April 14, 1964 A. R. MIZZY 3,128,766

MEDICINAL SYRINGE

Filed June 15, 1962

FIG. 1

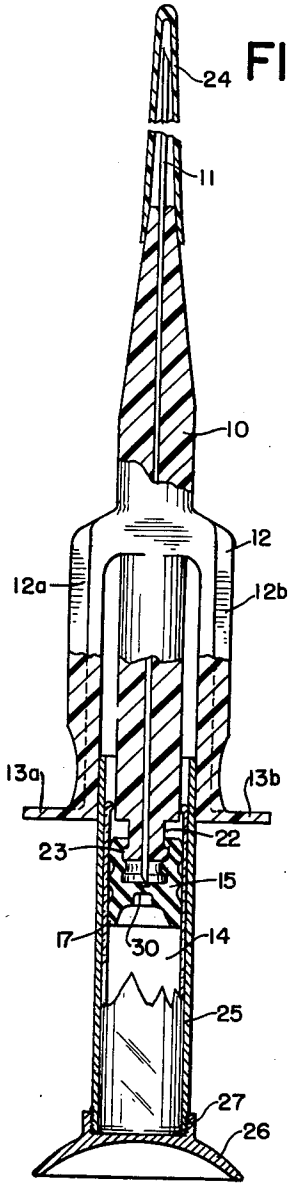


FIG. 2

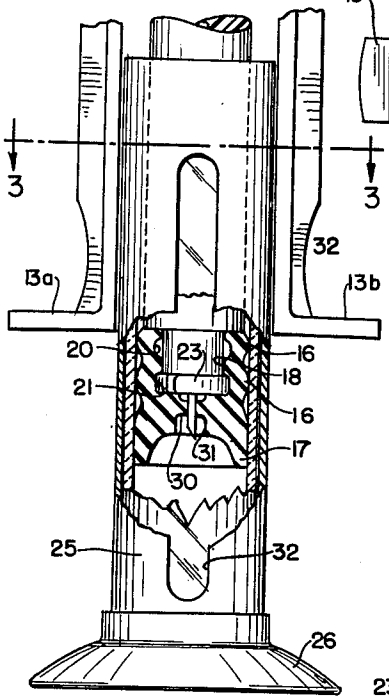


FIG. 3

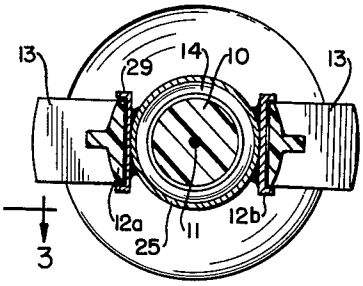


FIG. 4

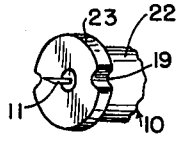


FIG. 5

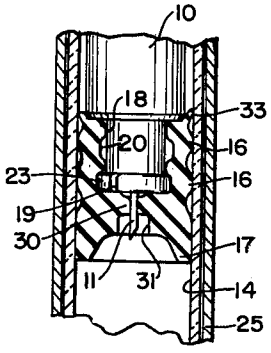


FIG. 6

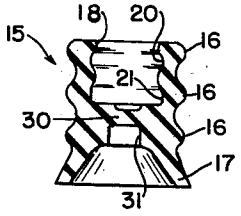


FIG. 7

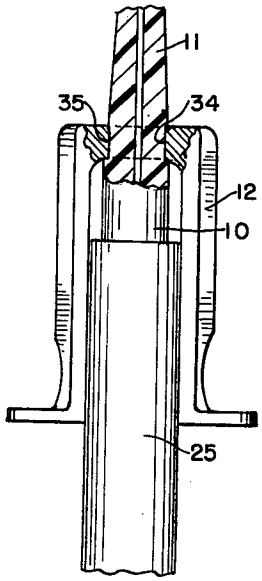
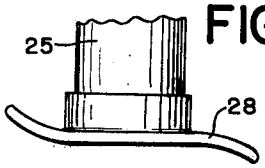


FIG. 8



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MEDICINAL SYRINGE

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The present invention relates to syringes for the injection of medicinal fluids into the body tissue. The invention relates particularly to such a syringe, the major portions of which are disposable, so that these major portions may be charged with a predetermined volume of injection fluid with the apparatus completely sterile, used once and disposed of. As is clear from the above the syringe of this invention is readily fabricated and assembled at low cost making the disposability of the device after a single use practical.

