Jan. 20, 1931. J. MUIR 1,789,766

SURGICAL INSTRUMENT FOR IMPLANTING CAPILLARY SEEDS CONTAINING RADIUM EMANATION

Original Filed July 19, 1924

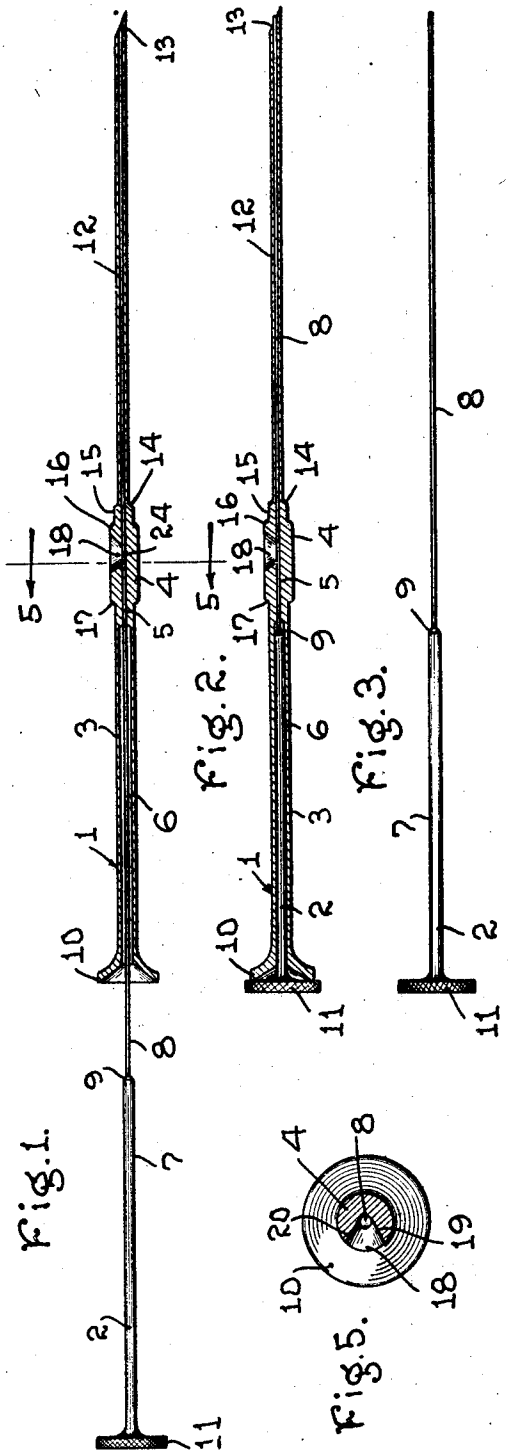


Fig. 1.



Fig. 2.



Fig. 3.



Fig. 5.

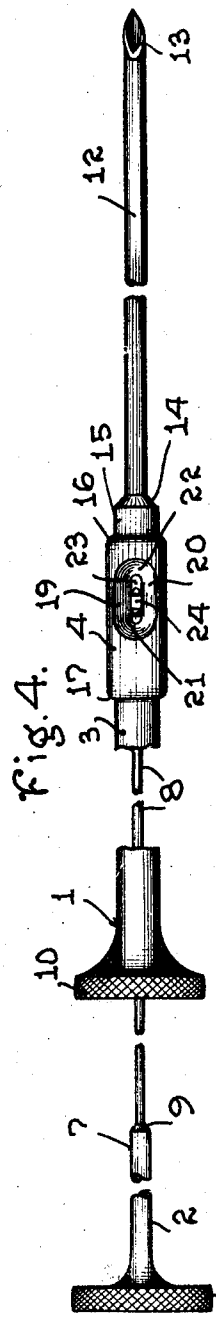


Fig. 4.

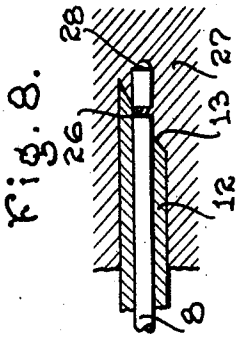


Fig. 8.

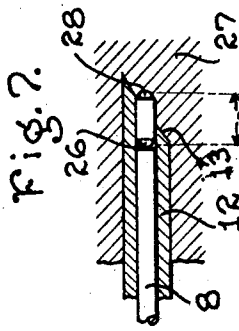


Fig. 7.

