

[54] **BIOLOGICAL FLUID SAMPLING APPARATUS**

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[51] Int. Cl. **G01n 33/16**

[58] Field of Search 233/26, 1 R, 3; 23/259, 292; 134/8; 210/361, 359, 183, 83; 259/124; 15/104.05, 236

[56] **References Cited**

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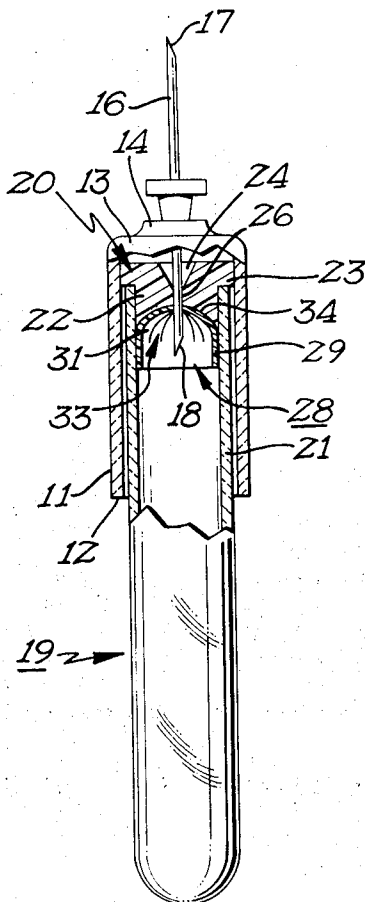
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[57] **ABSTRACT**

A biological fluid sample tube assembly includes a collection tube with a closure member sealing one end of the tube. The closure is adapted for penetration by a cannula needle for delivery of a fluid sample through the cannula and closure member into the tube. A processing member, such as a scraping member, is movably supported within the tube and is movable by application of force externally of the tube in order to perform a desired processing function without opening the tube. Thus the member can scrape clotted blood or other solids, which may have coagulated while the sample tube was awaiting further processing, to a desired location in the tube out of the way of the liquid sample to be evaluated. Preferably the scraping member is designed for axial movement within the tube from a position adjacent the closure member to a position at the other end of the tube in response to the centrifugal forces applied when the tube and its sample are placed in a centrifuge for separation of solid particles, such as the red blood corpuscles in a blood sample, toward the end of the tube opposite the closure member.

