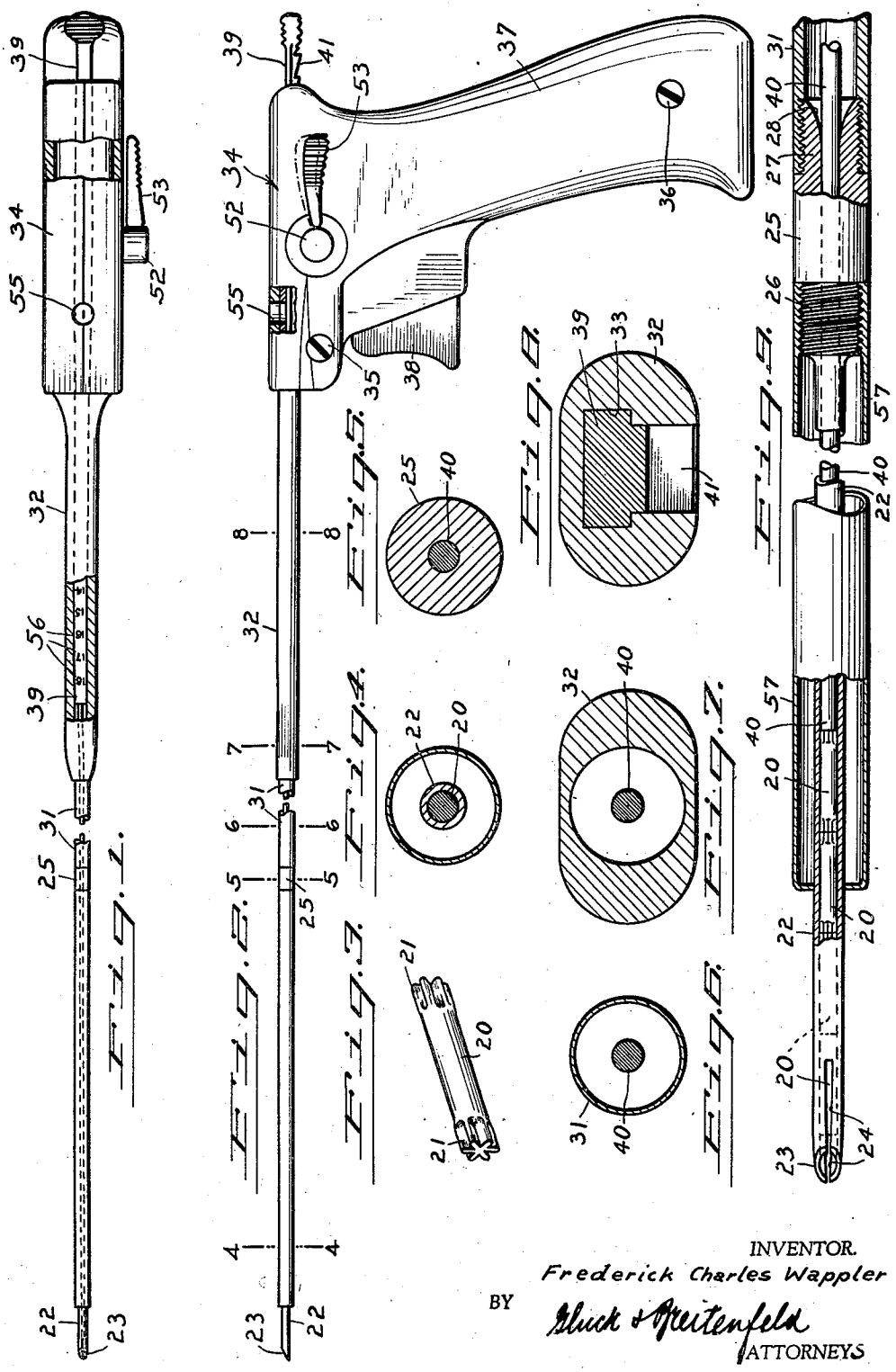
Jan. 13, 1942. F. C. WAPPLER 2,269,963

IMPLANTING DEVICE

Filed June 1, 1940 2 Sheets-Sheet 1



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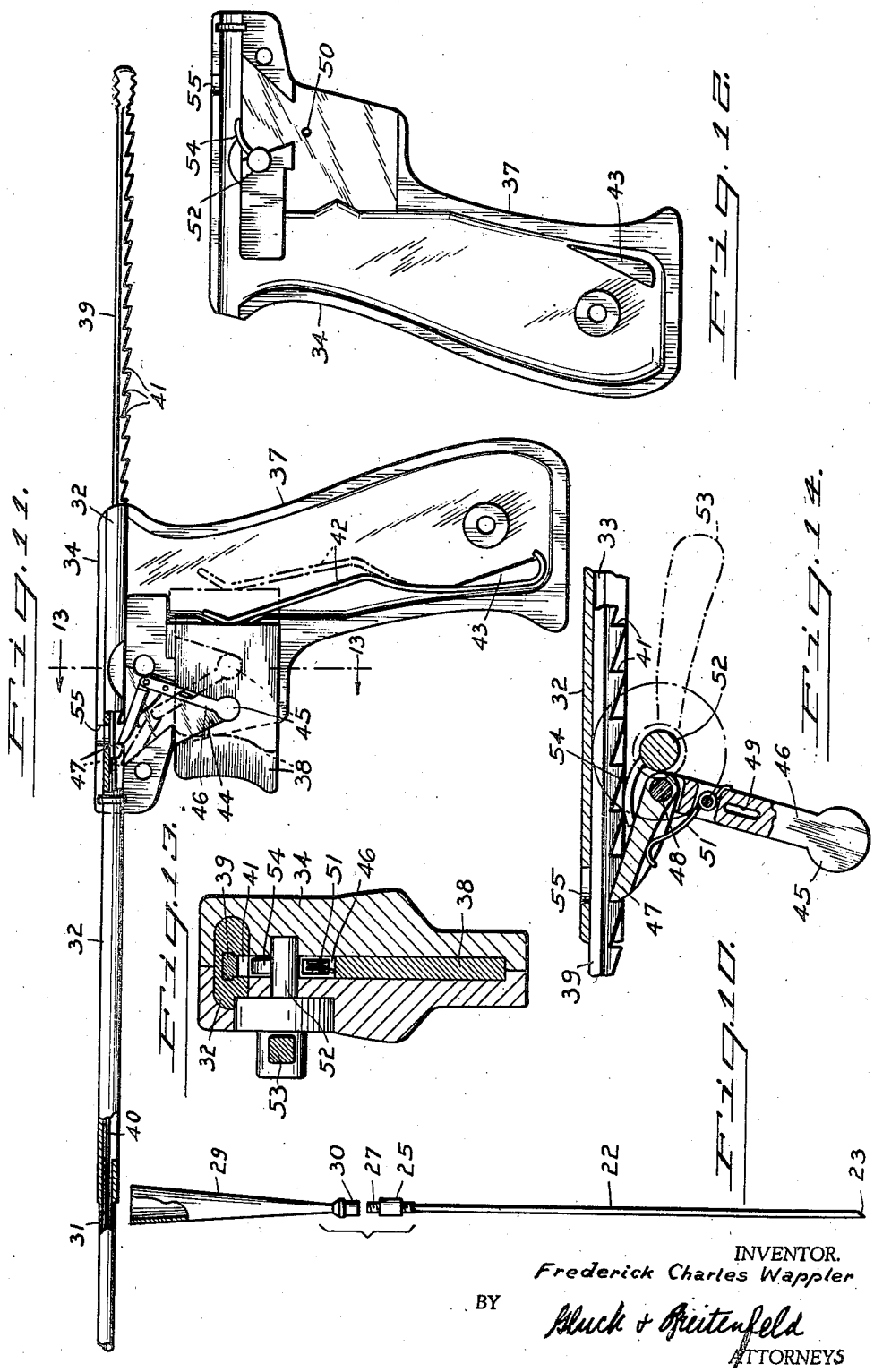

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IMPLANTING DEVICE

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4 Claims. (Cl. 128—217)

My present invention relates generally to surgical instruments, and has particular reference to an improved implanting device.

The primary object of the invention is to provide an efficient and simplified instrument by means of which small solid bodies may be implanted in the human body. Although not necessarily so restricted, my invention is primarily intended to be used for implanting so-called "radium seeds." These are minute bodies, substantially cylindrical in shape, with blunted ends. They are usually not much more than about ⅛ of an inch in length and less than $\frac{1}{32}$ of an inch in diameter; they are composed of small sections of a fine tubing, such as gold, sealed at their ends, and containing minute but very powerful quantities of a radioactive material such as radium emanations or the like. After implantation in the body, these "seeds" constitute sources of radioactivity beneficial in the treatment of cancerous growths and the like.

