

Modified Syringe

Field of the Invention

The invention relates to a syringe for extracting body fluid samples.

Background of the Invention

5 There is frequently a requirement, in the clinical setting, to obtain a sample of blood from a patient usually with a view to undertake a medical test. Blood testing can provide important data representative of a plethora of clinical signs and symptoms, thereby facilitating diagnosis and
10 subsequently timely treatment.

Typically, blood tests determine physiological and biochemical indices of the body, for example, body mineral or metabolite (or electrolyte) content, oxygen and carbon dioxide levels, drug effectiveness, and also organ
15 function. Furthermore, blood tests are commonly used as a form of drug or alcohol testing. Blood tests are also a way to obtain a DNA sample for genetic testing and screening, for example, to diagnose genetic conditions, or even to undertake forensic examinations.

20 The most common blood test performed on a patient is the full blood count, a test wherein the key components of the blood (leukocytes, erythrocytes and thrombocytes) are counted to predict a patient's general state of health. More definitive blood tests include kidney or liver function tests, blood glucose or cholesterol level tests, blood clotting tests, allergy
25 tests and blood grouping.

Although the term blood test is used, most routine tests (except for most haematology) are performed on the blood plasma component of the blood instead of on the blood cells. Depending upon the nature of the test, most
30 commonly a single blood sample is taken. However, some blood tests

require several samples to be taken over a period of time, for example, to assess the effectiveness or duration of an administered drug.

5 A sample of blood is most often taken from a patient by venepuncture, wherein a minor-invasive incision is made in the skin in an attempt to obtain intravenous access. Most commonly, this involves taking a sample of blood from a vein in the arm, the median cubital vein, which lies within the cubital fossa anterior to the elbow. This vein lies close to the surface of the skin with little nerve supply, and consequently its puncture is
10 relatively painless. The procedure involves the application of a tourniquet 3-4 inches above the selected puncture site to reduce the blood flow and increase vein visibility. A needle, attached to a syringe or specialised collection vessel, is inserted through the skin and into the lumen of the vein to extract the blood. Once an adequate sample has been collected,
15 the needle is removed leaving a minor wound, which heals in a few minutes. The procedure is relatively quick with few side effects, although minor bruising can sometimes occur.

A blood sample taken using the above procedure is deposited in a sample
20 tube which may contain additional substances to preserve the blood for processing in the medical laboratory. Sample tubes are commonly provided with no additives (for blood clot analysis), serum separator gels or anticoagulants (e.g. heparin, EDTA, sodium citrate for most analyses), chelating agents (e.g. sodium EDTA for the removal of metal ions),
25 complement inactivators (e.g. acid-citrate dextrose, for HLA tissue typing) or certain preservatives (e.g. sodium fluoride and potassium oxalate, antiglycolytic agents that preserve glucose levels). To aid the user, blood sample tubes are colour coded and this coding is standardised across manufacturers. When taking multiple samples, blood collection tubes
30 must be drawn in a specific order to avoid cross-contamination of additives between tubes.

Therefore, numerous devices have been developed and are known in the art for use in venepuncture and blood sampling. At all times, as with all techniques involving body fluid transfer, medical staff carrying out blood sampling procedures must be aware of the risk associated with blood borne pathogens, such as those responsible for HIV, Hepatitis, syphilis, malaria, herpes, and tuberculosis. The most simple, and commonly used device, is a needle and syringe, comprising a cylindrical container (or barrel) with a hypodermic needle and a plunger. The hypodermic needle is inserted through the skin and, whilst holding the barrel, a user retracts the plunger. This results in an increase in volume in the barrel and consequently a decrease in pressure, resulting in a differential pressure between the syringe and vein. This causes blood to flow into the barrel of the syringe. As the user extracts the plunger further, the pressure gradient is maintained and blood is extracted until the syringe is full, or the desired volume of blood has been taken. The needle is then removed, and the sample of blood transferred to a suitable container for storage. This most frequently involves positioning the end of the needle into a sample tube container and applying pressure to the plunger thereby expelling the blood. The sample tube may have a rubber cap and, in this instance, the needle is forced through the centre of the cap and blood is expelled within the sealed tube. Depending on the number of blood analyses required, the sample may be divided between different collection tubes each with different additives, as described above. An advantage of the syringe device is that the user can control the differential pressure gradient, thereby controlling the rate of blood flow and also the volume of sample taken. This is particularly advantageous with patients with small or fragile veins, where an excess of pressure may result in the collapse of the vein e.g. elderly patients, oncology patients, severely burned patients, obese patients, or patients with unreliable or fragile veins. However, a disadvantage of the syringe technique is the requirement to transfer the blood to sample tubes, thereby increasing the risk of spillage, cross-contamination, user contamination and analytical outcome.