9 Claims, 9 Drawing Figures



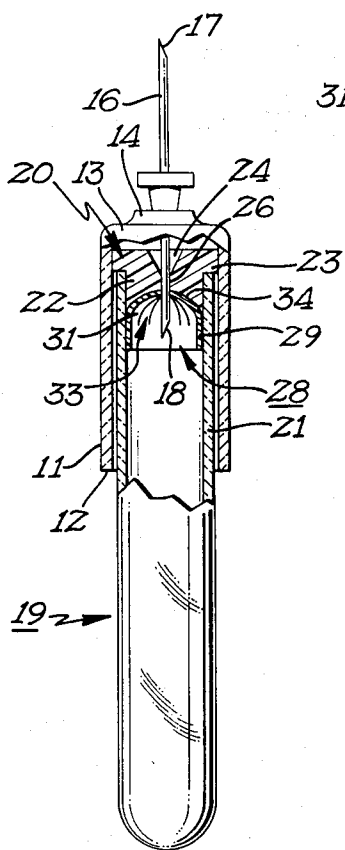


FIG 1

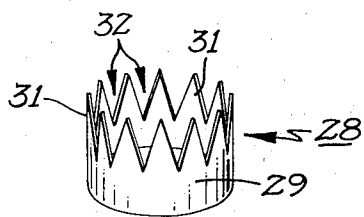


FIG 2

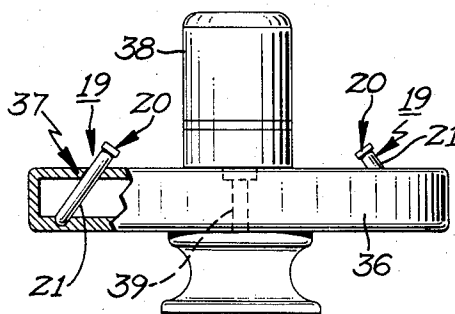


FIG 3

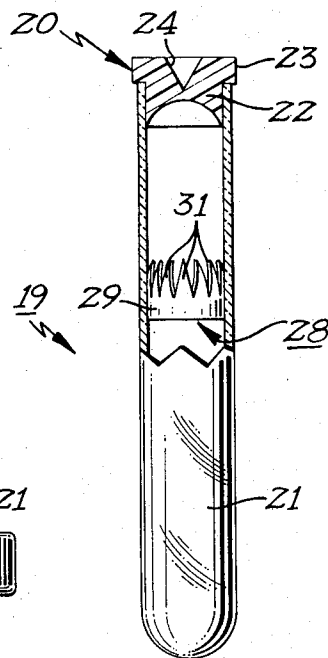


FIG 4

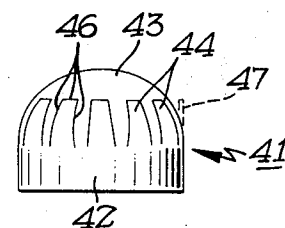


FIG 5

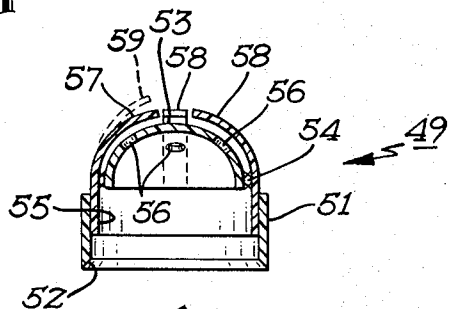


FIG 6

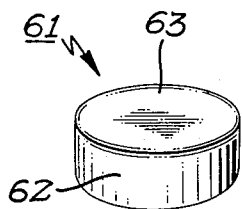


FIG 7

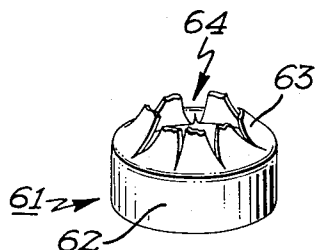


FIG 8

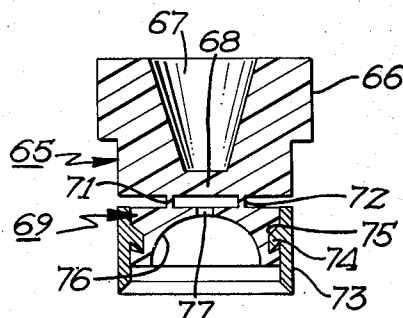


FIG 9

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BIOLOGICAL FLUID SAMPLING APPARATUS**BACKGROUND OF THE INVENTION**

In presently known blood sample tubes, it is customary to have a sample holder provided with a needle or cannula which can be inserted into the blood vessel of a patient to obtain a blood sample or a series of such samples. The holder includes a needle portion extending away from the patient and is designed to penetrate the closure member at one end of a sample collection tube which is removably positioned within the holder. Thus when the sample tube is within the holder, the closure of the sample tube is penetrated by the holder needle for delivery of blood from the patient through the holder needle and through the pierced closure member of the sample tube into the interior of such tube. Some sample tubes have been vacuumized to expedite the drawing of the sample. When the desired sample has been collected, the sample tube is withdrawn from the holder, and turned over to laboratory personnel for desired testing.

Substantial time may elapse between the taking of the sample from a patient and the actual testing of the sample in the laboratory. During such time, some of the blood may coagulate or clot and be deposited on the inner surfaces of the tube or closure member. For example, if the tube has been left on its side, there may be a deposit of clotted blood particles on the inner surface of the closure member and on the wall portions of the tube adjacent thereto.

In the prior art processing of such samples in the laboratory, it has been necessary to remove the closure member or stopper and manually insert a stick or stirring rod to scrape the clotted material down from the walls of the container, before the sample is placed in a centrifuge for centrifugal separation of the red cells into the bottom of the sample tube. Failure to perform such a scraping operation could leave the clotted materials in the upper portion of the tube, where they might accidentally be withdrawn as a part of a sample of clear serum and thus adversely affect those tests which are normally performed on the clear fluid. The opening of the sample tube, however, and the scraping operation just described, provide an increased opportunity for infection of a laboratory worker. The increasing incidence of hepatitis, for example, and its presence in blood samples of patients who may not even be suspected of having such infection, have increased the risk that laboratory testing personnel may suffer from this disease.