The syringe of the present invention is an improvement upon that shown in my Patent No. 2,864,364, issued December 16, 1958. It differs from the syringe of that patent particularly in that it supplies a finger grip member so that the depth of penetration may be readily controlled and differs further in that a standard vial or cartridge may be utilized rather than a special cartridge.

The present invention also provides a guiding means which is utilized with the disposable syringe and with a standard cartridge so as to assure that the needle penetrates the cartridge or vial closure properly and assures that the material will be ejected from the cartridge without any binding of the ejection plunger on the cartridge walls or otherwise.

It is an object of the invention to provide a syringe, major portions or all of which may be disposable.

It is another object of the invention to provide such a syringe wherein a standard form of cartridge or vial may be utilized.

It is a further object of the invention to provide a syringe of the type described having a finger piece formed integrally therewith which can cooperate with a thumb piece to control the depth of penetration of the needle into the body tissue or into a vein for intravenous injections.

It is a further object of the invention to provide a syringe of the type described, in which either the finger piece or the thumb piece is reusable.

It is a still further object of the invention to provide a syringe as indicated which may be readily manufactured at low cost and which, although provided with a finger piece as described, may be manufactured in a split mold without using a core in the molding process.

Other objects and features of the invention will be apparent when the following description is considered in connection with the annexed drawings, in which,

FIGURE 1 is a side elevational view, largely in longitudinal cross section, of the syringe of my invention;

FIGURE 2 is an enlarged fragmentary view of a portion of the syringe of FIGURE 1 showing the position of the inner end of the needle relative to the vial or cartridge closure when the syringe has been operated sufficiently to cause the needle to penetrate the closure member;

FIGURE 3 is a transverse cross-sectional view taken on the plane of the line 3—3 of FIGURE 2 showing particularly the manner in which the finger piece is constructed and the manner in which that finger piece guides the cylindrical member which terminates in the thumb piece;

FIGURE 4 is a perspective view of the inner end of the plunger showing particularly the mode of providing for escape of air from the closure member when the plunger is moved from the position of FIGURE 1 to that of FIGURE 2;

FIGURE 5 is a fragmentary longitudinal sectional view of the device of FIGURES 1 and 2 showing particularly

the modified form of closure member for the vial or cartridge;

FIGURE 6 is an enlarged showing of the closure member of FIGURES 1 and 2 prior to its insertion into a vial or cartridge;

FIGURE 7 is a fragmentary longitudinal view of a modification of the plunger and finger piece structure of FIGURE 1, wherein the finger piece is intended to be reusable and is mounted on the plunger in such manner that it may be removed from the disposable plunger and reused; and

FIGURE 8 is a fragmentary showing of a modified structure of the vial holder and guide adapted for use with the palm or heel of the hand instead of the thumb.

Referring now to the drawings, the syringe shown comprises a plunger **10** formed of molded plastic which is molded about the needle **11**. The molded plastic plunger in the form shown in FIGURES 1 and 2 has integral therewith the finger piece **12** which, as is clearly shown in the drawing, is formed in a U-shape having arms **12***a* and **12***b* and is provided with the finger members **13***a* and **13***b* at the lower end thereof. The two arms **12***a* and **12***b* of member **12** are generally rectangular in cross section so that the plunger element **10** including the finger grip element **12** may be formed in a split mold which of course needs no core since the needle **11** forms the core. In the construction above-described the needle and plunger are of such length that no ferrule or the like is necessary to aid in bonding the elements together, all requirements of strength being made without the use of such aids to bonding.

The plunger element thus far described is intended to be used with a standard vial or cartridge shown at **14**, this cartridge being provided with a seal and plunger member **15** which is particularly adapted to use with the plunger element described above.

