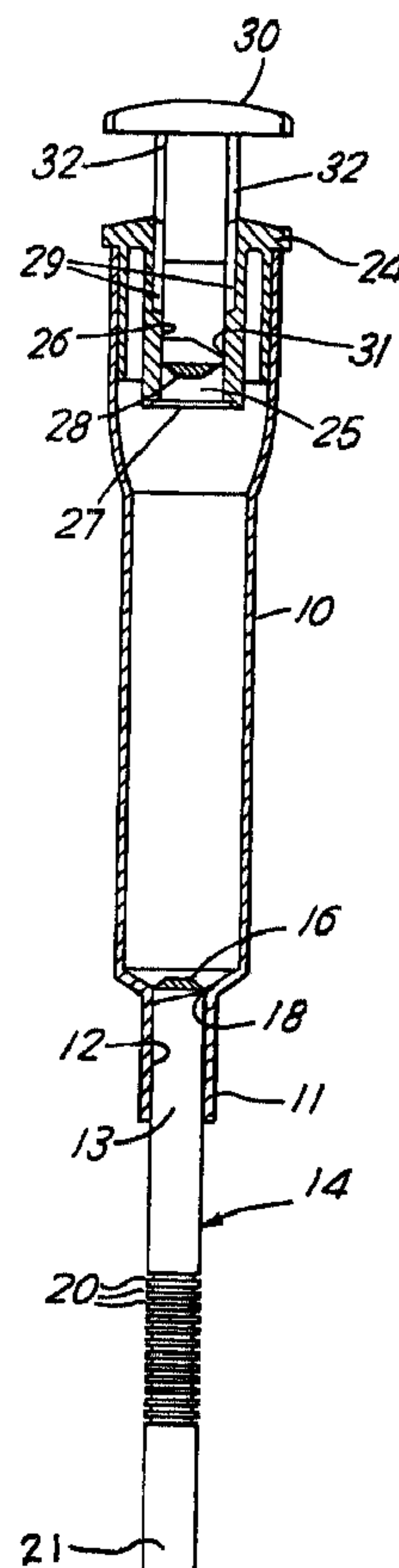




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(54) Title: SAMPLING DEVICE



(57) Abrégé/Abstract:

A sampling device comprises a cylindrical tube (10) with a smaller diameter cylinder (11) at one end thereof in which a plunger (14) is mounted for sliding sealing movement. The inner end of the cylinder is sealed from the interior of the tube by a rupturable element (16), and the plunger (14) has sharp end edge (18) which will rupture the sealing element (16) when the plunger is



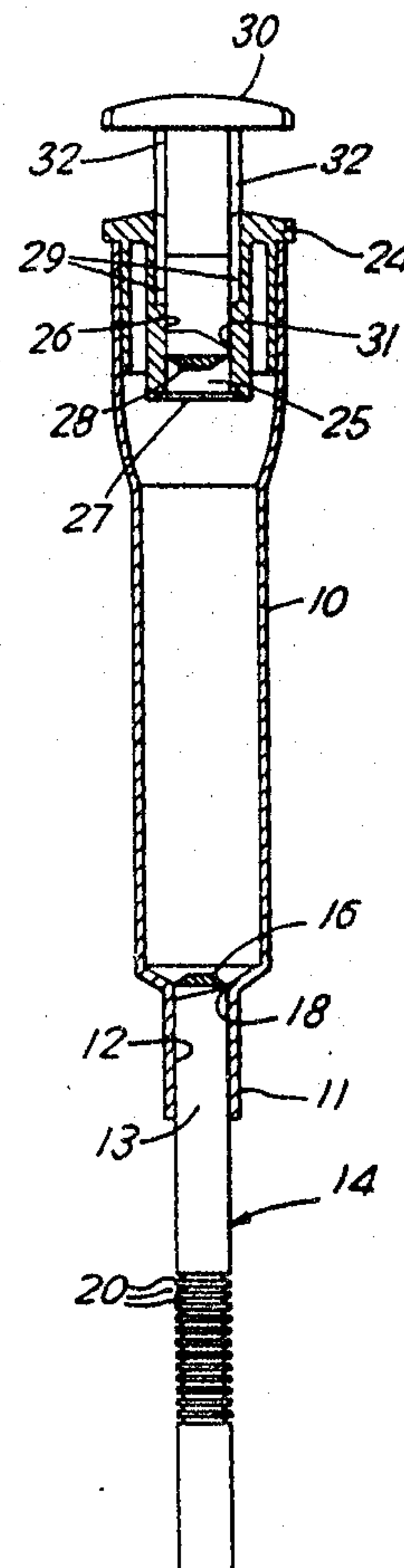
(57) Abrégé(suite)/Abstract(continued):

depressed. The outer end of the plunger is formed with a series of grooves (20) capable of retaining a sample. Depression of the plunger breaks the sealing element and carries the sample into the interior of the tube (10) to test its reaction with a reagent previously sealed into the tube. The end of the plunger remote from the sealing element forms a seal in the cylinder. A generally similar arrangement at the opposite end of tube (10) allows a second reagent to be added to the reagent in the tube.