SUMMARY OF THE INVENTION

According to the present invention an improved biological or body fluid sample container assembly is provided, in which a processing member is movably supported within a sample container and can be moved within the container in response to force applied externally of the container to perform a desired processing action, such as the scraping of clotted material into the bottom of the container, without the necessity of opening or unsealing the container. The container is preferably a tube having a closure member at one end adapted for penetration of a cannula needle for delivery of a fluid sample through the closure member into the tube. The processing member preferably has releasable means normally holding the processing member at

a first position in the container during normal handling of the container. The releasable means is constructed and arranged to permit movement of the processing member away from its first position in response to the application of substantial forces to the assembly externally of the container. While various means for application of force externally to such a container or tube may be used, the preferred form of the invention includes a movable member within the tube which is moved in a desired direction by centrifugal force, while the tube is being processed in a centrifuge for suitable separation of its contents. Thus a scraper member is movably positioned, in one form of the invention, within the upper end of the tube immediately adjacent the closure member through which a cannula needle introduces a fluid sample into the tube. When the tube is placed in a centrifuge, so that centrifugal force is applied lengthwise of the tube to force clotted particles, such as red blood cells, or other denser materials toward the bottom of the tube, the scraping member according to the present invention is also forced axially lengthwise down the tube and thereby carries any such materials from the upper end of the tube toward the lower portion thereof in order to provide a substantially clear region at the upper end of the tube for the clearer or lighter liquid which remains in that part of the tube following the centrifugal separation.

A preferred form of scraping member includes a cap or transverse wall portion which extends completely across the tube and which may be initially located close to the closure member at the top of the tube, so that the fluid sample is introduced into that portion of the tube below the scraping member. Subsequent movement of the scraping member axially down the tube can thus carry along any clotted materials which might otherwise have been deposited on the inner surface of the closure member itself. The necessity of opening the fluid sample tube prior to its normal processing in a suitable centrifuge is accordingly eliminated or essentially reduced to those special situations where some other factor requires opening of the tube. The scraper member will remain in the bottom of the tube after centrifuging, so that it will be out of the way and impose no obstacle to the withdrawal of the clear serum or other fluid from the upper portion of the sample tube.

The invention is described with particular reference to the collection and processing of blood samples from a human patient.

BRIEF DESCRIPTION OF THE DRAWING

The invention is more particularly described with reference to the accompanying drawings, in which like reference characters indicate like parts, and in which FIG. 1 is a side elevation, partly in section, of an improved fluid sample tube assembly according to the invention shown in combination with a sample tube holder of known construction;

FIG. 2 is an enlarged perspective view of a scraping member of the type shown in the sample tube assembly of FIG. 1;

FIG. 3 is a general schematic view, partly in section, showing the positioning of blood or other fluid sample tubes in a centrifuge during processing;

FIG. 4 is a view of the sample tube assembly of FIG. 1 after its removal from the holder, showing the scraper member in an intermediate position as it is forced

downwardly through the liquid in the tube, e.g., during centrifuging;

FIG. 5 is a side view of a modified form of scraper member for use in place of the member shown in FIG. 2;

FIG. 6 is a sectional view of another modified scraper according to the invention;

FIG. 7 is a perspective view similar to FIG. 2 of another modification of the scraper member;

FIG. 8 is a view similar to FIG. 7, which shows the member of FIG. 7 after it has been punctured by a fluid delivery needle and moved away from its supported position adjacent to the closure member of a fluid sample tube; and

FIG. 9 is an enlarged view of a modified construction in which the scraper member is initially formed as an integral part of a sample tube closure member and is separated therefrom before or after insertion of a fluid sample, e.g., by the forces applied during the centrifuging of such a sample.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A body fluid collecting apparatus embodying the invention is shown in FIG. 1. Here a suitable cylindrical holder 11, which may be of known construction, is open at its lower end 12 and is closed at its upper end by end wall 13 which, in turn, has a central supporting portion 14 for a cannula or needle 16. The upper end 17 of needle 16 is adapted for insertion into a blood vessel or other body portion of the patient to withdraw a biological fluid sample therefrom. Needle 16 has a lower end 18 through which the fluid sample is delivered to a sample tube assembly 19 through the closure member 20 at one end of the sample tube 21.