Alternatively, and also frequently used are so-called vacuum tubes, for example the Vacutainer® blood collection tubes. These devices comprise a sterile glass or plastic tube with a rubber cap, and an enclosure that is evacuated to create a vacuum inside the tube. Often they are used in conjunction with double-ended needles. The first needle is inserted into the vein as described above, whilst the second, shorter, needle is pushed into the rubber cap of the vacuum tube therefore coming into contact with the partial vacuum contained therein. Due to the differential pressure gradient between the vein and the vacuum tube, blood quickly flows from the vein through the hypodermic needle into the tube. As blood enters the tube, the pressure increases until the pressure inside the tube is equivalent to the vein, whereupon blood flow ceases. The double-ended needle may be in the form of a standard butterfly needle, or alternatively, the second needle may be encased in a plastic sheath to prevent the user from suffering a needle-prick injury. The filled tube is then removed, and since it is already sealed there is no need to transfer the sample and so the problems associated with transfer are avoided. If required, a second tube can be used and filled in the same way, thereby permitting multiple samples of blood to be taken using different vacuum tubes. Often, the vacuum tubes are provided with different additives to stabilise samples prior to testing (as described above) and these, too, are indicated by colour-coded caps. It is important to remove the tube before withdrawing the needle, as there may still be some suction left, causing pain upon withdrawal.

A disadvantage of the vacuum tube is that the user cannot see fluid flow through the needle nor can one control the differential pressure gradient across the vein. This is determined by the vacuum pressure upon manufacture, and therefore the user cannot control the blood flow rate across the needle. As patients have different blood pressures (dependent on age, size, disease state etc.) the blood flow is different from one

patient to the next. Although some tubes are manufactured for different flow and draw volumes, it can be difficult for the user to determine the appropriate tube (and therefore vacuum pressure) to use. Failure to choose the correct pressure can result in an insufficient blood sample volume (insufficient vacuum pressure) or, alternatively, collapse of the vein (excessive vacuum pressure). This has implications for the use of vacuum tube additives (e.g. sodium fluoride, anti-complement agents, or anticoagulants), whose volume in each tube is pre-determined and whose effects are concentration dependent. Furthermore, the use of the same needle across multiple samples (e.g. for different tests) raises the possibility of cross-contaminating samples and so invalidating test results, and also has the potential to result in leakage of blood upon removal of each tube, posing a potential health risk.

Therefore, herein disclosed is a modified syringe for extracting a body fluid sample that, following extraction, can be adapted to provide a container that is suitable for storing or transporting said sample prior to further analysis. Consequently, this modified syringe overcomes the need to transfer body fluid samples into various assay tubes at the point of extraction, thereby simplifying the extraction procedure. We have therefore provided a device that combines the advantages of both the conventional syringe and vacuum tube and so enables a user to control the rate and volume of sample extraction whilst obviating the need to transfer the sample into multiple assay tubes for subsequent storage and transport. Moreover, our syringe also, advantageously, reduces the potential for cross-contamination of samples that may affect analysis and also minimises exposure of the user to potential health hazards e.g. blood borne pathogens.

Statements of Invention

According to a first aspect of the invention there is provided a syringe for extracting a body fluid sample comprising:

at least one elongate barrel member having, at a first end, a removable end-cap including a nozzle; and, at a second end, at least one plunger assembly comprising a transverse piston and, operably but removably connected thereto, a longitudinal shaft member; and a shield
5 for placing partially over said end-cap after use of said syringe;

whereby, in use, movement of said plunger assembly out of said barrel member draws said sample into said barrel member through said nozzle and,

then removal of said shaft member from said piston and location of
10 said shield over said end-cap provides a container for storing or transporting said sample until said end-cap is removed.

