ABSTRACT: A double lumen cannula instrument for use in withdrawing blood from a patient and having an outer lumen for providing an anticoagulant diluent and an inner lumen for withdrawing blood plus diluent, the body portion of the instrument being approximately one inch long and made of a silastic material. A method and apparatus for separating red cells from plasma in whole blood is also provided in which a diluent is added to whole blood to produce separation of the red cells.
A DOUBLE LUMEN CANNULA FOR BLOOD SAMPLING

This invention relates to double lumen cannula instruments, particularly of the type used in practice and in experimental research on animals and human beings.

In hospitals and research institutions, it is often necessary to withdraw blood from an animal or a human patient over long intervals of time and, in some tests, it may even be necessary to withdraw blood substantially for between two to five hours. For example, in metabolic testing a sugar solution is injected into a patient at a regular predetermined rate or at regular predetermined intervals while at the same time a continuous sample of the patient's blood is carried out. The blood is then subjected to certain testing procedures in order to ascertain its sugar content throughout the period of test. For this purpose, it is necessary to insert a cannula into the patient's vein or artery whereby the blood can be continually withdrawn. In order to prevent coagulation, it is, of course, necessary to provide an anticoagulant diluent and therefore a double lumen cannula instrument is normally used whereby two concentric tubes are provided, the anticoagulant diluent flowing towards the vein or artery along the outer tube whilst the mixture of blood and anticoagulant diluent is withdrawn through the inner tube by means of a pumping action. Steps should, of course, be taken to ensure that the anticoagulant diluent does not enter the blood stream of the patient.

As will be clear from the above description, a double lumen cannula instrument must be provided to permit the anticoagulant diluent to flow towards the vein or artery to facilitate the withdrawal of the blood plus diluent away from the vein or artery. The tubes from the diluent-supplying means and the blood-pumping means must be connected each to the respective one of the two concentric tubes forming the double lumen cannula. In some instances, this has been achieved by obtaining a metal two-way stopcock, welding the handle of the stopcock so that it is in an open position whereby a cannula can be passed through the bore thereof for use in withdrawing blood whereby one end is inserted into the vein or artery whilst the other end is connected to the pump. A plastic sheath was fitted over that end of the cannula which was to project into the vein or artery and slid along the external surface of the cannula and over the respective part of the stop cock so as to be sealed thereto by means of a sealing compound. A sealing compound was also sometimes used to seal the cannula to the metal stop cock so as to provide a fluidtight seal. However, in practice, it was found extremely difficult to maintain a fluid-tight seal and, furthermore, the metal stopcock was found to be relatively heavy resulting in a discomfort to the patient when used over a long period of time. The metallic stopcock was found to be cumbersome in use and spaces within its body resulted in blood clots being formed in the withdrawn blood.

It is an object of the present invention to provide a double lumen cannula instrument which is not as cumbersome as the above-mentioned stopcock instrument, is considerably lighter whereby the discomfort caused to a patient is not so greater, and wherein there is less tendency for blood clotting to occur.

Accordingly, there is provided a double lumen cannula instrument comprising a mounting of a nonmetallic material, said mounting being formed with a first bore extending therethrough and of such a diameter as to be capable of receiving a cannula extending through the mounting, the mounting including a second bore extending from the exterior of said mounting into a cavity at the junction of said first and second bores, said first bore being of one diameter at one end and of a slightly greater diameter at the other end, whereby when said cannula is in position the penetrating end protruding out of said other end, a fluid flow is possible from said second bore, into said cavity within said mounting and out through said other end to the exterior of the mounting.