Closure member 20 has a main body portion 22 which fits resiliently within the upper open end of tube 21 to provide a closure and seal for the tube. Flanges 23 on the upper end of member 20 provide a limiting means to determine the position at which the stopper or closure member fully seals the tube. These flanges 23 also extend circumferentially slightly outwardly beyond the margins of tube 21 to provide a guide or bearing portion for the tube 21 and stopper 20, as these portions of the sample collection tube assembly are positioned within the holder 11.

As is well known in the art, the end 17 of cannula 16 of holder 11 is first inserted in the appropriate portion of the patient's body. Then the holder can be used for collection of one or more fluid samples in individual sample tube assemblies 19, without the necessity of removal and reinsertion of the cannula with respect to the patient. An individual sample tube assembly 19 is pushed into the open end 12 of holder 11, until the closure member 20 is penetrated by the lower end 18 of the cannula or needle. This permits delivery of a fluid sample through the cannula to the interior of tube 21. To facilitate the insertion and removal of tube 21 and its cap 20 with respect to holder 11, the cap 20 has a central axial recess 24 at its upper end thereby providing a portion 26 of reduced thickness along the longitudinal axis of the stopper 20 and tube 21 at the area to be penetrated by the lower end 18 of needle 16. Stopper 20 is made of resilient material which is adapted to provide a self-sealing action and close the opening made by needle portion 18, as the tube 21 and closure member 20 are withdrawn from holder 11. Thus, the

biological fluid sample will be retained in the individual sample tube assembly 19 in a sealed condition for further processing and/or testing.

The construction as described up to this point may be essentially similar to the known sample collecting devices presently available in the medical arts. Such sample tube assemblies 19, for example, are customarily vacuumized, so that the relatively lower pressure within tube 21 will assist in drawing body fluid through needle 16 from the patient, and will permit the complete filling of tube 21 without having to provide for escape of air as the tube is filled.

According to the present invention, the improved sample tube assembly of FIG. 1 is further provided with a movable member 28 which is designed to serve in this embodiment as a scraper member for removal of clotted blood from the upper portion of tube 21 to the lower portion of the tube during subsequent centrifuging of the sample. Member 28, as shown in FIG. 2, includes an annular scraping ring portion 29 having an external diameter designed to fit closely within the inner surface of tube 19, but not so tightly as to prevent all axial movement of the member 28 along the inside wall of the tube. Member 28 may be initially formed from a cylindrical tube of plastic material, cut into sections as shown in FIG. 2. Each section includes a series of angular segments 31 projecting axially from the annular scraping portion 29 of member 28. The segments or flaps 31 are defined by intermediate cuts 32 which remove a portion of the material between the flaps 31.

The exact shape and dimensions of flaps 31 may be varied to accommodate the particular shape of the closure member with which they are designed for use. As shown in FIG. 1, the cuts have such shape and dimensions as to let them flex inwardly and provide a substantially continuous cap portion at 33 covering the underside 34 of stopper 20 when member 28 is positioned immediately below and adjacent to the stopper 21. Thus, if stopper surface 34 is spherical, the segments 33 will be cut as segments of a sphere so that they will fold together and form a spherical inner cover at 33 for the stopper surface 34, when the parts are assembled in the position of FIG. 1. In this position the inner stopper surface 34 and the upper inner wall portions of tube 21 are covered and protected by member 28. Thus any of the fluid which clots or dries within that portion of the tube will be deposited on the inner surface of member 28, rather than on the portion of the stopper or tube walls covered and protected by member 28.