In a further preferred embodiment, said nozzle is fashioned for the removable attachment of a needle. Most ideally, said nozzle is fashioned
15 for the removable, but sealed, attachment of the needle. As will be appreciated by those skilled in the art, said needle is removably attached by means of a friction fit and/or a screw fix or any other suitable means known to those skilled in the art. Ideally, where a screw fix is used the needle has an internal thread and said nozzle has a complimentary
20 external thread, or vice versa. Alternatively, and more preferably, said needle is fixed by a friction fit augmented by lock means such as a luer lock. Alternatively, said needle is contiguous with said syringe and so fixed thereto.

25 Alternatively said nozzle is fashioned for the removable attachment of syringe tubing. As will be appreciated by those skilled in the art, said syringe tubing may be linked to a needle, such as but not limited to, a push-button valve butterfly needle, intravenous cannula, or the like, which needle is inserted into the body (e.g. a vein) and permits flow of the fluid
30 once the valve is opened. Thereby in use, said body fluid sample is extracted through said tubing into said barrel, and contained in accordance with the invention as described.

Advantageously, if required, the user can use a second syringe according to the invention to extract a second fluid sample.

- 5 In a further preferred embodiment of the invention, said end-cap is attached to, and released from, said barrel using a screw thread arrangement. Ideally, said end-cap has an internal thread and said barrel member a complimentary external thread, or vice versa.
- 10 As will be appreciated by those skilled in the art, said piston is fashioned such that it provides a hermetic seal in said barrel, therefore preventing loss of fluid from the second end of said barrel. Additionally, said end-cap once attached provides a similar, hermetic seal preventing loss of extracted fluid from the first end of said barrel. Further, said nozzle is
- 15 fashioned such that fluid flow can only occur through said nozzle upon movement of said plunger assembly.

- In yet a further preferred embodiment of the invention, said shaft member is attached to, and released from, said piston using a screw thread
- 20 arrangement. Ideally, said piston has an internal thread and said shaft a complimentary external thread, or vice versa.

- In yet a further preferred embodiment of the invention, said shaft member further comprises a grip member at the opposite end to said piston,
- 25 thereby facilitating movement of said plunger assembly by the user. As will be appreciated by those skilled in the art, said grip member may be of numerous shapes and cross-sections.

- In yet a further preferred embodiment of the invention, said shield is
- 30 ideally located over said end-cap by means of a friction fit. As will be appreciated by those skilled in the art, once the body fluid sample has been extracted, locating said shield over said end-cap provides a further

seal containing the extracted body fluid sample in said barrel member. Advantageously, this also prevents the likelihood of needle-prick injuries when using a needle and syringe. To ensure the shield and end-cap cannot be removed at the same time a different mechanism of operation is used for each. Thus, ideally, said end-cap is attached to, and removed from, said barrel member using a screw fix arrangement whereas said shield employs a friction fit arrangement, or, less preferably, vice versa. Again, with a view to improving the safety and ergonomics of the device, ideally, said shaft is attached to, and removed from, said piston using the same attachment mechanism as the end-cap.

In yet a further preferred embodiment of the invention, a needle-cap is provided for location, ideally, using a friction fit, over said needle. As will be appreciated by those skilled in the art, this therefore provides an additional level of safety for the user thus further reducing the likelihood of a needle-prick injury. In use, therefore, following the fluid extraction procedure said needle-cap is located over said needle, and said shield placed over said end-cap.

It yet a further preferred embodiment still, said barrel and/or said end-cap is/are transparent and, ideally, tapered toward said nozzle, thereby improving visibility during use. Further, this helps to improve user control of fluid extraction.

In yet a further preferred embodiment of the invention, said barrel has a volume capacity of 1-20 ml, or more ideally between 3-10 ml and more ideally still selected from one of the following options 3, 5, 10, ml. As will be appreciated by those skilled in the art, the volume of said barrel will vary according to the size of the fluid sample to be extracted.

