United States Patent

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[54] **SYRINGE PLUNGER HEAD**
9 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** **222/386,**
128/218P
[51] **Int. Cl.** **A61m 5/00**
[50] **Field of Search** 222/386;
128/218, 218P

[56] **References Cited**
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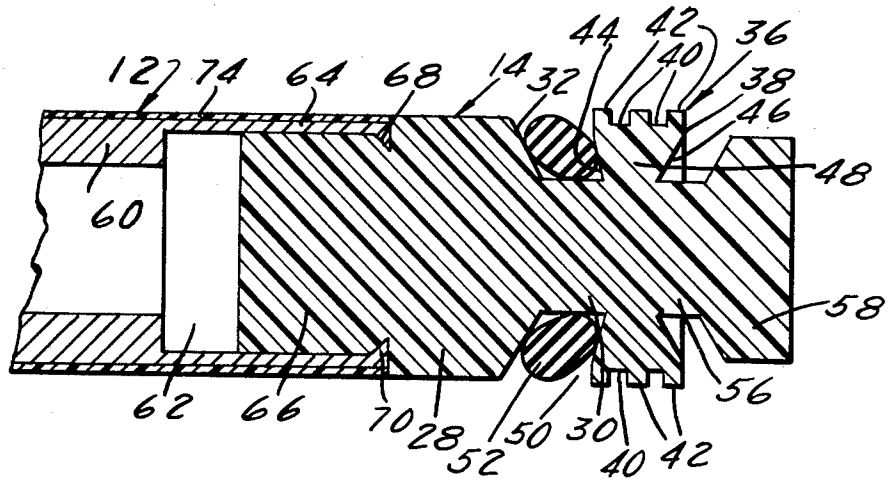
ABSTRACT: Syringe apparatus having a plunger head with a peripherally grooved flange urged against the interior wall of the syringe by a resilient O-ring wedged in an annular groove in the head.



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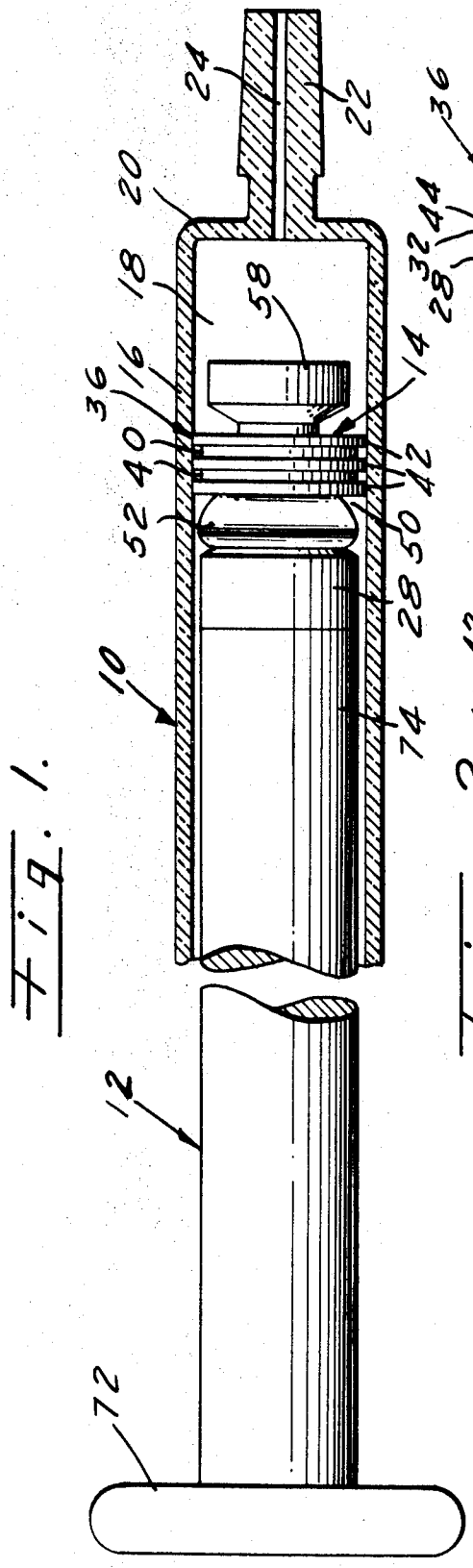

Fig. 1.