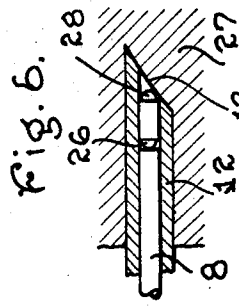


Fig. 6.

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# UNITED STATES PATENT OFFICE

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## SURGICAL INSTRUMENT FOR IMPLANTING CAPILLARY SEEDS CONTAINING RADIUM EMANATION

Continuation in part of application Serial No. 727,094, filed July 19, 1924. This application filed July 30, 1925. Serial No. 47,101.

This invention relates to an instrument for implanting radium emanation capillary tubes, technically known as bare tubes or seeds, in biological tissue.

Radium emanation tubes contain radium emanation in equilibrium with the products of decomposition of radium emanation. The tubes are made of glass and at each end have a glass ball formed in sealing the tube. The dimensions are usually ½ mm. in diameter and 3 mm. in length. The short length of the tube and its method of manufacture confer thereon great strength and resistance to pressure when this pressure is exerted from both ends.

In using the tube or seeds, it is to be noted that they are implanted in solid tissue, in a solid mass, not at random but in a predetermined position. These tubes or seeds are not dropped into open cavities of biological tissue but are positioned in the solid tissue so that they will remain in situ. In positioning the bare tubes or seeds they are implanted under pressure so as to break the biological tissue while being guided by a suitable seed guide.

Radium emanation capillary tubes cannot be handled with the bare hands; the employment of a forceps is absolutely necessary. In view of the above it is obvious that any instrument in order to adequately take care of the requirements of a radium emanation tube implanter, must be of such a nature that it can be used without the person handling it touching the emanation tube. Further, the time element in handling is of great importance. Therefore, the implantation instrument or needle used must be capable of allowing the entire process of loading the emanation tubes or seeds into the instrument and implanting the seeds in the biological tissue to be carried out quickly so as to allow the implantation operator to be exposed to a minimum of radiation.

It is the primary object of this invention to provide an instrument for implanting seeds in accordance with the above stated requirements. Specifically, the invention has for its objects the implantation of the seeds, under pressure so as to break the solid biological tissue under pressure while said seeds are being guided; the provision of a needle having a plunger having portions of different flexibility so as to give a certain amount of elasticity while the seeds are being implanted under pressure; the provision of a needle which will make its own portal of entrance in solid tissue, and successfully force a seed through the needle and into the tissue at the place where the point of the needle is situated in a minimum of time so as to reduce the radiation influence to which the operator is subjected; and the provision of a needle having a loading slot, particularly adapted to receive a single seed and allow it to be implanted before the needle is charged with another seed.

In the accompanying drawing,

Fig. 1 is a longitudinal section partly in elevation, the plunger feeding element being shown in an extracted position;

Fig. 2 is a similar view to Fig. 1 but the plunger feeding element is shown completely inserted in its tubular encasing body portion;

Fig. 3 is an elevation of the plunger;

Fig. 4 is an enlarged elevation of the complete instrument;

Fig. 5 is a cross section on line 5—5 of Fig. 1;

Fig. 6 is a diagrammatic view showing the needle proper and a tube before the latter has begun to break the solid tissue;

Fig. 7 is a similar view showing the tube after it has made its own portal of entrance into the solid tissue, and

Fig. 8 is a similar view showing the emanation tube in final position allowing the removal of the instrument.

In the drawing, wherein for the purpose of illustration there is shown a preferred embodiment of this invention, the numeral 1 designates as an entirety the body portion of the instrument and the numeral 2 as an entirety the plunger portion. The body portion comprises an upper tubular body portion 3 and a lower tubular body portion 4, the outside diameter of the latter being greater and inside diameter less than that of the former thereby providing bores 5 and