In a further preferred embodiment of the invention, said needle has a diameter and length appropriate for the extraction of the body fluid sample. As will be appreciated by those skilled in the art, the size of said needle will depend upon the site from which the body fluid is to be
5 extracted and also the volume to be extracted such as, but not limited to, 7-33 gauge according to the Stubbs Iron Wire Gauge System.

In a yet a further preferred embodiment of the invention, said barrel further contains at least one chemical additive, such as but not limited to,
10 heparin, EDTA, sodium citrate, Citrate theophylline adenosine dipyridamole (CTAD), chelating agents, complement inactivators, Sodium polyanethol sulphonate, serum separator gels, or chemical preservatives.

In yet a further preferred embodiment of the invention still, said barrel
15 comprises a visual indicator of the nature of an additive contained therein such as, but not limited to, a coloured or partially coloured barrel member and/or a coloured or partially coloured piston.

In yet a further preferred embodiment of the invention, said barrel further
20 comprises markings and/or indentations to indicate the volume of body fluid extracted.

In a further preferred embodiment of the invention, said barrel further comprises a label to permit the user to provide information to identify the
25 body fluid sample, such as but not limited to, patient source, fluid type, or date.

In yet a further preferred embodiment of the invention, said barrel is fabricated from any appropriate medical grade material, such as but not
30 limited to, plastic or glass, such that it is sufficiently durable and can be sterilised for clinical or medical use.

In a further preferred embodiment of the invention, said needle is fabricated from any appropriate medical grade material, such as but not limited to, fine gauge stainless steel, titanium, ceramic material, diamond or diamond-coated substrate or the like, such that it is sufficiently durable
5 and possesses the capacity to provide a sharpened tip for piercing patient tissue.

It will be apparent to those skilled in the art that the design of the syringe enables the user to perform body fluid sample extraction. A needle, either
10 contiguous with, or attached to, the nozzle of the syringe or attached via tubing, is inserted into the body e.g. a vein. The user then retracts the plunger assembly from the barrel creating a differential pressure gradient, consequently filling the syringe with body fluid. Following extraction, the user places a shield over the end-cap, thereby sealing the nozzle. Prior
15 to this, optionally, the user may also place a needle-cap over said needle, thereby reducing the risk of needle-prick injury. Additionally, the user removes the shaft member of the plunger assembly from the piston, thereby containing the extracted sample in the syringe for transport to the laboratory. A technician is then able to unscrew the end-cap from the
20 syringe thus gaining access to the sample for analysis.

Advantageously, additional syringes may be provided with appropriate sample additives, thereby simplifying subsequent sample preparation.

25 According to a second aspect of the invention there is provided a syringe for extracting at least one body fluid sample comprising:

an elongate barrel member, longitudinally partitioned into a plurality of compartments, and having, at a first end, a guide plate for guiding said sample into at least one of said compartments and a removable end-cap
30 including a nozzle; and, at a second end, at least one plunger assembly for each compartment wherein said assembly comprises a transverse piston and, operably but removably connected thereto, a longitudinal shaft

member; and a shield for placing partially over said end-cap after use of said syringe;

whereby, in use, movement of said plunger assemblies out of said barrel member compartments draws said sample into at least one of said compartments through said nozzle and said guide plate,

then removal of each shaft member from each piston and location of said shield over said end-cap provides a container for storing or transporting said sample until said end-cap is removed.

10 In a preferred embodiment of this aspect of the invention said shaft members are located in a removable harness whereby their movement can be co-ordinated.

15 In yet a further preferred embodiment of this aspect of the invention said guide plate is located in said end-cap, ideally sealed therein, and it preferably comprises a plurality of holes or channels which, in use, are aligned with said compartments.

20 In yet a further preferred embodiment of the invention, said compartments further contain at least one chemical additive, such as but not limited to, heparin, EDTA, sodium citrate, Citrate theophylline adenosine dipyridamole (CTAD), chelating agents, complement inactivators, Sodium polyanethol sulphonate, serum separator gels, or chemical preservatives. More ideally, said compartments contain different additives. As will be
25 appreciated by those skilled in the art, according to this second aspect of the invention, the user can obtain multiple samples of body fluid in separate compartments. Advantageously, as each compartment may contain a different additive, the samples are prepared for different analytical tests.