The tube 21 and stopper 20 are removed as a unitary assembly from holder 11 for further processing. It is then possible to apply force externally of the tube and cause movement of member 28 downwardly along the longitudinal axis of tube 21. The necessary forces can be applied either manually or mechanically, without removing the stopper 20 and exposing the operator to the risk of infection from the contents of the tube or allowing evaporation of the contents to occur or exposure of such contents to room air. As shown in FIG. 3, the forces are preferably applied by centrifuging the sample tube assembly and its contents in known manner. As member 28 is urged downwardly by centrifugal force in the centrifuge, it starts its movement down through the tube 21, the segments 31, when moved away from the stopper surface 34, will tend to flex upwardly to their original positions as shown in FIG. 2. Thus the member 28 will effectively provide a fluid pas-

sage means through the central space which was originally covered by segments 31. This will permit member 28 to move down through the fluid as shown in FIG. 4, without substantial resistance by the fluid. The fluid is thus shifted relatively to the scraper member 28 from the lower side to the upper side of that member as member 28 moves down through the fluid in tube 21.

As shown schematically in FIG. 3, a plurality of sample tube assemblies 19, with the stoppers 20 still in place on tubes 21, can be positioned in a centrifuge of known construction which is then rotated at high speed to apply centrifugal forces tending to drive the heavier or denser portion of the tube contents from the top toward the bottom of the tube. In normal blood testing, for example, such centrifuging will move the red cells of the blood down to the bottom of the tube and will leave relatively clear fluid of serum or plasma at the top of the tube. This clear fluid can later be removed for any desired testing.

The scraper of the present invention responds to the forces generated during such a centrifuging operation and is forced downwardly through the tube, just as the red cells are forced downwardly. During this movement through the tube and through the fluid within the tube, the member 28 maintains its orientation by virtue of the axial length of the annular ring portion 29, so that the member 28 does not become angularly tilted or stuck within the tube. During downward movements, the lower edge of the annular portion 28 effectively scrapes along the inner walls of tube 21 to loosen any clotted materials and insure their movement downwardly out of the desired clear fluid area at the top of the tube. Any clotted materials which were initially deposited on the inner surfaces of either the annular portion 29 or cap segments 31 will also be pulled downwardly with the scraper member 28 so that the upper portion of the tube including both the tube walls and the inner surfaces of stopper 20 will be clear of such solid particles. The clear fluid at the top of the tube can subsequently be removed in known manner for further laboratory processing, including any desired tests of the clear serum, without its contamination by solid particles which might otherwise have been deposited and remain in the upper portions of the tube.

As further shown in FIG. 3, a simple centrifuge includes a rotary carrier portion 36 having a rack or other holding means 37 in which the individual tube assemblies 19 can be supported, with their closure members 20 still in sealing position. A suitable motor 38 causes high speed rotation of the carrier 36 around a central axis or shaft 39. Since the bottom portions of tubes 21 are supported at a greater distance from the axis of rotation 39 than the upper portions of tube 21, the centrifugal force applied to the contents of each tube 21 will tend to urge the denser or heavier particles toward the bottom of the tube, while the lighter material such as the clear fluid needed for further testing remains at the top portion of each tube.

FIG. 5 shows a modified form of scraping member according to the invention. In this form, the member 41 is formed of plastic material or chemically inert substance with a base scraper portion 42 of annular ring-like configuration and with a hemispherical upper cap portion 43 integrally connected to the annular scraping portion 42. To provide passage means for relative movement for fluids from the lower side of member 41 to the upper side, when this member is forced down-

wardly within a sample tube 21, the member is provided with a series of valves or flap members 44 defined on three sides by appropriate cuts 46 in the cap material. The flap portions are held in their cap closing or hemispherical positions as shown in heavy lines in FIG. 5, when the cap member 41 is positioned immediately below and adjacent a stopper or closure member such as 20 in FIG. 1. When the application of external force, for example by a centrifuge, starts the downward movement of scraper member 41 through the tube 21, the valve or flap members 44 can flex outwardly as shown in dotted lines at 47 in FIG. 5. Thus each flap will provide an opening in the cap member 41 to permit the cap to move down through the fluid, so that the fluid which was originally below the cap will not resist the downward movement of the cap, but will effectively flow through the flap opening to a relative position above the downwardly displaced cap.