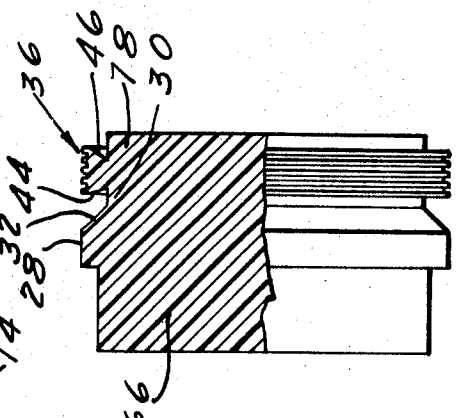

Fig. 3.

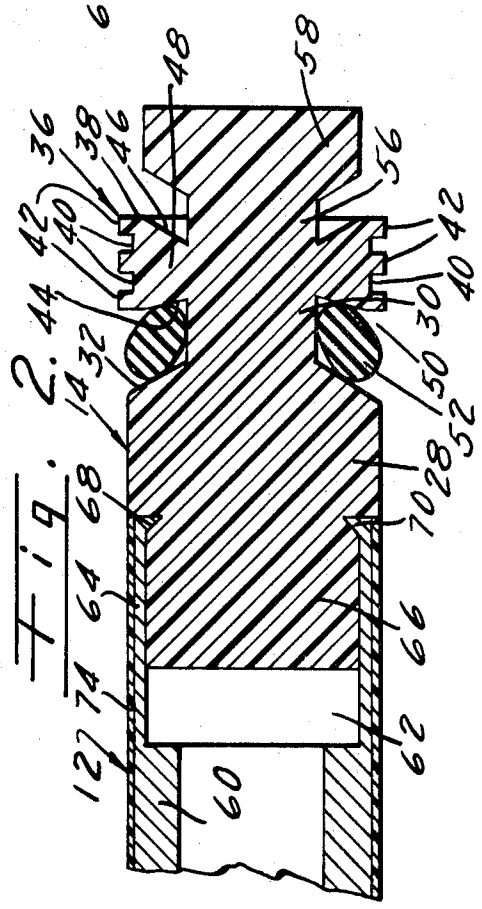

Fig. 2.

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SYRINGE PLUNGER HEAD

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to syringes and relates more particularly to plungers of precise measuring devices or syringes which are used to inject minute samples in gas chromatography, for delicate medical injections, in treatment of small animals, and for a variety of similar projects in chemical and medical research laboratories.

2. Description of the Prior Art

There are various types of plunger heads for syringes used in chromatographic work and the like but there has been a problem in some types of such syringes of keeping tight sealing engagement of the plunger head with the inner wall of the syringe bore so that relatively high pressures may be developed by the syringe without leakage.

BRIEF SUMMARY OF THE INVENTION

The present invention comprises a plunger head for precise measuring syringes having a tubular or hollow barrel, and a plunger which carries the plunger head.

The present plunger head includes a cylindrical body from the forward end of which extends a reduced diameter part. There is an annular flange on the reduced diameter part of the head, the periphery of the flange slidingly and sealingly engaging the interior bore of the syringe barrel. The flange is thinner at the base where it joins the reduced diameter part and the head has an annular, outwardly opening groove at the inner side of the open end so that said groove is narrower at the bottom than at the top. A resilient or elastic O-ring is tightly wedged in the groove and urges the flange forwardly to increase the sealing pressure of the periphery of the flange against the wall of the bore of the barrel. The O-ring itself does not engage the barrel but exerts a pressure on the flange such that it urges the free peripheral part of the flange forwardly and this in turn increases the pressure of the flange on the wall of the barrel bore.

OBJECTS OF THE INVENTION

It is an object of the invention to provide a syringe plunger head having a highly effective sealing relation with the wall of the bore of the syringe barrel.

It is another object of the invention to provide a plunger head having a flange the periphery of which engages the wall of the bore of the syringe barrel and there is an O-ring providing pressure to increase the pressure of the flange on the wall of the syringe barrel bore.