30

According to a third aspect of the invention there is provided a syringe for extracting at least one body fluid sample comprising:

an elongate barrel member, longitudinally partitioned into a plurality of inner barrels, and having, at a first end, a guide plate for guiding said sample into at least one of said inner barrels and a removable end-cap including a nozzle; and, at a second end, at least one plunger assembly
5 for each inner barrel wherein said assembly comprises a transverse piston and, operably but removably connected thereto, a longitudinal shaft member; and a shield for placing partially over said end-cap after use of said syringe;

whereby, in use, movement of said plunger assemblies out of said
10 inner barrels draws said sample into at least one of said inner barrels through said nozzle and said guide plate,

then removal of each shaft member from each piston and location of said shield over said end-cap provides a container for storing or transporting said sample until said end-cap is removed.

15

In a preferred embodiment of this aspect of the invention said shaft members are located in a removable harness whereby their movement can be co-ordinated.

20 In yet a further preferred embodiment of this aspect of the invention said guide plate is located in said end-cap, ideally sealed therein, and it preferably comprises a plurality of holes or channels which, in use, are aligned with said inner barrels.

25 In yet a further preferred embodiment of the invention, said inner barrels further contain at least one chemical additive, such as but not limited to, heparin, EDTA, sodium citrate, Citrate theophylline adenosine dipyridamole (CTAD), chelating agents, complement inactivators, Sodium polyanethol sulphonate, serum separator gels, or chemical preservatives.

30 More ideally, said inner barrels contain different additives. As will be appreciated by those skilled in the art, according to this third aspect of the invention, the user can obtain multiple samples of body fluid in separate

inner barrels. Advantageously, as each inner barrel may contain a different additive, the samples are prepared for different analytical tests.

It will be further apparent to those skilled in the art that the device is used
5 for research, cosmetic or medical purposes.

It will be even further apparent to those skilled in the art that the device is used for blood extraction.

10 Any of the aforementioned aspects of the invention may, in preferred embodiments, include or be characterised by any of the aforementioned features pertaining to the syringe. Thus, preferred features of each aspect of the invention may be as described in connection with any of the other aspects.

15

In the claims which follow and in the preceding description of the invention, except where the context requires otherwise due to express language or necessary implication, the word "comprises", or variations such as "comprises" or "comprising" is used in an inclusive sense i.e. to
20 specify the presence of the stated features but not to preclude the presence or addition of further features in various embodiments of the invention.

Preferred features of each aspect of the invention may be as described in
25 connection with any of the other aspects.

Other features of the present invention will become apparent from the following examples. Generally speaking, the invention extends to any novel one, or any novel combination, of the features disclosed in this
30 specification (including the accompanying claims and drawings). Thus, features, integers, characteristics, compounds or chemical moieties described in conjunction with a particular aspect, embodiment or example

of the invention are to be understood to be applicable to any other aspect, embodiment or example described herein, unless incompatible therewith.

Moreover, unless stated otherwise, any feature disclosed herein may be
5 replaced by an alternative feature serving the same or a similar purpose.

The present invention will now be described by way of example only with particular reference to the following figures wherein:

10 **Figure-A.** A sectional side assembled view of a syringe, according to a first aspect of the invention;

Figure-B. A sectional side exploded view of the different components of the syringe shown in Figure A;

15

Figure-C. A sectional side assembled view of the syringe shown in Figure A after use, wherein the syringe is full of body fluid extract and the shaft of the plunger assembly has been removed;

20 **Figure-D.** A sectional side view of a syringe in figure A prior to use;

Figure-E. A sectional side assembled view of a syringe according to a second or third aspect of the invention;

25 **Figure-F.** A sectional side exploded view of the syringe in figure E;

Figure-G. A guide plate for use in a syringe according to a second or third aspect of the invention, as viewed from X in figure F;

30 **Figure-H.** A transverse cross-sectional view of a syringe according to a third aspect of the invention, as viewed from Y in figure F; and

Figure-1. A sectional side view of a syringe in figure F after use.