The extremely potent and inherently dangerous nature of these minute bodies requires the use of an implanting instrument which is absolutely reliable, so that the number of seeds loaded into the instrument, implanted into the body, or still available within the instrument, may be accurately kept track of at all times. This requirement, coupled with the minuteness of the bodies, presents special problems which the present invention aims to solve.

A feature of my invention lies in the provision of a tubular chamber or magazine adapted snugly to accommodate one or more of the rod-like bodies in tandem relation, i. e., with the bodies abutting end to end. One end of the chamber may, if desired, be sharply beveled to provide a flesh-piercing point. Projecting into the other end of the chamber is a special plunger by means of which a predetermined pressure can be exerted upon the rearmost body to bring about the desired discharge from the forward end of the chamber of the body which is at that moment ready for implantation.

In accordance with my invention, these elements of the instrument are associated with a trigger intended to be actuated by the surgeon. A specially designed means, controlled by each actuation of the trigger, serves to bring about advancement of the plunger by a predetermined increment. In the preferred embodiment of the invention, the length of this increment of advancement is an even multiple of the length of one of the rod-like bodies. For example, in the instrument herein illustrated and described, the increment of advancement of the plunger is exactly equal to the length of one of the rod-like bodies, whereby a single actuation of the trigger brings about the implantation of a single "seed."

The advancement of the plunger is preferably accomplished by means of a ratchet mechanism which serves, at the same time, to lock the plunger against inadvertent retrograde movement. A special adjustable member is provided for rendering the advancing means inoperative when retrograde movement is desired.

Another feature of my invention lies in the provision of a means for constantly indicating the number of bodies accommodated within the chamber at any instant of time. This is preferably accomplished by means of an indicator fixedly associated with the chamber, and indicia carried by the plunger arranged to register successively with the fixed indicator as the plunger moves.

A still further feature of my invention lies in the provision of a special form of loading funnel which may be removably associated with the rear end of the chamber or magazine whenever one or more of the rod-like bodies is to be fed or loaded into the instrument.

These and other features, hereinafter to be described in greater detail, contribute toward the accomplishment of the desired objective, whereby a reliable and efficient instrument is produced.

I achieve the foregoing objects, and such other objects as may hereinafter appear or be pointed out, in the manner illustratively exemplified in the accompanying drawings, in which—

Figure 1 is a top view of an implanting device embodying the features of the present invention, certain parts being broken away for the sake of clearness;

Figure 2 is a side view of the instrument shown in Figure 1;

Figure 3 is a greatly enlarged perspective view of a typical rod-like body whose implantation is to be effected by the present device;

Figures 4–8 inclusive are enlarged cross-sectional views taken, respectively, along substantially the corresponding lines indicated in Figure 2;

Figure 9 is an enlarged longitudinal view, partly in section, through the forward portion of the instrument;

Figure 10 is a view illustrating the loading funnel and its method of use;

Figure 11 is a view of the rear portion of the instrument, taken in the same direction as Figure 2, with parts removed to reveal hidden mechanism;

Figure 12 is a view of the handle portion that has been removed from Figure 11;

Figure 13 is an enlarged cross-sectional view taken substantially along the line 13—13 of Figure 11; and

Figure 14 is a greatly enlarged view of certain elements of the ratchet mechanism.

The rod-like body 20, shown most clearly in Figure 3, is of the minute size hereinbefore men-

tioned, and may have the crimped ends 21 which keep it sealed. This body, along with one or more additional bodies of the same kind, is adapted to be accommodated within the tubular chamber or magazine 22, shown most clearly in Figures 9 and 10. This chamber may be of any suitable length. Merely by way of example, it may be approximately four inches long and it may have an external diameter of approximately $\frac{1}{16}$ of an inch. At its forward end, it may be sharply beveled as indicated by the reference numeral 23, thereby defining a flesh-piercing point. Whether beveled or not, this end is preferably provided with the longitudinal slits 24, and the portions between these slits are caused to converge slightly toward the front. In this way, the bodies within the chamber are prevented from escaping through this end except under a deliberate expulsive force, in which case the inherent springiness of the forward end of the chamber allows it to expand sufficiently to permit the discharge of one or more of the bodies.