In FIG. 6, another modified form of scraper member is shown at 49. In this case the scraper is of composite construction and includes an annular solid ring 51 which may be of metal or other solid material. Ring portion 51 has a sharp lower scraping edge 52 and the solid ring is designed to slide readily down through a sample tube 21 without tilting or jamming. Member 49 also includes a hemispherical cap portion 53 which has its lower edge bonded or adhesively connected at 54 to a flexible annular member 55. Member 55 in turn is adhesively bonded or otherwise connected to the inside of annular ring 51. Thus the members 51, 53 and 55 form a composite scraper member with an annular ring portion 51 and a cap portion 53. Within the cap area 53 one or more openings 56 are provided to serve as valve openings for the purpose already discussed. Intermediate member 55 includes upwardly projecting flexible portions 57 and 58 which overlie the respective openings 56 and effectively close them to provide a continuous cap area, when the member 49 is positioned in a tube 21 immediately below and adjacent to the stopper or closure member 20. Here again, when the application of external force urges member 49 downwardly in tube 21, the cover flaps 57, 58 may flex upwardly as shown in dotted outline in 59 to uncover the openings 56. These openings 56 then provide a passage way for relative movement of the fluid from a position below the member 49 to a relative position above that member, as member 49 moves downwardly through the fluid.

Another form of scraper member according to the invention is shown in FIGS. 7 and 8. This scraper member 61 includes a relatively solid annular scraping portion 62 designed to fit within and slide longitudinally of a sample tube 21. Across one end of the annular ring 62, a relatively thin rupturable membrane 63 is secured. Thus, as shown in FIG. 7, membrane 63 fully covers the end of annular scraping ring portion 62 and provides a composite member 61 which may be positioned immediately below the stopper of a sample tube 21, in the same general manner illustrated in FIG. 1. When the stopper 20 of such a sample tube is penetrated by the lower end 18 of a needle in a holder 11, the needle will also penetrate membrane 63. In this case the lower surface of stopper 20 could be formed as a flat surface corresponding to the surface of membrane 63, so that the membrane would be held flat against the stopper during the preliminary insertion of the sample tube in the holder. Preferably the nature

and thickness of membrane 63 is selected so that penetration of the holder needle end 18 will not completely rupture the membrane 63 but will merely perforate it at its center. Upon subsequent application of external force by a centrifuge or otherwise, however, the scraper member 61 will be urged downwardly through the liquid in the sample tube, and the membrane 63 may be further ruptured or torn as shown at 64 in FIG. 8 as needed to permit movement of the member 61 downwardly through the fluid. As indicated, the selection of material and dimensions for membrane 63 is preferably such that the membrane will not be ruptured by mere penetration of needle end 18 initially, but can readily be torn to the degree necessary to permit relatively free downward movement of member 61 during centrifuging.

Still another embodiment according to the invention is shown in FIG. 9. Here the scraping member is initially formed as an integral part of the cap or stopper member 65. Member 65 has an upper portion essentially similar to stopper 20 of FIG. 1 and is designed to fit tightly within the end of a sample tube 21. An enlarged upper end 66 provides a suitable flange to limit the inward positioning of the stopper within the tube. The central upper portion of the stopper is cut away at 67 to provide a relatively thin section 68 at the center of the stopper for penetration by the needle end 18 of the holder 11. A scraper member 69 is integrally connected to the upper stopper portion 65 by one or two connecting portions 71 and 72 of relatively small cross section. The total cross section of these connecting sections 71 and 72 is just sufficient to hold the scraper portion 69 in assembled position with cap 65, but is dimensioned to provide a readily frangible connection between these two parts. Scraper member 69 includes an annular scraping ring section 73 of relatively rigid and heavy material, which is inter-connected with portion 69 by a suitable annular projection 74 on ring 73 which interfits with a suitable groove 75 in member 69. The lower surface of member 69 within ring 73 may be of hemispherical shape as shown at 76. An opening 77 is provided at the center of scraper portion 69 so that initial insertion of the holder needle end 18, when the sample tube is positioned within holder 11, will permit free movement of needle end 18 through the scraper member 69, without prematurely pushing the scraper away from the rest of stopper 65 by breaking the connections at 71 and 72. By making scraper ring 73 of reasonably heavy material, the force available to rupture the connection 71 and 72 during centrifuging will be effectively increased.