Referring to figure A, there is shown a sectional side assembled view of the syringe according to a first aspect of the invention. The syringe is generally elongate and is of a size that is suitable for the volume of body fluid to be extracted. The syringe is generally made from synthetic materials including plastics, or alternatively glass. Ideally, the material of manufacture is also transparent, to improve visibility during use.

10 The syringe has a longitudinal elongate barrel member [12] which may have a variety of cross-sectional shapes, but ideally is circular in cross-section (not shown). At a first end, there is provided a removable end-cap [11], which is hermetically attached to the barrel by means of a screw thread arrangement [1]. The end-cap, in this illustration, comprises a
15 nozzle [11a] fashioned for the removable attachment of a needle [6], which is securely fixed thereto prior to use. In other embodiments, the needle [6] is contiguous with the nozzle (not shown). Alternatively, said nozzle may be fashioned for the removable attachment of syringe tubing that is connected at the opposite end to a needle, such that fluid is
20 extracted via such tubing (not shown). Additionally, in other embodiments the barrel [12] and/or end-cap [11] may be tapered toward the nozzle to improve visibility during use (not shown).

At a second end, there is provided a plunger assembly comprising a
25 transverse piston [2] and operably connected thereto a removable longitudinal shaft member [3]. Ideally, the shaft member is securely fixed to the piston prior to use by means of a screw thread arrangement [1] such that it cannot be moved during use. In this illustration, the shaft member comprises a grip member [3a] to facilitate use. The individual
30 components of the syringe are best viewed in figure B, where there is shown a sectional side exploded view of the different components of the syringe shown in Figure A.

In a further embodiment of the invention, the barrel [12] further contains an appropriate chemical additive (not shown) to preserve the body fluid sample. The nature of the additive may be indicated by the colour of the piston [2] and/or barrel (not shown).

In use, the plunger assembly is moved out of the barrel [12], thereby drawing in body fluid. Following use, the syringe is provided with a shield [4], which is located over the end-cap [11], ideally by means of a friction fit (not shown). Ideally, the shield is located over only the furthestmost end of the end-cap thus ensuring a user can grip at least a part of the end cap in order to remove same from the barrel member. Optionally, in one embodiment, prior to location of the shield over the end-cap the user may also locate a needle-cap [5] over the needle [6] for improved safety. Additionally, the shaft member [3] is removed from the piston [2]. This thereby provides a sealed container, wherein the extracted fluid sample is hermetically sealed with the barrel for transport and storage, until the end-cap [11] is subsequently removed.

As shown in figure B, the barrel may also further comprise a label [7] which can be used by the user to identify the sample. Further, the screw-thread arrangements [1] can be clearly seen on the piston [2] and the end-cap [11]. In a preferred embodiment, the shaft member [3] is provided with an external screw thread and the piston [2] a complimentary internal screw thread. Additionally, the end-cap [11] is provided with an internal screw thread and the first end of the barrel member [12] a complimentary external screw thread.

Now referring to figure C, there is shown a sectional side assembled view of the syringe shown in figure A after use, wherein the barrel [12] is full of body fluid extract [8]. As shown, the shaft [3] of the plunger assembly has been removed, and the shield [4] and needle-cap [5] located over the end-

cap [11] and needle [6], respectively. In this way, the syringe provides a sealed container wherein the extracted body fluid sample is hermetically contained in the barrel for storage and transport, until subsequent removal of the shield [4] and end-cap [11]. It is also shown that the barrel contains an air-space [9] located adjacent to the end-cap [11]. This reduces the risk of spillage when the laboratory technician opens the tube to access the blood.

In figure-D there is shown a sectional side view of a syringe in figure A prior to use. The end-cap [11] is securely attached to the first end of the barrel. The needle [6] is exposed for insertion into the body and the plunger assembly fully engaged in the barrel [12]. Notably, the air-space [9] is present prior to use, due to the tapered nature of the barrel and end-cap (not shown). Therefore, the barrel contains a sealed, and also ideally sterile, chamber for containment of the body fluid sample. Further, the barrel may be provided with at least one appropriate chemical additive for preservation of the body fluid sample, which may be illustrated by a colour coded piston or barrel (not shown).