More specifically, a double lumen cannula instrument according to the present invention comprises a body portion made of silastic, said body portion including an integral neck portion of silastic, a bore of a first diameter extending for a first distance towards said neck portion from the opposite end of said body and opening into a second bore, said second bore being of a second greater diameter than said first bore and extending from its junction with the first bore towards and through said neck portion to form an orifice to the exterior of said neck portion, a third bore extending through said body portion from the exterior thereof and opening into said second bore substantially in the region of said junction with said first bore, said first diameter being substantially equal to the external diameter of an inner-lumen-forming cannula to be used in the instrument so as to provide a fluidtight seal between said body portion and the inner-lumen-forming cannula, said neck portion being adapted, in use, to receive one end of a plastic cannula sheath concentric with said inner cannula whereby an outer lumen is formed between the external surface of said inner-lumen-forming cannula and the inner surface of said plastic cannula sheath whereby, in use during the sampling of a patient's blood, an anticoagulant diluent can be passed along said outer lumen to the outer tip of the inner lumen and blood plus anticoagulant diluent can be withdrawn along said inner lumen.

The overall length of the body portion of the double lumen cannula instrument may desirably be approximately 1 inch.

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

FIG. 1 is a diagrammatic representation of a double lumen cannula instrument according to the present invention;

FIG. 2 is a diagrammatic re-orientation view of a mould for forming the instrument of FIG. 1;

FIG. 3 shows a rod for insertion in the mould of FIG. 2 to ensure correct formation of the double lumen cannula instrument;

FIG. 4 is a diagrammatic representation of part of a red cell blood separator unit for use with the double lumen cannula instrument as shown in FIG. 1 or independently thereof;

FIG. 5 diagrammatically illustrates a further part of a red cell blood separator unit; and

FIG. 6 is a diagrammatic representation of a separator system.

The double lumen cannula instrument as shown in FIG. 1 comprises a body portion 1 including an integral neck portion 2 formed as one unit, by a moulding operation, from a moulding compound, Silastic "A" RTV (Dow Corning). The overall length of the body portion, including the neck portion, is approximately 1 inch.

During the moulding of the cannula instrument, the body portion 1 is provided with a bore 3 of a first diameter extending for a first distance towards the neck portion 2 from the opposite end 4 of the body portion 1. The cannula instrument is also provided with a second bore 5 of a second greater diameter, the second bore extending from the region 6 of its junction with the first bore 3 and towards the neck portion 2. The bore 5 extends through the neck portion 2 so as to form an orifice 7 to the exterior of the neck portion.

The body portion 1 is also provided with a third bore 8 extending through the body portion from the exterior thereof and opening into the second bore 5 in the region 6. The third bore 8 is shown substantially at right angles to the second bore 5 although this is not, of course, essential to the invention.

In use, a 20 gauge lumen-forming cannula 9, i.e. a smaller diameter stainless steel tube, is inserted into the bore 3 with a substantial part of its length projecting forwardly of the orifice 7 in the neck portion 2 and a part projecting backwardly from the opposite end of the body portion 1 whereby a pumping device (not shown) can be attached by suitable tubing to that end of the lumen-forming cannula 9. It will be appreciated that, in use, the free end of the cannula 9 is inserted into the vein or artery of a patient whereby blood may be drawn for sampling. The blood vessel of a patient is diagrammatically illustrated in FIG. 1 and is identified by the numeral 10.

In FIG. 1, there is also shown a plastic outer lumen sheath 11 of a medical cannula which is of such a length that its end
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projects approximately 1 mm. beyond the end of the inner lumen 9 when the two are inserted into a blood vessel 10. The plastic lumen sheath 11 fits onto the neck portion 2 of the double lumen cannula instrument and because of the properties of the silastic material from which the body portion is moulded, a fluidtight seal is obtained between the neck portion 2 and the plastic sheath 11. It will thus be seen that an inner lumen is formed by the lumen-forming cannula 9 while an outer lumen is formed between the external surface of the inner lumen-forming cannula 9 and the inner surface of the concentric plastic diluent-forming cannula 11.