However, as will later appear, the vial or cartridge **14** with its seal **15** may be used with a standard non-disposable syringe thus making it possible to supply the cartridge or vial in a single form whether its ultimate use is to be with the device of the present invention or with an older form of syringe.

The sealing member **15** comprises a rubber or plastic flexible seal of cylindrical form having a plurality of exterior annular ridges **16** and a dependent skirt portion **17**. Additionally, the seal member has an internal bore **18** provided with two annular grooves **20** and **21**. The plunger **10** is formed at its lower end, as seen in FIGURE 1, with a portion of reduced diameter **22** which terminates in a slightly enlarged portion **23** forming an annular rib.

The annular rib **23** is provided with at least one longitudinally extending groove **19** in order to assure that air which may be trapped in the interior bore **18** may escape, thus assuring that there will be no undesired resistance to movement of the plunger from the groove **20** into the groove **21**.

If the cartridge is to be sold with the plunger portion **10** then the vial or cartridge with the medicament and the seal in place is assembled with the plunger as shown in FIGURE 1, this assembly being performed under sterile conditions and the exposed upper end of needle **11** being capped by means of the flexible sealing cap **24**. On the other hand, it is entirely possible that the vial or cartridge be sold separately in which case not only the exposed upper end of the needle, but also the exposed lower end of the needle would be provided with a protecting cap as would the vial **14**. In this event the physician or other user would remove the seal from the vial and from the lower end of the needle and plunger and insert the plunger into the seal **15** in the position shown in FIGURE 1 prior to utilizing the syringe.

In addition to the elements heretofore described there

is provided a cylindrical guide member **25** which is of a size to fit over the exterior of the vial **14**. The guide is preferably provided with the guideways or channels **29** on opposite sides thereof which cooperate with the members **12***a* and **12***b* to assure axial movement of the vial. Member **25** terminates at its lower end, as seen in FIGURE 1, in a thumb piece **26** which may be made integral with the cylindrical portion **25** or may be fixed thereto as by the threads shown at **27**. If desirable the thumb piece **26** may be omitted and a common form of operating member adapted to fit the palm or heel of the hand be substituted therefor, this being for example in the form shown in FIGURE 8 and designated **28**.

The assembled plunger element **10**, vial **14** and guide cylinder **15** are shown in their position prior to initial operation in FIGURE 1. It will be seen that by moving the guide cylinder **25** upwardly relative to the plunger **10**, the lower end of the plunger and specifically the annular rim **23** moves from the groove **20** into the grooves **21**, the lower end of needle **11** thus penetrating the web portion **30** of the seal **15** and extending into the cup shaped depression **31** formed in that seal being thus in communication with the interior of the vial **14**.

Although in the above the vial **14** and guide cylinder **25** are described as separate elements, it is entirely possible to utilize a single member which serves both as container and guide. Such a member may, for example, be made of plastic and may, if desired, be transparent or provided with transparent areas.

The needle **11** may then be inserted into the body tissue and the depth of penetration controlled due to the provision of the finger piece **12** and its extensions **13**. When the device has penetrated to the desired extent the finger pieces are held stationary and the guide member, together with vial **14**, moved relatively thereto in the upward direction as seen in FIGURE 1 thereby causing the fluid in the vial to be forced under pressure through the needle **11** and injected.

In order that the quantity of fluid injected may be determined, the guide cylinder **25** is provided with sight slots **32** at spaced intervals about its circumference through which the vial and thereby the level of fluid in the vial can be observed, thereby obviously also indicating the amount of fluid injected at any instant. These sight slots are also important in the event that the syringe of the instant invention is used to inject fluid not provided in a vial or cartridge but taken from some other container. In this case the device may be assembled with an empty vial properly sterilized and the upper end of needle **11** inserted through the container closure, the guide cylinder and finger piece having been operated to place the seal member **15** against the bottom of the vial. Then by separating the finger pieces **13** from the thumb piece **26** the seal will be withdrawn from the base of the vial and the medicament by suction caused to pass through the needle **11** into the vial **14** and the syringe thus prepared for injection of this fluid.