Referring now to figure-E, there is shown a sectional side assembled view of a syringe according to a second or third aspect of the invention. In the second aspect, the barrel [12] of the syringe comprises at least one longitudinal bisecting wall partitioning the barrel into a plurality of compartments. Alternatively, in a third aspect the barrel [12] is longitudinally partitioned into a plurality of inner barrels [13], this is best viewed from the transverse cross-sectional view shown in figure H. As will be appreciated, the plurality of compartments or inner barrels permits multiple samples of body fluid to be extracted simultaneously, each sample being contained in its respective separate compartment or inner barrel. In a further embodiment of the second and third aspects of the invention, the compartments or inner barrels further contain at least one additive, and more ideally contain a different additive with respect to each

other (not shown). In this way, multiple samples can be extracted and preserved accordingly for further disparate analytical tests.

In both the second and third aspects of the invention, at a first end, the
5 barrel comprises a removable end-cap [11] as described above. Additionally, each compartment (or inner barrel) comprises its own plunger assembly as described above, comprising a longitudinal shaft [3] operably, but removably, attached to a transverse piston [2] by means of screw thread arrangement [1]. Furthermore, the plunger assemblies may
10 further comprise a removable harness [10] that engages the plunger assembly of each compartment (or inner barrel) to coordinate their movement such that the plungers can be moved simultaneously.

The second and third aspects of the invention also further comprise a
15 guide plate [15] positioned at the first end of the barrel [12]. The guide plate is sealingly engaged with the barrel and is provided with a plurality of guide holes or channels [14], which serve to direct the flow of the extracted body fluid into the respective compartments or inner barrels. The structure of the guide plate is best viewed in figure G.

20 The individual components of the multiple sample syringes are shown in the sectional side exploded view of figure F. As shown, each respective compartment or inner barrel [13] comprises a plunger assembly, comprising a piston and removably attached thereto a shaft [3]. The
25 harness [10] can be used to co-ordinate the simultaneous movement of the plunger assemblies, which following use is subsequently removed. Each respective shaft member can then be unscrewed from their piston. In this illustration, the guide plate [15] is located in the end-cap [11], and is separated from the nozzle by an air space [9]. The cross-section of the
30 guide plate, as viewed from X in figure F, is shown in figure G.

Referring to figure H, there is shown a transverse cross-sectional view of a syringe according to a third aspect of the invention, as viewed from Y in figure F. As illustrated, the barrel [12] contains a pair of inner barrels [13]. Alternatively, the syringe may comprise greater than two inner barrels (not shown).

Figure-I shows a sectional side view of a multiple sample syringe after use. The compartments, or inner barrels, are full of body fluid extract [8]. An air space [16] is provided between same and the end of the barrel.

When fluid is drawn into the syringe, the fluid [8] together with a little air is then drawn, via the holes [14] of the guide plate [15], into the inner barrels or compartments. Further air [16] may be drawn to reduce the risk of spillage when the end-cap [11] is unscrewed. As shown, the shafts [3] of the plunger assemblies have been removed, and the shield [4] and needle-cap [5] located over the end-cap [11] and needle [6], respectively.

In this way, the syringe provides a sealed container of multiple extracted body fluid samples for storage and transport, until subsequent removal of the shield [4] and end-cap [11].

Use of the syringe as afore described thus ensures that at least one sample of body fluid can be extracted and contained and transported: i) relatively easily with a user determining flow rate and volume, with the possibility of extracting multiple samples in one procedure, and ii) with no requirement for subsequent transfer, thereby reducing the risk of cross-contamination or the possibility of a user contacting potentially dangerous material.