6 to receive the plunger 2. At the juncture of the lower body portion 4 and the upper body portion 3 a shoulder 17 is formed and at the lower extremity of the lower body portion 4, there is a corresponding shoulder 16 which joins the elongated needle terminal 15 to the said lower body portion. The elongated needle terminal 15 terminates in an inverted frustum of a cone 14 which receives the needle 12. The plunger 2 is composed of an upper plunger portion 7 having a diameter slightly less than the inside diameter of the tubular upper body portion 3, and a lower plunger portion 8 of slightly less diameter than the inside diameter of the tubular lower plunger portion 4. The lower plunger portion 8 which is joined to the upper plunger portion 7 at 9 is of notably greater flexibility than the upper plunger portion 7 so as to provide for a certain amount of flexibility and elasticity while the emanation seeds are being implanted under pressure. The lower plunger portion 8 is about one and three quarters times as long as the upper plunger portion 7, the relationship being desirable so as to insure the proper degree of elasticity. It will be seen that this construction of the plunger is important when it is considered that the seeds or tubes are implanted under pressure and make their own portal of entrance into the solid tissue. If the seeds were to be inserted into a biological cavity, this construction would not be necessary. The joint 9 may be a solder joint. At the outer end of the body portion 1 and the plunger 2 there are flared ends or heads 10 and 11. The head 11 of the plunger is of slightly larger diameter than that of head 10 of the body portion 1. This insures rapid withdrawal of the plunger and this is absolutely necessary in order to carry out the process of implantation in the minimum time.

The needle 12 is joined to the lower body portion 4 by means of needle terminal 15 and the inverted cone frustum 14 which acts as a rest when the needle is inserted into the tissue. The needle is provided with a point 13 formed by beveling off the needle proper at an acute angle. The walls of the lower portion of the needle act as a guide and prevent transverse displacement of a seed as it passes through the needle and into the solid tissue. It is to be noted that the needle does not make a cavity which finally receives the seed or tube. On the contrary, the emanation tube, due to the pressure exerted thereon forms its own portal of entrance in the solid tissue as illustrated in Figs. 6, 7 and 8.

In the lower tubular body portion 4, there is formed a countersunk groove 18 communicating with bore 5 in the body portion 4 said countersunk groove permitting the insertion of emanation tubes within the bore 5. The groove 18 which is positioned slightly below the shoulder 17 has side walls 19 and 20 and end walls 21 and 22 all extending at an acute angle to the axis of the bore 5. The uppermost portions of the walls 19 and 20 are in a plane slightly below the level of the plane defined by the uppermost portion of the walls 21 and 22, said uppermost portion of the walls 21 and 22 being in the circular plane of the lower body portion 4.

A countersunk groove of the construction specified is advantageous in that it allows the insertion of but one emanation tube at a time and this is quite necessary since the emanation capillary tubes can not, due to their shape, be bunched in a loading magazine. For many years, instruments having loading magazines have been used to inject medicinal substances in open cavities but not in solid tissue. When injecting the emanation tubes in solid tissue, each tube is usually positioned differently. Therefore, a loading magazine is not desirable and further, as stated it can't be used when injecting radium emanation tubes due to their shape.

The operation of the instrument is as follows:

Upon the withdrawal of the plunger 2 from the lower body portion 4 and bore 5, the entrance 23 to the bore 5 is uncovered and an emanation tube 24 is placed in countersunk groove 18. When the tube 24 is positioned within the bore 5, the plunger 2 is moved downwardly thereby forcing the tube 24 into the guiding needle 12 and then out of the same into solid tissue.

Upon inspection of Figs. 6, 7 and 8 it will be clear how the emanation tubes are placed in the solid tissue. The capillary tube after being placed in the countersunk groove 18 travels easily through the bore 5 of the body portion and through the needle 12 when pushed by the plunger 2 until the point of the needle is reached. In this position, the further end 28 of the emanation tube is in direct contact with the tissue 27 while the other end 26 of the tube is in contact with the lower body portion 8 of the plunger 2, the plunger, of course, exerting pressure as it is moved downwardly. Fig. 6 shows the position of the tube just before the tissue is broken. Further pressure upon the plunger portion 8 causes the capillary tube 24 to advance to a position illustrated in Fig. 7. As the tube 24 advances it is guided by the walls of the lower portion of the needle end and is thereby held against transverse displacement partially by said guiding walls and partially by the walls formed by the broken tissue. The portion A indicated in Fig. 7 of the needle acts as the guide. When breaking the tissue the capillary tube makes its own portal of entrance and on continued pressure the tube is substantially completely inserted into the solid tissue as shown in Fig. 8. Thereafter the instrument may be removed. The

capillary tube remains in the original position due to the pressure exerted by the broken tissue on all sides of the radium emanation tube, the surrounding of the tube by the solid tissue preventing any transverse displacement of the tube.