As has been indicated, the syringe of the instant invention may be utilized either with a vial such as that shown at **14**, that is, with a glass container having an integral glass bottom or may be utilized with a cartridge, that is, a glass tubular container which is closed at one end by means of a plug or seal rather than with the integral glass bottom. In either case, the seal **15** would be provided at the upper end.

Further as has been indicated, such vials or cartridges can be used with other forms of syringe by inserting a needle through the seal **15** and, in the case of the cartridge, pressing the opposite seal toward the seal **15** to eject the fluid, or in the case of a vial utilizing it by inserting the needle of other forms of syringe through the seal and thereafter pressing the seal toward the vial bottom to eject the fluid.

The provision of the annular ribs **16** on the seal **15** lessens the area of contact between the interior walls of the vial and the seal **15** thus provides for better sliding contact without requiring the use of any lubricant such as silicone which is undesirable since it might contaminate the medicinal fluid. Normally the seal is formed of extremely resilient material, but in the present construction this resilience is somewhat lessened in order to assure that the pointed inner end of the needle **11** penetrate the web portion of the seal **15** rather than merely deforming that web. Because of this use of less resilient material the seal might not be as effective as is necessary and therefore the skirt **17** has been provided, the skirt as shown in FIGURE 6 being forced inwardly and compressed when the seal is inserted in the vial.

Thus the combination of the annular ribs **16** with the skirt **17** provides for the proper sliding movement while at the same time maintains the seal between the vial wall and the seal member **15**, it being understood as pressure increases in the interior of the vial the skirt **17** is forced more tightly against the vial wall to prevent leakage as the fluid is injected through the needle **11**.

As indicated in FIGURE 5 in a modified form of my invention I prefer to provide the seal **15** with an upwardly extending small skirt member **33** which even further enhances the seal especially under circumstances where the exterior pressure exceeds the pressure within the vial prior to the injection operation and where therefore the skirt **17** would not be fully effective since pressure against that skirt from the exterior would tend to collapse it. Such circumstances arise, for example, when the liquid first expands as a result of increasing temperature or altitude and thereafter contracts thereby creating a partial vacuum, tending to draw air into the vial. This feature is also important when the syringe is filled before use by means of suction so that the external atmospheric pressure is at least momentarily greater than that within the vial.

In the form of the invention thus far described, all portions of the syringe are disposable except that the guide cylinder **25** with its terminating thumb or palm portion **26** or **28** may be reusable. It may at times, however, be desirable to have the finger piece **12** also detachable from the plunger **10** and reusable.

In this event, the finger piece **12** may be formed as a U-shaped piece having an aperture such as **34** in the base portion therof as shown in FIGURE 7. This finger piece may be formed of metal or of other material such as plastic and, irrespective of the material of the finger piece, the plunger element **10** is then formed with a shallow annular groove **35**, the diameter of the groove being substantially that of the aperture **34**. In preparing the device for use when this form of finger piece is utilized, the finger piece is slipped over the upper end of the plunger and the needle assembly and moved downwardly along the plunger until the material immediately above the groove has been compressed sufficiently so that the finger piece aperture moves into the groove whereby the material above the groove is release from its compressed state thereby holding the finger piece firmly in position on the plunger. After use the finger piece may of course be removed from the plunger by simply pulling it off the upper end of the plunger-needle assembly and retaining it while discarding the remainder.

Although the device has been described as being provided with a seal member which, prior to utilization, provides a barrier wall separating the lower end of the needle **11** from the fluid within the vial, it will be understood that if this barrier is unnecessary, the vial, plunger and seal assembly may be made with the rib **23** of the plunger in the lower groove, the needle already having penetrated the barrier wall. Also it will be understood that if this is done the seal may be shortened and the upper groove **20** omitted.

While I have described a preferred embodiment of my invention, it will be understood that I wish to be limited

not by the foregoing description, but solely by the claims granted to me.