In use, an 18 gauge stainless steel tube 12 having a length of approximately $\frac{1}{2}$ inch is inserted into the third bore 8 so as to form a fluidtight seal therewith. Apparatus (not shown) is connected to the stainless steel tube 12 to supply an anticoagulant diluent therealong and along the outer lumen formed between the tube 9 and the sheath 11 towards the blood vessel 10. Pumping means (not shown) is connected to the end of the tube 9 remote from the blood vessel 10 whereby blood may be withdrawn from the blood vessel for sampling purposes. Due to the pumping action, the anticoagulant diluent is also drawn along the lumen 9 which therefore carries a mixture of blood and diluent so that substantially no diluent is passed into the blood vessel 10.

As will be clear from the above, the double lumen cannula instrument shown in Fig. 1 may conveniently be used in blood-sampling tests on both human patients and animals. Because of the particular construction of the lumen cannula instrument and the advantageous medical properties of the silastic material used, it has been found that patients find it not only comfortable as the previously used metal cannula instrument and that during a sampling period of from 2 to 5 hours the silastic cannula instrument is not as heavy and uncomfortable on the patients' arm as was the previously used metal instrument. Further more, it has been established during use that the silastic cannula instrument is not as liable to form clots in the withdrawn blood as was the previously used metal cannula instrument. As will be clear, the double lumen cannula is particularly useful for in vivo study of a patient and permits the continuous withdrawal of blood from the respective vein or artery by permitting the simultaneous infusion of the anticoagulant, which mixes only with the withdrawn blood, whereby preventing the formation of clots in the sample tube 9. The mixing of the withdrawn blood and the anticoagulant occurs only at the tip of the inner lumen 9 which is approximately 1 mm. beyond the tip of the inner lumen-forming cannula 9 within the blood vessel 10 (Fig. 1). If necessary, the two lumen-forming components may be pushed further into the blood vessel. The pump is now started and the whole blood sample is drawn into the cannula tip at the rate $R_2$ at the same time being properly mixed with isotonic diluent and anticoagulant. The diluent is pumped to the cannula tip along the outer lumen formed by the concentric sheath 11 at the rate $R_3$. The diluted blood is withdrawn from the cannula tip via the inner lumen at the rate $R_1$, which is simply the sum of the rates $R_1$ and $R_3$. This configuration prevents anticoagulant and diluent from entering the bloodstream of the organism.

In one constructed system according to the present invention, the blood sample mixed with anticoagulant and isotonic diluent was drawn from the double lumen cannula by means of a peristaltic pump (Technicon proportioning pump—single speed) fitted with a manifold (Technicon manifold) containing one pump tube (Technicon pump tubes) whose diameter is defined the flow rate $R_2$. Tygon tubing was used to connect the cannula to the input of the pump and this should, of course, be kept as short as possible (between two and three feet) and its internal diameter should, of course, be small—about 0.025 inches. These constraints minimize longitudinal diffusion in the tubing and also filter the flow irregularities of the peristaltic pumping. Further dilution of the blood sample can be car-
ried out at the peristaltic pump by mounting on the same manifold a second tube, pumping at the rate R₂, as mentioned above. The total dilution factor D₁ can be determined by measuring the flow rate R₁ and the combined flow rate (R₁+R₂). From these two rates, the rate R₂ can be calculated for any desired dilution factor by applying the relationship R₂ = R₁ - D₁(R₁+R₂) where R₁ is the rate of flow to the double lumen cannula tip.

Thus, the rate of the whole blood removal is given by the formula Rₚ = R₁ + R₂. 1)

During experiments, it has been found the Rₚ should preferably be greater than 0.1 ml/min. in order to minimize the peristaltically induced fluctuations in the flow R₁.

Accurate measurement of the flow rates R₁ and (R₁+R₂) can be simply achieved by using two pipettes and a stop watch. The diluent at flow rate R₂ passes along a path through the proportioning pump rollers to a three-way stopcock capable of passing the diluent either to waste or into the flow line of the flow at rate R₁ (blood plus anticoagulant diluent), after the respective proportioning pump roller in the direction flow. When the first-mentioned stopcock is in the correct position, the combined flow (R₁+Rₚ) is passed to a further three-way stopcock inserted in the fluid line whereby the fluid flow may be arranged to enter a 5 ml pipette.