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(54) Title: SAMPLING DEVICE (57) Abstract A sampling device comprises a cylindrical tube (10) with a smaller diameter cylinder (11) at one end thereof in which a plunger (14) is mounted for sliding sealing movement. The inner end of the cylinder is sealed from the interior of the tube by a rupturable element (16), and the plunger (14) has sharp end edge (18) which will rupture the sealing element (16) when the plunger is depressed. The outer end of the plunger is formed with a series of grooves (20) capable of retaining a sample. Depression of the plunger breaks the sealing element and carries the sample into the interior of the tube (10) to test its reaction with a reagent previously sealed into the tube. The end of the plunger remote from the sealing element forms a seal in the cylinder. A generally similar arrangement at the opposite end of tube (10) allows a second reagent to be added to the reagent in the tube.		



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SAMPLING DEVICE

This invention relates to sampling devices.

WO 90/0354 describes the use of a reaction
5 which is open at the top end and into which a reagent
is carried by a plunger housed in a cylinder opening to
the chamber. The plunger carries a sealing element on
its forward end, and in the initial position of the
plunger outside the chamber the sealing element seals
10 the end of the cylinder adjoining the chamber.

US-A-3715189 describes a reaction chamber, a
cylinder projecting into the chamber, and a piston
slidably mounted in the cylinder, the inner end of
which is sealed by a glass diaphragm. A reagent is
15 disposed between the piston and the diaphragm and is
expelled into the chamber by force applied to the
piston to fracture the diaphragm.

WO 79/01131 describes an arrangement in which
a membrane sealing a chamber is pierced by pressing
20 against it one end of a tube. The membrane forming a
seal about the tube and the contents of the tube are
drawn into the chamber by a sub-atmospheric pressure
which exists in the chamber.

According to the present invention there is
25 provided a sampling device comprising a closed reaction
vessel, and a cylinder formed integrally with a wall of
the vessel and having a bore in which a cylindrical
plunger is mounted for sliding sealing movement, the
plunger having on its surface means for holding a
30 predetermined quantity of a sample, and the inner end
of the bore being sealed from the interior of the
vessel, characterized in that the inner end of the bore
is sealed from the interior of the vessel by a sealing
element capable of being ruptured by the application of
35 force against the sealing element by the end of the
plunger nearer the said sealing element, part of the

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length of the plunger projecting axially from the bore,
and said means for holding a predetermined quantity of
the sample comprising one or more grooves, holes or
recesses in the cylindrical surface of the plunger, the
5 arrangement being such that said one or more grooves,
holes or recesses carrying the sample can by pressing
the projecting part of the plunger into the bore be
moved past the sealing element into the interior of the
vessel, the bore remaining sealed by the plunger.

10 According to a preferred feature of the
invention said one or more grooves, holes or recesses
are formed in the projecting part of the plunger. In a
preferred arrangement, said means for holding a
predetermined quantity of a sample comprises a
15 plurality of circumferential grooves in the plunger, in
which grooves a predetermined quantity of a sample can
be retained by surface tension.

According to another preferred feature of the
invention, in order to seal the bore when the said part
20 is disposed in the interior of the vessel, the end
portion of the plunger remote from the vessel may be of
divergent cross-section, or may have one or more
circumferential sealing ribs, so as to be capable of
forming a tight seal in said bore when the said part of
25 the plunger is disposed within the interior of the
vessel.

According to a further preferred feature of

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SUBSTITUTE SHEET

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the invention, the vessel has at least one chamber in the wall thereof which chamber is isolated from the interior of the vessel by a first seal and from the ambient surroundings by a second seal and which is
5 intended to contain a reagent, and a second plunger mounted in a bore in a second cylinder on the wall of the chamber which plunger is operable to rupture said second and first seals in succession and serves then to seal the chamber (and in consequence the interior of
10 the vessel) from the ambient surroundings.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 shows a sampling device according
15 to the invention in axial section, and

Figure 2 illustrates a modification.

Referring to the drawing, a cylindrical tube moulded from a plastics material such as polypropylene affords a vessel 10 and has at one axial end thereof a
20 reduced diameter portion forming a cylinder 11 in the bore 12 of which one end portion 13 of a plunger 14 is slidably and sealingly mounted. The end of the bore 12 adjoining the interior of the vessel is formed with an integral sealing element 16, and the inner end of the
25 plunger is cut so as to form a sharp edge 18 capable of rupturing the seal. The middle part of the plunger projecting from the bore is formed with a series of shallow circumferentially extending grooves 20 which are adapted to hold a predetermined small quantity of a
30 sample, using surface tension properties. The free end portion 21 of the plunger further from the vessel is slightly divergent so that when the plunger is depressed to rupture the seal and to carry the sample in the grooves into the interior of the vessel, the end
35 portion 21 of the plunger forms a tight seal in the bore 12.