What is claimed is:

1. A syringe comprising: an integrally molded plastic one-piece plunger member having a first plunger portion which surrounds and holds a hollow needle, said needle extending longitudinally of said first plunger portion and protruding through both ends thereof, said plunger member also being integrally molded with a pair of upwardly extending arms which are generally parallel to and spaced from said first plunger portion to define a space therebetween, said arms being separated from each other along the lengths thereof, each of said arms terminating in a finger grip member which is generally transverse to said plunger and said arms; a separate generally cylindrical container adapted for holding a quantity of a fluid therein to form a unitary operating device with said plunger member, said container having an outer diameter less than the distance between the insides of said two arms and an inner diameter greater than the diameter of said plunger first portion extending between said two arms whereby said fluid container can move over said plunger in the space between said plunger and said arms, a seal for one end of said fluid container, said seal being pierced by said needle as said container is moved over said plunger to provide communication between the interior of said container and the hollow needle.

2. A syringe as set forth in claim 1 wherein said arms and said container are provided with mating guide means.

3. A syringe as set forth in claim 1 wherein the end of said fluid container opposite the seal is provided with a generally S-shaped thumb-piece to facilitate movement of the cylinder with respect to the plunger.

4. A syringe according to claim 1 wherein said seal comprises a generally cylindrical plug member of an outer diameter substantially equal to the inner diameter of said fluid container, said seal having a plurality of annular grooves formed therein and an outwardly flared skirt at the end thereof remote from said plunger.

5. A syringe according to claim 1 wherein said seal comprises a generally cylindrical plug member of an outer diameter substantially equal to the inner diameter of said fluid container, said seal having a plurality of annular grooves formed therein and an outwardly flaring skirt at the end thereof adjacent said plunger.

6. A syringe according to claim 1 wherein said seal comprises a generally cylindrical plug member of an outer diameter substantially equal to the inner diameter of said fluid container, said seal having a plurality of annular grooves formed therein and having an outwardly flared skirt at the end thereof remote from said plunger, and a second outwardly flared skirt at the end adjacent said plunger.

7. A syringe comprising: an integrally molded plastic one-piece plunger member having a first plunger portion which surrounds and holds a hollow needle, said needle extending longitudinally of said first plunger portion and protruding through both ends thereof, said plunger member also being integrally molded with a pair of upwardly extending arms which are generally parallel to and spaced

from said first plunger portion to define a space therebetween, said arms being separated from each other along the lengths thereof, each of said arms terminating in a finger grip member which is generally transverse to said plunger and said arms; a separate generally cylindrical guide member forming a unitary operating device with said plunger member and adapted for holding a cartridge type fluid container which is closed at one end thereof, a seal at the other end of said fluid container, the outer diameter of said cylindrical guide member being less than the distance between the insides of said two arms and the inner diameter of said fluid container being greater than the diameter of said plunger first portion extending between said two arms whereby the fluid container can move over said plunger with the cylindrical guide member being guided between said arms, said seal being pierced by said needle as said container is moved over said plunger to provide communication between the interior of said container and the hollow needle.

8. A syringe as set forth in claim 7 wherein the said arms and said cylindrical guide member are provided with mating gude means.

9. A syringe as set forth in claim 7 wherein the end of said cylindrical guide member adjacent the sealed end of the fluid container is provided with a generally S-shaped thumb-piece to facilitate movement of the guide member with respect to the plunger.

10. A syringe according to claim 7 wherein said seal comprises a generally cylindrical plug member of an outer diameter substantially equal to the inner diameter of said fluid container, said seal having a plurality of annular grooves formed therein and an outwardly flared skirt at the end thereof remote from said plunger.

11. A syringe according to claim 7 wherein said seal comprises a generally cylindrical plug member of an outer diameter substantially equal to the inner diameter of said fluid container, said seal having a plurality of annular grooves formed therein and an outwardly flaring skirt at the end thereof adjacent said plunger.

12. A syringe according to claim 7 wherein said seal comprises a generally cylindrical plug member of an outer diameter substantially equal to the inner diameter of said fluid container, said seal having a plurality of annular grooves formed therein and having an outwardly flared skirt at the end thereof remote from said plunger, and a second outwardly flared skirt at the end adjacent said plunger.

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