To measure R₂, the flow R₂ is diverted to waste by the first-mentioned stopcock and the flow R₁ is directed into a 2 ml pipette by means of the second-mentioned stopcock. The time to pump a known volume of liquid is measured and the flow can be calculated. For the flow (R₁+R₂), as mentioned, a 5 ml pipette is used and by this means both flows can be measured.

In FIG. 2, there is shown a mold for manufacturing the silastic cannula instrument of FIG. 1. The mold may conveniently be a two-piece mould made of the plastic referred to as Lucite (registered trade mark). The mold is shown in cross section in FIG. 2 and it will be appreciated that prior to drilling and milling the mould, the two pieces of Lucite are fitted together and held by means of 3/32 inch studs approximately 1 inch long and having a half-round end together with a threaded opposite end. Conveniently, Lucite blocks may be used having a length several times the size of the required cannula instrument and, for example, a Lucite block may be 4-½ inch long so that six moulds may be drilled and milled into each block so as to produce the body portions for six double lumen cannula instruments according to the present invention. Thus, a piece of Lucite material would be required having dimensions 7/16 x 1/4 x 4-½ inch. The dimensions required for each mould are indicated in FIG. 2 for convenience, the overall thickness of the moulded body portion being arranged to approximately ¼ inch.

Referring to FIG. 2, it will be seen that the mould 20 includes a main space 21 within which the main body portion 1 will be formed. The neck portion 22 (FIG. 1) will be formed within the neck space 22 which continues through into a space 23 corresponding to the second bore 5 of the double lumen cannula instrument of FIG. 1. The wall of the mould 20 is provided with a drilled, or otherwise formed, bore 24 having a diameter of 0.025 inch and emerging into the main space 21 of mould 20.

In FIG. 3, there is shown a rod 25 for insertion within the mould of FIG. 2 to ensure that the bores 3, 5 and 8 (FIG. 1) are properly formed. The rod 25 is of 1/16 inch diameter and 1 inch total length. At one end it is provided with an axially located bore 26 and a transverse bore 27 as shown in FIG. 3.

During a moulding operation, the end 28 of the rod 25 is inserted in the space 23 (FIG. 2) with the major portion of the rod 25 projecting into the space 21. To ensure that the bores 3 and 8 are properly formed, two pieces of wire, such as piano wire, are used. The first piece of wire having a diameter of 0.024 inch and a length of approximately ½ inch is inserted in the bore 26 of rod 25 so as to project upwardly through the top of the mould 20. The second piece 0f wire having a diameter of 0.024 inch and a length of approximately ½ inch is inserted in the bore 27 so as to project horizontally through the bore 24 in the mould 20 of FIG. 2. Thus, when the silastic "A" RTV (Dow Corning) moulding compound is injected into the mould, the bores 3, 5 and 8 will be properly formed.

The steps in the moulding operation may be summarized as below.

1. Ensure that the components of the mould are clean and dry.
2. Assemble the Lucite pieces of the mould together using, for example, 3/32 inch diameter threaded studs approximately ¼ inch long.
3. Insert rod or wire into the axially located bore 26 of rod 25.
4. Clamp the assembled combination of rod 25 and the above-mentioned rod or wire with a pair of hemostats and insert the end 28 of rod 25 into the ¼ inch diameter hole 23 in the Lucite mould.
5. Align the bore 27 in rod 25 with the 0.025 inch diameter bore 24 in the mould 20 of FIG. 2.
6. Push the end of the respective rod or wire through the 0.025 inch bore 24 in mould 20 and into the bore 27 of rod 25 (FIG. 3).
7. Prepare the moulding compound, silastic "A" RTV (Dow Corning) moulding compound, and inject it into the mould, starting at the bottom and filling the mould to the top so as to ensure that no air bubbles are trapped by the silastic material.

