whereof I have affixed my signature.

ERNEST H. MARCY.

CERTIFICATE OF CORRECTION.

Patent No. 1,728,260. Granted September 17, 1929, to

ERNEST H. MARCY.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 6, after line 101, insert the following as claim 20.

"20. A medicine ampoule comprising a tube and plugs inserted into the opposite ends of said tube, one of the plugs being adapted to slide endwise through the tube and constituting a piston and having a substantially central projection on its inner end, and the other plug having a recess at its inner end the length and width of which are greater than the corresponding dimensions of said projection.";

and the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 22nd day of October, A. D. 1929.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.

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