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The opposite end of the cylindrical tube is closed off by an annular plug 24 moulded from a plastics material such as polypropylene and having a central bore 26. The end of the bore adjoining the interior of the vessel is sealed by a rupturable sealing diaphragm 27, and spaced along the bore from the diaphragm is a second rupturable sealing element 28 which is moulded integrally with the plug. A sealed chamber 25 formed between the diaphragm 27 and element 28 may contain a reagent. The axially outer end portion of the bore in the plug is formed with two diametrically opposite key-ways 29. A plunger 30 slidably and sealingly mounted in the bore has its end 31 adjoining the integral seal sharpened so as to be capable of rupturing the sealing element 28 and the diaphragm 27, and has its axially outer portion formed with keys 32 capable of engaging in the key-ways in the bore. Thus the plunger can only be depressed to rupture the sealing element 28 and the diaphragm 27 when its keys are aligned with the key-ways 29 in the bore. This prevents accidental depression of the plunger.

In the modification illustrated in Figure 2, the free end portion 21 of the plunger is formed with two circumferential sealing ribs 34 instead of being divergent as in the arrangement of Figure 1.

In one mode of using the device, a quantity of a reagent is placed in the tubular vessel 10, the plunger 14 is immersed in a solution containing a sample and the solvent allowed to evaporate leaving the sample dried on the grooved area of the plunger. The plunger may first need to be treated with an appropriate reagent (e.g. a surfactant) before it can pick up the sample, but the first reagent and the surfactant may be one and the same. A precise volume of the sample is drawn up by surface tension onto the externally grooved region of the plunger. This volume

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can be carefully controlled in forming the grooves in manufacture and may be as large as necessary. In typical examples, the volume of the sample is 50 ul.

5 As the sample makes contact with the first reagent, the first chemical reaction occurs. The time of reaction can be as long as necessary. When sufficient reaction time has elapsed, the plunger 14 is depressed to rupture the seal, to convey the grooved area of the plunger into the interior of the vessel and
10 to cause the divergent or, as the case may be, ribbed end portion 21 of the plunger to form a tight seal in the bore. The secondary reagent in the interior of the vessel can react with the product of the first reaction or any remaining unused first reagent. The time for
15 this reaction can also be as long as necessary. After this reaction, if further processing is required the contents of the chamber 25 can be added to the contents of the vessel by operation of the second plunger 30 to initiate a further reaction, by inversion if necessary.

20 It will therefore be understood that the illustrated device enables a series of reactions to be carried out without further dispensing or dilution or other treatments. Additionally, the device will fit into many detection instruments such as luminometers.

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CLAIMS

1. A sampling device comprising a closed reaction vessel, and a cylinder formed integrally with a wall of the vessel and having a bore in which a
5 cylindrical plunger is mounted for sliding sealing movement, the plunger having on its surface means for holding a predetermined quantity of a sample, and an inner end of the bore being sealed from the interior of the vessel, characterized in that the inner end of the
10 bore is sealed from the interior of the vessel by a sealing element capable of being ruptured by the end of the plunger nearer the said sealing element, the cylindrical surface of the plunger forming a seal with the bore, and in that part of the length of the plunger
15 projects axially from the bore when the plunger is in contact with the sealing element, the plunger having on its surface means for holding a predetermined quantity of the sample comprising one or more grooves, holes or recesses in a region of the cylindrical surface of the
20 plunger, and the arrangement being such that said one or more grooves, holes or recesses carrying the sample can by pressing the projecting part of the plunger into the bore be moved past the sealing element into the interior of the vessel, the bore remaining sealed by the plunger.

25 2. A sampling device as claimed in claim 1, wherein said means for holding a predetermined quantity of a sample comprises a plurality of circumferential grooves in the plunger, in which grooves a predetermined quantity of the sample can be retained by surface
30 tension.

3. A sampling device as claimed in any one of claims 1 or 2, wherein in order to seal the bore when the said part is disposed in the interior of the vessel, an end portion of the plunger remote from the vessel is
35 of divergent cross-section so as to be capable of forming a tight seal in said bore when said end portion

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of the plunger is disposed within the interior of the vessel.

4. A sampling device as claimed in any one of claims 1 and 2, wherein an end portion of the plunger remote from the vessel has one or more circumferential sealing ribs adapted to form a tight seal in said bore when said end portion of the plunger is disposed within the interior of the vessel.

5. A sampling device as claimed in any one of claims 1 to 4, wherein the vessel has at least one chamber in the wall thereof which chamber is isolated from the interior of the vessel by a first seal and from the ambient surroundings by a second seal and which is intended to contain a reagent, and a second plunger mounted in a bore in a second cylinder on the wall of the chamber which plunger is operable to rupture said second and first seals in succession and serves then to seal the chamber, and consequently, the interior of the vessel from the ambient surroundings.

6. A sampling device as claimed in any one of claims 1 to 5, wherein the vessel is tubular and said cylinder forms a tubular continuation of the tubular vessel.