After the silastic material has properly set and catalyzed, the mould may be taken apart as follows.

1. Remove the rod or wire from the bore 27 by merely pulling it straight out.
2. Remove the threaded bolts or studs holding the two parts of the Lucite mould together.
3. Carefully separate the two parts of the Lucite mould.
4. Remove the silastic double lumen attachment from the Lucite mould.
5. Carefully pull out the remaining rods or wires, i.e. the rod 25 and the wire previously inserted into the bore 26 thereof.
6. Insert the two pieces of stainless steel tubing 9 and 12 of FIG. 1 into the moulded silastic body portion.

The stainless steel tubing constituting the lumen-forming cannula 9 and the stainless steel tube 12 of FIG. 1 must be carefully checked to ensure that no burrs, fragments of steel, or dirt are introduced into the final instrument. For the instrument of FIG. 1, the stainless steel tubing 9 should be of 20 gauge and approximately 4 inches long and, in step 6, is passed axially through the moulded body portion. The tube 12 should be of 18 gauge stainless steel tubing and approximately ¾ inch long and, in step 6, would be inserted perpendicularly into the moulded body portion. In this way, a double lumen cannula instrument as shown in FIG. 1 would be constructed.

Sterilization of the double lumen cannula instrument may be effected by any of the usual methods.

The double lumen cannula instrument described above may conveniently be used for in vivo monitoring of blood parameters in response to drugs and/or other substances in humans or animals. General cannulations involving a double lumen catheter of any length can employ the double lumen cannula instrument to prevent the anticoagulant to the site of blood removal. Provided that the blood vessel is found and entered quickly, the procedure in using the described double lumen cannula instrument is simple and straightforward, taking only a minute or so, and once the pump is started the blood sample may be withdrawn continuously for as long as necessary and advisable. The double lumen cannula instrument has proved, in use, to be both rigid and strong and it has been discovered by experimentation that practical cannula instruments constructed of the above-mentioned silastic rubber moulding compound are particularly useful for medical purposes. Furthermore, the described double lumen cannula instrument may be regard as a disposable item, for use in one operation only.

Turning now to another aspect, I have designed apparatus for separating blood by a new method.
In medical practice and research on animals and humans, it is sometimes necessary to separate whole blood into its constituent plasma and red cells. Centrifugation methods have previously been used in separators to separate the respective components from diluted whole blood. As is known, some chemical analysis must be made on plasma rather than on whole blood and therefore separated flows, one of diluted plasma and the other of diluted plasma plus the cells, are obtained by separation techniques so that the appropriate chemical analysis may be made.

By pumping a whole bloodstream into a diluent stream so dilution occurs continuously, hence dynamically (dynamic dilution), whole blood may be separated into two laminar streams. The upper stream will consist mainly of diluent and plasma while the lower stream will consist of concentrated red cells and some plasma. In other words, the settling time of red cells can be greatly enhanced when a small flow of blood is pumped into another flow of diluent. Settling then occurs in about one second and the liquid proceeds in two layers along the tubing of the apparatus used.

In FIG. 4, there is shown a part of a red cell blood separator unit.

The unit shown in FIG. 4 comprises a first part 30 having a cross-sectional shape as shown so as to form two passageways, a first passageway 31 for the flow of diluent and a second passageway 32 for the flow of whole blood. The passageway 32 joins the passageway 31 at right angles thereto and the output flow of the first part 30 continues in a single flow path along an outlet passageway 33 in-line with the passageway 31. A passageway 34 of a nipple part 35 is provided in-line with the passageway 31, the part 35 being held in abutting relationship with the part 30 by means of a Tygon (trade mark name) sleeve 36. A length of Tygon Tubing 37 is provided on end of the nipple part 35 whereby the flow thereto may be fed to subsequent apparatus.