Claims

1. A syringe for extracting a body fluid sample comprising:
 - 5 at least one elongate barrel member having, at a first end, a removable end-cap including a nozzle and, at a second end, at least one plunger assembly comprising a transverse piston and, operably but removably connected thereto, a longitudinal shaft member; and a shield for placing partially over said end-cap after use of said syringe;
 - 10 whereby, in use, movement of said plunger assembly out of said barrel member draws said sample into said barrel member through said nozzle and,
 - then removal of said shaft member from said piston and location of said shield over said end-cap provides a container for storing or transporting said sample until said end-cap is removed.
 - 15
2. A syringe according to claim 1 wherein said nozzle is fashioned for the removable attachment of a needle.
- 20
3. A syringe according to claim 1 wherein said syringe comprises a needle contiguous with said nozzle.
4. A syringe according to claim 1 wherein said nozzle is fashioned for the removal attachment of syringe tubing.
- 25
5. A syringe according to any preceding claim wherein said end-cap is removably attached to said barrel by means of a screw thread arrangement.
- 30

6. A syringe according to any preceding claim wherein said shaft is removably connected to said piston by means of a screw thread arrangement.
- 5 7. A syringe according to any preceding claim wherein said shaft member further comprises a grip member at the opposite end to said piston.
8. A syringe according to any preceding claim wherein said shield is
10 located on said end-cap by means of a friction fit.
9. A syringe according to any preceding claim further comprising a removable needle-cap.
- 15 10. A syringe according to any preceding claim wherein said barrel and/or end-cap is transparent.
11. A syringe according to any preceding claim wherein said barrel and/or end-cap is tapered toward said nozzle.
- 20 12. A syringe according to any preceding claim wherein said barrel further contains at least one chemical additive.
13. A syringe according to claim 12 wherein said barrel further
25 comprises a visual indicator of the nature of the chemical additive.
14. A syringe according to claim 13 wherein said indicator is a coloured or partially coloured barrel and/or piston.
- 30 15. A syringe according to any preceding claim wherein said barrel further comprises volume markings and/or indentations.
16. A syringe according to any preceding claim wherein said barrel further comprises a label.

17. A syringe for extracting at least one body fluid sample comprising:
an elongate barrel member, longitudinally partitioned into a plurality of compartments, and having, at a first end, a guide plate for guiding said sample into at least one of said compartments and a removable end-cap including a nozzle; and, at a second end, at least one plunger assembly for each compartment wherein said assembly comprises a transverse piston and, operably but removably connected thereto, a longitudinal shaft member; and a shield for placing partially over said end-cap after use of said syringe;
whereby, in use, movement of said plunger assemblies out of said barrel member compartments draws said sample into at least one of said compartments through said nozzle and said guide plate,
then removal of each shaft member from each piston and location of said shield over said end-cap provides a container for storing or transporting said sample until said end-cap is removed.
18. A syringe according to claim 17 wherein said shaft members are located in a removable harness.
19. A syringe according to claims 17 or 18 wherein said guide plate is located in said end-cap.
20. A syringe according to claims 17 -19 wherein said guide plate further comprises a plurality of holes aligned with said compartments.
21. A syringe according to claims 17-20 wherein said compartments further contain at least one chemical additive.

22.A syringe according to claim 21 wherein said compartments contain different additives.

23.A syringe for extracting at least one body fluid sample comprising:

5 an elongate barrel member, longitudinally partitioned into a plurality of inner barrels, and having, at a first end, a guide plate for guiding said sample into at least one of said inner barrels and a removable end-cap including a nozzle; and, at a second end, at least one plunger assembly for each inner barrel wherein said
10 assembly comprises a transverse piston and, operably but removably connected thereto, a longitudinal shaft member; and a shield for placing partially over said end-cap after use of said syringe;

 whereby, in use, movement of said plunger assemblies out
15 of said inner barrels draws said sample into at least one of said inner barrels through said nozzle and said guide plate,

 then removal of each shaft member from each piston and location of said shield over said end-cap provides a container for storing or transporting said sample until said end-cap is removed.

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24.A syringe according to claim 23 wherein said shaft members are located in a removable harness.

25 25.A syringe according to claims 23 or 24 wherein said guide plate is located in said end-cap.

26.A syringe according to claims 23-25 wherein said guide plate further comprises a plurality of holes aligned with said inner barrels.

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27.A syringe according to claims 23-26 wherein said inner barrels further contain at least one chemical additive.

28. A syringe according to claim 27 wherein said inner barrels contain different additives.