At its rear end, the chamber 22 is preferably provided with the enlarged portion 25. Immediately in front of this portion I have shown an exteriorly threaded portion 26, and immediately behind the portion 25 I have shown an exteriorly threaded portion 27. At the extreme rear end, the chamber 22 is preferably internally beveled as indicated at 28.

When the device is to be loaded, the chamber 22 is separated from the instrument as a whole, and the special loading funnel 29 (Figure 10) is associated with its rear end. For this purpose, the forward end of the funnel 29 is provided with an internally threaded attachment neck 30 which is adapted to engage with the threaded portion 27. After this engagement has been effected, one or more of the rod-like bodies 20 are introduced into the wide end of the funnel 29, and these find their way, one by one, into the chamber 22. The bevel 28 helps them to become properly aligned. It will be observed that the chamber 22 has an internal diameter which is just sufficient snugly to accommodate these bodies. There is, accordingly, no danger or likelihood of any jamming, and when a number of these bodies are accommodated within the chamber 22 they are arranged in tandem relation as shown in Figure 9, i. e., each of the bodies 20 is in endwise abutment with the body in front of it and the body behind it.

After the chamber 22 has been loaded, it is separated from the funnel 29, and brought into engagement with the forward end of the hollow tubular extension 31, as indicated in Figure 9. The internal diameter of the tube 31 may be considerably larger than that of the chamber 22.

The rear portion of the tube 31 is fixedly mounted in association with the elongated member 32 which is preferably of substantially elliptical contour as indicated in Figures 7 and 8. For a purpose presently to be described, the member 32 is provided with a T-shaped longitudinal slot 33.

The member 32 is mounted in and projects forwardly from a housing 34. This housing may be conveniently made of any suitable molded material, and is preferably constructed in the split form of two complementary halves secured together, in separable relation, by the threaded studs 35 and 36. The housing 34 is internally configured to provide suitable accommodation for the rear end of the member 32, and for the pivots, springs, and other elements of the mechanism presently to be described.

It will be observed that the housing 34 is shaped to include the pistol-grip handle 37. Associated with this handle, preferably on the forward portion thereof, is a trigger 38, the intention being that the surgeon will grasp the handle 37 as he would a pistol, placing his forefinger on the trigger 38.

Mounted in the T-shaped slot 33 is the rear portion 39 of a plunger. The forward portion 40 of this plunger, shown most clearly in Figure 9, is of substantially circular cross-section so that it may fit snugly into the chamber 22 behind the series of bodies 20 which are accommodated in the chamber. The rear portion 39 of the plunger, as indicated most clearly in Figures 8 and 13, is of substantially T-shaped cross-section so that it may slide smoothly within the slot 33. The under-surface of the portion 39 is provided with a series of ratchet teeth 41.

Referring now to Figures 11, 13 and 14, it will be observed that the trigger 38 is an independent element slidably mounted within the handle 37. Its rear surface presses against a spring 42, secured within the housing, as at 43, whereby the trigger 38 is constantly but yieldably urged into the projecting position shown in Figure 2 and in full lines in Figure 11. When the trigger is actuated, it moves into the dot-and-dash position of Figure 11.

The ratchet mechanism may be of any suitable character. I have illustratively shown the upper portion of the trigger 38 provided with a V-shaped notch 44. Within the rounded apex of this notch the trigger pivotally engages with the rounded end 45 of a pawl shown most clearly in Figure 14. This pawl preferably consists of two parts 46 and 47, pivoted to each other as at 48. The slot 49 in the portion 46 fits over a pivot pin 50 provided in the housing, whereby actuation of the trigger 38 causes the member 46 to pivot from the full-line position of Figure 11 to the dot-and-dash position. A spring 51, secured to the member 46, constantly presses upwardly upon the member 47. Accordingly, whenever the trigger 38 is actuated, the pawl member 47 engages with one of the teeth 41 and advances the plunger by the predetermined increment. The parts are preferably constructed so that the length of this increment is an even multiple of the length of the body 20. In the illustrated instrument, this increment of advancement is exactly equal to the length of the body 20, so that when the trigger 38 is actuated, the pawl member 47 moves from the full-line position of Figure 11 to the dot-and-dash position of this figure, a single body 20 is discharged from the forward end of the instrument.