The first part 30 may conveniently be a glass T-fitting type DO or D1. (Technicon.)

It is important to note that air segmentation of the streams is not used because the air bubble tends to remix the blood cells and the plasma. Separators are effective to remove the lower layer of red cells. In FIG. 5, there is shown a further part of a red cell blood separator unit whereby the concentrated red cells and some plasma may be separated from the partially cell free diluted plasma. The incoming laminar flow of diluted plasma and settled red blood cells travels long a length of tubing 38, through a nipple part 39 and through an in-line passageway 40 of a further part 41. The nipple part 39 and the further part 41 are held in abutting relationship by means of a sleeve 42.

The combined flow of diluted plasma and settled blood cells travels along the passageway 40 into a junction region 43 where the concentrated red cells travel along a lower branch passageway 44 while the partially cell free diluted plasma travels along an upper branch passageway 45. The concentrated red cells travelling along the lower passageway 44 will, in fact, include some plasma therein but by using three cascaded separator units I have been able to separate in excess of 99 percent of red cells. This figure is, of course, subject to rechecking.

The partially cell free plasma flowing along passageway 45 may, of course, be passed through a second and then a third separator to further accomplish separation. I believe that the first separator will remove along passageway 40 a volume of fluid corresponding to about twice expected red cell volume. Subsequent separators do approximately the same, but the net flow is less because the red cell concentration has already been reduced by the first separator unit.

For proper settling of the whole blood, the tubing connecting each separate unit should be preferably maintained horizontal and the locus of its path should be kept smooth with only gradual changes. Smooth transition along the passageways formed by the respective tubing's internal diameters and the glass fittings must be maintained to avoid turbulence and nonlaminar flow which results in mixing of the two streams.

A slight downward slope of the whole apparatus should enable the red cells to slide and flow at about the same velocity as the supernatant plasma and diluent.

Obviously, completeness of separation and volume of cell free plasma bear to each other a reciprocal relationship.

At the present moment, I do not have a concrete theoretical explanation of the settling phenomenon. It does, however, occur at low concentrations as well as in dilute aqueous solutions. Into the discussion is that further discussion does not take place. The simultaneous electrolytes channel of one auto-analyzer determines Na\textsuperscript{+}, K\textsuperscript{+}, Cl\textsuperscript{−}, CO\textsubscript{3}\textsuperscript{−} in the separated plasma; while another auto-analyzer channel measures glucose in the separated red cell suspension.

The advantages of the continuous separation technique described above are believed to be as follows:

1. The cells are separated anaerobically, rapidly, and continuously.
2. The separation occurs 'on line' as it were.
3. The gravitational stresses applied to the cells are insignificant.
4. The cells are not packed tightly together so that there is less chance of their contents exchanging with their environment.
5. The separated plasma is removed from the cells almost immediately.
6. The system also introduces several advantages:
7. The flow rate of blood withdrawn can be made very small, 0.1 mL/min. so that frequent measurements may be made.
8. The system is particularly useful in continuous monitoring work because it eliminates the need for discrete batch centrifugation and thereby permits complete automation and integration of the withdrawal-analysis system.

There are also some possible disadvantages:
1. The measured plasma concentration depend on the sample hematocrit because the whole blood is diluted first and then separated; in contrast to first separating the plasma from the cells and then diluting the plasma for analysis. The latter method is believed to introduce no hematocrit dependence.

The described separator method and apparatus may be used in conjunction with the double lumen cannula instrument illustrated in FIG. 1 or, alternatively, it may be used separately therefrom or with other suitable apparatus.

I have constructed a multiple separation unit for continuous separation using pieces of glass and tubing, etc. manufactured by the Technicon Company.