Although FIG. 9 shows portions 71 and 72 as being made of the same material as the stopper 65 and the scraper member cap portion 69, this exemplification of the invention may be further modified by first forming the stopper and scraper members as entirely separate members and then interconnecting them at points such as 71 and 72 by a spot of readily releasable adhesive. Thus the scraper (or some other desired processing or treatment member) may be initially secured in some way to the closure cap of a sample tube assembly and may be forceably separated from the cap at a desired time by application of suitable force externally of the tube assembly.

The fluid sampling apparatus described in this specification thus provides a novel means for desired processing or treatment of a biological or other fluid in a

sample container by application of external forces to the container to cause movement of a suitable processing member within the container, without the necessity of opening the container. The processing members shown herein have releasable means normally holding the processing member at a first position in the container during normal handling of the container. The releasable means is constructed and arranged to permit movement of the processing member away from its first position in response to the application of substantial forces to the assembly externally of the container. In some cases the releasable means is provided by frictionally interengaging portions on the processing member and container. In other cases the releasable means may be provided by a releasable connection between the processing member and the inner side of a closure member for the container. The invention is particularly useful for the scraping or clearing of clotted materials from one end of a blood sample container, but may also be useful in other applications.

It will be apparent to those skilled in the art that the shape, dimensions and other details of construction of the fluid sample tube assemblies shown in the drawings could be further modified in various ways within the principles of the present invention. The present specification, however, sets forth some of the ways in which the invention may be put into practice, including the best mode presently contemplated for carrying out the invention.

I claim:

1. A biological fluid sample assembly comprising an initially closed fluid sample collection container for receiving a biological fluid sample from a body portion of a patient and in which the biological fluid may be centrifuged to separate solid from liquid portions of such fluid, said container having a longitudinally extending interior wall surface portion of uniform cross section, a cannula-penetrable closure member sealing one end of the container, at least a portion of the closure member being adapted for penetration by a cannula-needle for delivery of a biological fluid sample from a body portion of a patient through the closure member into the container, and a scraping member within the container, said scraping member having a peripheral scraping edge portion slidably engaging the uniform interior wall surface portion for relative scraping movement of the scraping member edge portion along such surface, said scraping member also having releasable means normally holding the scraping member at a first position in the closed container adjacent the closure member during normal handling of the container while receiving such sample and holding the sample for further processing, said releasable means being constructed and arranged to permit movement of the scraping member away from its first position in response to and during application of such centrifugal forces to the assembly externally of the container as required to separate said solid and liquid portions, and said scraping member including means providing a longitudinal passage positioned inwardly from the scraping edge portion for free relative movement of fluid longitudinally from one side of the scraping member to the other when the scraping member moves away from its first position, said scraping member thereby being responsive to the external application of such forces for movement away from such first position during the separa-

tion of the solid and liquid portions without the necessity of opening the container.

2. A fluid sample assembly according to claim 1 in which said releasable means includes interengaging portions on said scraping member and container, said interengaging portions having relative dimensions and locations providing frictional retaining engagement between them normally retaining the scraping member at its first position, while permitting relative movement of the scraping member away from said first position in response to said centrifugal forces.

3. A fluid sampling assembly according to claim 1 in which the said releasable means includes a releasable connection between said closure member and scraping member.

4. A fluid sampling assembly according to claim 3 in which said closure member and scraping member each include respective portions of identical material and said releasable connection consists of at least one connecting portion of the same material integrally connecting said respective portions, said connecting portion having a limited cross section providing a frangible connection between said respective portions.

5. A biological fluid sample tube assembly having a fluid sample collection tube in which a biological fluid may be centrifuged to separate solid from liquid portions of such fluid, a cannula-penetrable closure member sealing one end of the tube, at least a portion of the closure member being adapted for penetration by a cannula needle for delivery of a biological fluid sample from a body portion of a patient through the closure member into the tube, and a scraping member supported within the tube adjacent the closure member, said scraping member being movable within the tube away from the closure member in response to and during application of such centrifugal force applied externally of the tube as is required to separate said solid and liquid portions without the necessity of opening the tube, the tube having an interior wall surface of uniform cross-section, and the scraping member having a peripheral scraping edge portion of which the entire outer peripheral edge fits said interior wall surface uniform cross-section during relative sliding movement of the scraping member and edge portion axially along the tube, the scraping member also having a cap portion extending substantially across the uniform cross-section of the tube in at least one position of the scraping member along the tube, and said scraping member further including means providing a passage inside the scraping edge portion for relative movement of fluid axially from one side of the scraping member cap portion to the other side of said cap portion when the scraping member moves axially along the tube through a fluid sample therein.