The characteristics and advantages of the invention are further sufficiently referred to in connection with the following detailed description of the accompanying drawings which represent certain embodiments. After considering these examples skilled persons will understand that many variations may be made without departing from the principles disclosed and I contemplate the employment of any structures, arrangements or modes of operation that are properly within the scope of the appended claims.

Referring to the drawings, which are for illustrative purposes only:

FIG. 1 is a longitudinal sectional view of a portion of a syringe barrel with a side view of the plunger head embodying the present invention operably anchored to and supported by the syringe plunger;

FIG. 2 is an enlarged longitudinal sectional view of the plunger head carried by said plunger; and

FIG. 3 is a longitudinal sectional view showing an alternative arrangement of the forward end of the plunger head.

Referring more particularly to the drawings, there is shown a syringe barrel, indicated generally at **10**, with a plunger member indicated generally at **12**, operably disposed therein and having a plunger head, indicated generally at **14**, anchored to the forward end of the plunger and supported by said plunger.

The syringe barrel **10** is of the usual well-known type and of any suitable material such as glass of suitable quality, for example. The barrel **10** has a cylindrical wall **16** defining a bore **18** which is closed at the forward end by an end wall **20** from which a tip **22** of well known character extends forwardly, there being a fluid passage **24** extending longitudinally from the forward free end of the tip into the bore of the barrel. The barrel is provided at the other end with a conventional flange, not shown.

The plunger head **14** is of any suitable material. A plastic material such as Teflon, for example, has been found to be very satisfactory, Teflon being Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins.

Plunger head **14** comprises a cylindrical body **28** from the forward end of which a reduced diameter part **30** axially extends, The exposed annular wall **32** of the forward end of the body is inclined inwardly and forwardly.

On the reduced diameter part **30** and spaced forwardly of said forward end wall of the body is an annular radially extending flange, indicated generally at **36**, of somewhat greater diameter than that of the body **28**. Flange **36** has a peripheral portion the peripheral surface of which has a plurality of external grooves **40** separating a plurality of lands **42** the surfaces of which engage the interior wall surface of the barrel bore.

At its base, where it joins the reduced diameter part **30** of the plunger head, the flange is thinner, there being sidewall parts **44** and **46** at the rear side and the front side respectively that taper or are inclined inwardly toward each other, as best shown in FIGS. **2** and **3**. The base of the flange **36** is to be considered the region where the flange joins the reduced diameter part and is indicated at **48**. From FIGS. **2** and **3** it will be apparent that in cross section the flange is somewhat wedge shaped and that it will flex in an annular pivotal area at the base.

The walls **32** and **44** of the body **28** and flange **36** respectively are inclined forwardly and inwardly to define the sidewalls of a groove **50** at the rear side of the flange **36**, with the wall **32** of the body inclined forwardly at a greater angle relative to the axis of the head than the forward inclination of the wall **44** so that the bottom of the groove **50** is narrower than the width of the open top of the groove.

Within the groove **50** is a resilient O-ring **52** of suitable material. For example, the O-ring may be of neoprene, or of Teflon, or Parker O-rings (Viton O-rings, Viton being the trademark of Parker Seal Co., 10567 W. Jefferson, City of Commerce, California).

The O-ring **52** is wedged in the groove **50** so that it exerts pressure against the flange **36** urging said flange forwardly and causing said flange to flex forwardly in the annular pivotal area at the base thereof. Thus the O-ring exerts pressure against the flange which in turn causes the flange, and particularly the lands **42** thereof, to be pressed tightly against the interior wall of the syringe barrel. This pressure of the O-ring on the flange effects a tilting thereof and greatly increases the effective sealing engagement of the flange with the interior wall of the barrel.

The O-ring is of such cross-sectional area and of such external diameter that when it is in the groove **50** it is wedged therein in such manner as to exert forward pressure on the flange but does not contact the internal wall of the syringe barrel. Thus the O-ring functions only as a spring. It is to be understood that the size of the O-ring is such that it must be stretched in order to place it in the groove **50**, and when disposed in said groove it will be wedged therein due to the groove **50** tapering inwardly and being inclined forwardly, the bottom being narrower than the top.

By way of example, the angle of the wall **32** of the body **28** is 45° relative to the axis of the plunger head while the angle of the wall **44** is 75° relative to said axis. Also, the angle of the wall **46** of the flange is 60°. These angles may be varied according to the flange action desired.