The arrangement is shown diagrammatically in FIG. 6 and it will be seen that heparinized, diluted whole blood flow from a double lumen cannula instrument, such as shown in FIG. 1, is fed along one input line while an isotonic diluent NaCl or LiNO\textsubscript{3} is fed along another input line. The flow rates at various parts of the arrangement are indicated in mL/min. and a
Technicon proportioning pump is utilized to ensure continuous blood withdrawal. The pump tube shoulder colors are indicated on the respective lines. Identification of the respective parts in FIG. 6 is indicated in the following list.

- (A) Tygon tubing 0.065" I.D. Length, 4 ft. minimum
- (B) Tygon tubing 0.065" I.D. Length, 8 in. minimum
- (C) Tygon tubing 0.065" I.D. Length, 8 in. minimum
- (D) Tygon tubing 0.025" I.D. Length, any
- (E) Tygon tubing varies I.D. Lengths, adjusted to
- (F) Tygon tubing varies I.D. Lengths, properly phase
- (G) Tygon tubing varies I.D. Lengths, flows from
- (R) Roller of Auto Analyzer Proportioning Pump (Technicon)
- (W) Glass fitting D2 (Technicon)
- (X) Glass fitting C3 De bubbler (Technicon)
- (Y) Glass fitting C2 De bubbler (Technicon)
- (Z) Glass fitting GO Caetus (Technicon)

The interconnecting tubes A, B and C serve the additional purposes of maintaining laminar flow as well as allowing settling of the red cells. It is necessary that they be placed to avoid any sharp bends or twists which would cause mixing of the two ribbons of fluid in the tubes.

All connections should be made properly using the appropriate nipples so that laminar flow is maintained throughout.

The red cell collecting tubes should be adjusted in length and internal diameter so that the three flows are in phase at the summation point Z. In this way, an analysis, such as glucose, performed on the red cell suspension will not suffer from excessive "mixing" or loss of "response" to a step change in concentration.

To maintain the 'response' of the separators it is also advantageous to place the separators in a descending cascade allowing the more viscous red cells to slide down a ramp thereby maintaining equal the velocity of both separated streams.

For different conditions, different pump tubes may be used. Perhaps only two instead of three separators need be used. The configuration shown is not necessarily the best; it removes better than 99 percent of the red cells, but proper adjustment of the orientation and settling lengths can increase this figure.

I claim:

1. In a blood sampling apparatus, a double lumen cannula instrument comprising:
   a. a body portion molded from silastic;
   b. said body portion including a integral neck portion of silastic and of smaller cross-sectional area than said body portion;
   c. a first bore of a first diameter extending for a first distance towards said neck portion from the opposite end of said body and opening into a second bore;
   d. said second bore being of a second greater diameter than said first bore and extending from its junction with the first bore towards and through said neck portion to form an orifice to the exterior of said neck portion;
   e. an inner-lumen-forming cannula extending through said first and second bores;
   f. said first diameter being substantially equal to the external diameter of the inner-lumen-forming cannula so as to provide a fluid tight seal between said body portion and the inner-lumen-forming cannula;
   g. a third bore extending through said body portion from the exterior thereof and opening into said second bore substantially in the region of said junction of said first bore and a tubular member in said third bore having one end emerging into said region and the other end extending to said exterior of the body portion;
   h. a plastic cannula sheath concentric with said inner cannula and having one end fitting over said neck portion whereby an outer lumen is formed between the external surface of said inner-lumen-forming cannula and the inner surface of said plastic cannula sheath;
   g. whereby, in use during the sampling of a patient’s blood an anticoagulant diluent can be passed along said outer lumen to the outer tip of the inner lumen and blood plus anticoagulant diluent can be with drawn along said inner lumen.

2. A cannula according to claim 1 wherein the oval length of the body portion of the double lumen cannula instrument is approximately 1 inch.

3. A double lumen cannula instrument according to claim 1 wherein said third bore is at right angles to said first bore.

4. A double lumen cannula instrument according to claim 3 wherein said tubular member is a stainless steel tube inserted in said third bore.