6. A fluid sample tube assembly according to claim 5 in which the scraping member is initially positioned with its cap portion adjacent to and substantially covering the inner surface of the closure member for penetration of the cap portion by said cannula needle during delivery of a fluid sample into the tube through the closure member.

7. A biological fluid sample tube assembly having a fluid sample collection tube with an interior tubular wall surface of uniform circular cross section, a closure member sealing one end of the tube, at least a portion of the closure member being adapted for penetration by a cannula needle for delivery of a biological fluid

sample from a body portion of a patient through the closure member into the tube, and a scraping member supported within the tube, said scraping member being movable within the tube in response to force applied externally of the tube without the necessity of opening the tube, said scraping member having an annular scraping edge portion slidably engaging the interior wall surface for relative movement of the scraping member and edge portion axially along the tube, said scraping member also having a cap portion extending substantially across the uniform cross section of the tube in at least one position of the scraping member along the tube, and said scraping member including means providing a passage for relative movement of fluid axially from one side of the scraping member cap portion to the other side of said cap portion when the scraping member moves axially along the tube through a liquid sample therein, and said scraping member consisting of a single tubular member of resiliently deformable material which normally has a uniform annular cross section throughout its length, one end of said tubular member constituting the annular scraping edge portion of the scraping member, said tubular member having cutaway portions at its opposite end providing a plurality of tapered segments projecting axially at said opposite end, said segments being deformable inwardly across the tubular member at said opposite end and thereby constituting the cap portion of said scraping member when the scraping member is in a position immediately adjacent said closure member with said segments engaging and substantially covering the inner surface of the closure member, and the segments at said opposite end being movable from their position constituting a cap portion covering the closure member back toward a normal axially projecting position, when the tubular member is moved away from the closure member by external application of force, said tubular member and said segments thereby constituting said means providing a passage for relative axial movement of fluid.

8. A biological fluid sample tube assembly having a fluid sample collection tube with an interior tubular wall surface of uniform cross section, a closure member sealing one end of the tube, at least a portion of the closure member being adapted for penetration by a cannula needle for delivery of a biological fluid sample from a body portion of a patient through the closure member into the tube, and a scraping member supported within the tube, said scraping member being movable within the tube in response to force applied externally of the tube without the necessity of opening the tube, said scraping member having an annular scraping edge portion slidably engaging the interior wall surface for relative movement of the scraping member and edge portion axially along the tube, said scraping member also having a cap portion extending substantially across the uniform cross section of the tube in at least one position of the scraping member along the tube, and said scraping member including means providing a passage for relative movement of fluid axially from one side of the scraping member cap portion to the other side of said cap portion when the scraping member moves axially along the tube through a liquid sample therein, and said annular scraping edge portion and said cap portion being formed as integral portions of a single piece of deformable material, said

11

means providing a passage consisting of at least one movable flap in said cap portion.

9. A biological fluid sample tube assembly having a fluid sample collection tube with an interior tubular wall surface of uniform cross section, a closure member sealing one end of the tube, at least a portion of the closure member being adapted for penetration by a cannula needle for delivery of a biological fluid sample from a body portion of a patient through the closure member into the tube, and a scraping member supported within the tube, said scraping member being movable within the tube in response to force applied externally of the tube without the necessity of opening the tube, said scraping member having an annular scraping edge portion slidably engaging the interior

12

5 wall surface for relative movement of the scraping member and edge portion axially along the tube, said scraping member also having a cap portion extending substantially across the uniform cross section of the tube in at least one position of the scraping member along the tube, and said scraping member including means providing a passage for relative movement of fluid axially from one side of the scraping member cap portion to the other side of said cap portion when the scraping member moves axially along the tube through a liquid sample therein, and said means providing a passage for relative movement of fluid comprising a rupturable cap portion.

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