When it is necessary to implant more than one radium emanation tube with the same portal of entrance the radium emanation tube to be placed further from the surface of the tissue is implanted first, following the procedure outlined above. To implant the next radium emanation tube, the plunger and needle are drawn back so that the point of the needle will be at the place where the new emanation tube is to be implanted. The instrument is charged again with the radium emanation tube and the plunger pushed all the way in so as to place the radium emanation tube in the required position.

It is desired to point out that the radium emanation tubes are very small and made of glass. Since the material of the tube is of this character, it is quite necessary to feed the instrument but one tube at a time. If several tubes were inserted at once there would be the possibility of the production of glass chips which is fatal. Before the introduction of applicant's instrument and the process of applying the emanation tubes to the instrument, it was usual to insert the emanation tube in the point 13 of the needle and then, in order to avoid loss of the tube, to apply a little paraffin to the needle and tube whereby the latter was temporarily held in place until the plunger of the needle was moved downwardly and contacted with the tube. Continued movement of the plunger forced the tube into the tissue. This method of procedure has several disadvantages. First, the possibility of losing the tube in applying the paraffin is very great; second, each time a tube had to be inserted, the instrument had to be removed from the tissue. According to applicant's process of inserting the emanation tube, the use of paraffin is avoided and when successive tubes are to be inserted into the tissue, the instrument need not be withdrawn from the tissue. All that is necessary is that the plunger be raised so as to uncover the loading slot 18, insert the tube and advance the plunger downwardly. Of course, usually, when several tubes are to be inserted, they are placed in different positions. In this case the instrument needle is not completely withdrawn from the tissue but the needle is simply advanced or partially withdrawn to effect a change of position. In the old method of feeding the tubes, it was necessary to completely withdraw the instrument from the tissue.

It is to be noted that the countersunk groove 18 communicating with the bore 5 in the body portion 4 is of such a size as to hold a single emanation seed and that this groove forms an opening in the wall of the body portion 4 for permitting the insertion of an elongated emanation tube and positioning the seed so that its single longitudinal axis substantially coincides with the axis of the lower tubular body portion 4.

The present application is a continuation in part of U. S. application Ser. No. 727,094, filed July 19, 1924 by Joseph Muir and Julius E. Underwood.

I claim:—

1. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion having an opening in its wall of such a size as to only permit the feeding of a single elongated emanation tube, said opening being so constructed as to position the tube with its single longitudinal axis substantially coinciding with the longitudinal axis of the tubular body portion, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle terminal and a plunger working in said body portions and needle and adapted to force the emanation tube under pressure through the needle, skin, and into or adjacent the diseased tissue.

2. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion, means therein for permitting the insertion of an elongated emanation tube, and positioning the tube so that its single longitudinal axis substantially coincides with the axis of the lower tubular body portion, a needle terminal at the lower extremity of the lower body portion, a guiding needle in said needle terminal, and a plunger working in said body portions and needle and adapted to force the emanation tube under pressure through the needle, skin, and into or adjacent the diseased tissue.

3. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radi-

um emanation, the combination of a tubular upper body portion, a lower tubular body portion of greater outside diameter and less inside diameter than the upper body portion, means in said lower tubular body portion for permitting the insertion of an elongated emanation tube and positioning the tube so that its single longitudinal axis substantially coincides with the axis of the lower tubular body portion, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle terminal, and a plunger working in said body portions and needle adapted to force the emanation tube under pressure through the needle, skin, and into or adjacent the diseased tissue.

4. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion of greater outside diameter and less inside diameter than the upper body portion, means in said lower tubular body portion for permitting the insertion of an elongated emanation tube and positioning the tube so that its single longitudinal axis substantially coincides with the axis of the lower tubular body portion, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle terminal, the juncture of the needle and needle terminal forming a shoulder acting as a rest when the needle is inserted into the tissue, and a plunger working in said body portions and needle and adapted to force the emanation tube under pressure through the needle, skin, and into or adjacent the diseased tissue.

5. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion, means therein for permitting the insertion of an emanation tube, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle terminal, and a plunger working in said body portions and needle and having an upper plunger portion of a diameter slightly less than the upper tubular body portion, and a lower plunger portion of slightly less diameter than that of the tubular lower body portion and needle, the lower plunger portion having a notably greater flexibility than the upper plunger portion.

6. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion of greater outside diameter and less inside diameter than the upper body portion, means therein for permitting the insertion of an emanation tube, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle terminal, and a plunger working in said body portions and needle having an upper plunger portion of a diameter slightly less than the tubular upper body portion, and a lower plunger portion of slightly less diameter than that of the tubular lower body portion and needle, the lower plunger portion having a notably greater flexibility than the upper plunger portion.

7. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion of greater outside diameter and less inside diameter than the upper body portion, means in said lower body portion for permitting the insertion of an emanation tube, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle terminal, and a plunger working in said body portions and needle, having an upper body portion of a diameter slightly less than the tubular body portion and a lower plunger body portion of slightly less diameter than that of the tubular body portion and needle, the lower plunger portion having a notably greater flexibility than the upper plunger portion, the juncture of the needle terminal and needle forming a shoulder acting as a rest when the needle is inserted into the tissue.

8. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular

body portion, a countersunk groove therein for permitting the insertion of an emanation tube, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle terminal, and a plunger working in said body portions and needle and adapted to force the emanation tube under pressure through the needle, skin and into or adjacent the diseased tissue.

9. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion, a countersunk groove therein, the walls of which are at an acute angle for permitting the insertion of an emanation tube, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle terminal, and a plunger working in said body portions and needle and adapted to force the emanation tube under pressure through the needle, skin, and into or adjacent the diseased tissue.

10. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion, a countersunk groove in the upper portion of the lower body member for permitting the insertion of an emanation tube, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle terminal, and a plunger working in said body portions and needle and adapted to force the emanation tube under pressure through the needle, skin, and into or adjacent the diseased tissue.

11. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion, a countersunk groove in the lower tubular body portion for permitting the insertion of an emanation tube, a needle terminal at the lower extremity of the lower body portion, a guilding needle carried by said needle terminal, and a plunger working in said body portions and needle, having an upper plunger portion of a diameter slightly less than the tubular upper body portion and a lower plunger body portion of slightly less diameter than that of the tubular lower body portion and needle, the lower plunger portion having a notably greater flexibility than that of the upper plunger portion.

12. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion, a countersunk groove in the upper portion of the lower body member for permitting the insertion of an emanation tube, said groove having walls extending at an acute angle to the axis of said lower body member, the tops of the side walls being in a different plane from the tops of the end walls, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle terminal, and a plunger working in said body portions and needle and adapted to force the emanation tube under pressure through the needle, skin, and into or adjacent the diseased tissue.

13. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion of greater outside diameter and less inside diameter than the upper body portion, means in said lower tubular body portion for permitting the insertion of an elongated emanation tube, a needle terminal at the lower extremity of the lower body portion, said needle terminal forming at its needle end an inverted frustum of a cone, a guiding needle carried by said needle terminal, the juncture of the needle and needle terminal forming a shoulder acting as a rest when the needle is inserted into the tissue, and a plunger working in said body portions and adapted to force the emanation tube under pressure through the needle, skin and into or adjacent the diseased tissue.

14. In an instrument for implanting radium emanation tubes of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the emanation tube, and subject the

emanation operator to a minimum exposure of radium emanation, the combination of a tubular upper body portion, a lower tubular body portion, means therein for permitting the insertion of an emanation tube, a needle terminal at the lower extremity of the lower body portion, a guiding needle carried by said needle extremity, and a plunger working in said body portions and needle and having an upper plunger portion of a diameter slightly less than the upper tubular body portion and a lower plunger portion of slightly less diameter than that of the tubular lower body portion and needle, the lower plunger portion having a notably greater flexibility than the upper plunger portion and being approximately one and three quarters times as long.

15. An implanting instrument, as characterized, for implanting radium emanation capsules of capillary dimensions through the skin and into solid tissue, such implantation requiring extreme care in manipulating the instrument in order to accurately radiate the diseased tissue, avoid loss of the radium emanation capsule, and subject the emanation operator to a minimum exposure of radium emanation, comprising a tubular receiving chamber having intermediate its ends a substantially cup-shaped recess with an elongated opening in its bottom leading into the passage of the chamber for admitting a radium emanation capsule, said chamber having a tubular needle member extending from one end of its passage, and a rod movable throughout the passage of the chamber and needle member for discharging the capsule under pressure from the needle member through the skin and into or adjacent the diseased tissue.

In testimony whereof I have subscribed my name hereto.

JOSEPH MUIR.