There is a part of the plunger head that extends forwardly of the plane of the forward end of the flange. In the arrangement shown in FIG. **2** there is a cylindrical part **56** that extends forwardly from the base of the flange and is about the same diameter as the diameter of the reduced diameter part **30**. At the end of the part **56** is an enlarged knob **58**. The purpose of this arrangement is to minimize the side of the bore **18** of the barrel ahead of the plunger, thereby providing greater accuracy of control of the discharge of the sample in the syringe.

The plunger member **12** comprises a tubular plunger rod **60** of suitable material such as stainless steel for example. The wall of the plunger rod is relatively thick but has an interior chamber portion **62** at the forward end that is of enlarged diameter so that the wall **64** of the portion **62** is thinner than the wall of the rest of the plunger rod.

The plunger head has an anchoring and support part **66** that extends rearwardly thereof and that is snugly received in the chamber **62**. At the junction of the anchoring and support part with the plunger head there is an annular groove **68** in said anchoring and support part, said groove being generally V-shaped in cross section. The forward end of the wall **64** of the plunger rod has an inwardly extending flange **70** having a shape corresponding to the shape of the groove **68** and is disposed therein to secure the plunger head to the plunger rod.

At its outer end the plunger rod has a radially extending annular flange or button **72** secured to the rod by any well-known means. The external diameter of the plunger rod is somewhat smaller than the diameter of the body **28** of the plunger head and said plunger rod, as well as the button **72** is coated with a layer of plastic **74**, Teflon being an example of a suitable plastic for the coating **74**.

In FIG. **3** there is shown another arrangement of the plunger head. In this arrangement the part that projects forwardly of the flange is a cylindrical part **78**, the part **78** being substantially shorter longitudinally than the parts **56** and **58** of the arrangement shown in FIG. **2**. Also, there is no groove at the forward end of the anchoring and supporting part **66**.

I claim:

1. A plunger head for a syringe comprising:

A. A cylindrical body;

B. a cylindrical reduced diameter part extending forwardly from the forward end of said body;

C. an annular flange on said reduced diameter part, said flange being spaced forwardly of the forward end of said body, there being an annular outwardly opening groove defined by the adjacent end walls of said body and said flange, said groove being narrower at its base where it joins the reduced diameter part than at the open top part and narrower longitudinally at its base than at the outer free end;

D. a resilient O-ring wedged in the groove exerting forward springlike pressure against and for urging the flange pivotally forwardly and flexing said flange in an annular pivotal base area in the region of the junction of the flange with the reduced diameter part of the plunger head and pressing the outer annular surface of said flange against the interior syringe wall, the outside diameter of said O-ring being no greater than the diameter of the flange;

E. and an anchoring and support part projecting rearwardly of the cylindrical body.

2. The invention defined by claim **1**, wherein the outside diameter of the O-ring, when disposed in said groove, is smaller than the diameter of the flange.

3. The invention defined by claim **2**, wherein the flange has a plurality of peripheral, cylindrical lands separated longitudinally by peripheral grooves.

4. The invention defined by claim **3**, including plunger rod, the anchoring and support part of the plunger head being secured to the front end of said plunger rod.

5. The invention defined by claim **1** wherein the flange has a plurality of peripheral grooves, and peripheral lands at the sides of said grooves.

6. The invention defined by claim **4**, including a tubular syringe barrel in which the syringe head and plunger are operably disposed, said flange being in peripheral engagement with the inner wall of the barrel, said barrel having a forward end wall from which a tip extends forwardly, there being a fluid passage through the tip and into the hollow interior of the barrel.

7. The invention defined by claim **4**, wherein the plunger rod is hollow and said anchoring and support part of the plunger head is disposed and secured within a forward portion of said plunger rod.

8. The invention defined by claim **1**, wherein the forward end of the plunger body has an annular wall adjacent the periphery of the body which is inclined forwardly and inwardly, and the adjacent side of the flange has at least an inner annular wall portion inclined forwardly and inwardly at a greater angle relative to the cylindrical surface of the reduced diameter part than the angle of the adjacent inclined annular wall of the body.

9. The invention defined by claim **8**, wherein the forward end of the flange has at least an inner annular wall part that flares from the base of said flange forwardly and outwardly.