Whenever the trigger is released, the pawl member 47 rides over the inclined face of the next tooth, and snaps into a position of readiness for the ensuing advance movement of the plunger. In this way, it will be observed that the plunger is normally locked against any retrograde movement. However, whenever retrograde movement of the plunger is desired, the advancing mechanism may be rendered momentarily inoperative. This is preferably accomplished by means of an adjustable member pivoted in the housing at 52. On the outside of the housing, the pivot 52 carries a handle 53. On the inside, it carries the finger 54 which engages with the top surface of the pawl member 47. Under normal conditions, the handle 53 is in the full-line

position of Figure 2, and the ratchet mechanism is operative. When the handle **53** is thrown into the dot-and-dash position of Figure 2 the finger **54** presses downwardly upon the pawl **47**, thereby holding this pawl out of engagement with the ratchet teeth **41**.

In the upper portion of the housing **34** I provide a sight opening **55**. An aligned opening is also provided in the upper wall of the member **32**. This opening serves as a fixed indicator, i. e., an indicator that is in fixed positional relation to the chamber **22**. On the upper face of the toothed portion **39** of the plunger I provide a series of indicia **56** which are adapted to register successively with the opening **55** as the plunger is moved. These indicia may be of any suitable character, and preferably consist of a series of numbers which show through the opening **55**. The numbers are so positioned that when the plunger is in contact with the rearmost body within the chamber **22**, the number showing through the opening **55** indicates the exact number of bodies within the chamber **22**.

The operation of the instrument will be obvious from the description hereinbefore given. After the chamber is loaded and associated with the housing and handle, the plunger is inserted forwardly through the member **32** until it contacts with the rearmost body **20** in the chamber **22**. Subsequent actuation of the trigger serves to discharge one body after another from the forward end of the instrument.

Where the forward end of the instrument is intended to be pierced into the portion of the body where implantation is to be effected, it may under certain circumstances be desirable to employ the gauge sleeve **57**. This is a sleeve of predetermined length adapted to be fitted over the forward end of the instrument and to be secured in screw-threaded relation to the threaded portion **26** of the chamber **22**, as shown most clearly in Figure 9. The forward end of the sleeve **57** serves as a gauge to enable the surgeon more accurately to control the extent of which the pointed end of the instrument is inserted into the body.

It will be understood that under certain circumstances the forward end of the instrument need not necessarily be pointed. Also, the entire device shown and described herein may be adapted for use through an outer endoscopic sheath.

While I have illustrated and described an instrument specially designed for implantation of rod-like "seeds" of the character shown in Figure 3, nevertheless it will be understood that certain phases of my invention are not restricted to this special use. Other types of solid bodies may conceivably be implanted by means of the present device and the general utility of the instrument in connection with the implantation of solid material generally will be readily understood by those skilled in the art.

In general, it will be understood that the details herein described and illustrated may be readily modified by those skilled in the art without departing from the spirit and scope of the invention as expressed in the appended claims. For this reason, it is intended that these details be interpreted as illustrative, and not in a limiting sense.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is—

1. In an implanting device of the character described, a tubular chamber adapted to accommodate, in tandem relation, a series of rod-like bodies intended to be discharged through the forward end of said chamber, a housing at the rear end of said chamber, a plunger extending into said chamber through said housing, a handle carried by said housing and provided with a trigger, means controlled by each actuation of the trigger for advancing the plunger by a predetermined increment, said means comprising a ratchet mechanism in said housing interposed between said trigger and said plunger, and means for indicating the number of bodies accommodated within the chamber at any instant of time, said means comprising a sight opening in said housing and indicia carried by the plunger and arranged to show through said sight opening as the plunger moves.

2. In an implanting device of the character described, a tubular chamber adapted to accommodate, in tandem relation, a series of rod-like bodies intended to be discharged through the forward end of said chamber, a housing at the rear end of said chamber including a pistol-grip handle, said housing having a sight opening therein, a plunger extending into said chamber through said housing, a trigger carried by said handle, means controlled by each actuation of the trigger for advancing the plunger by a predetermined increment, said means comprising a ratchet mechanism in said housing interposed between said trigger and said plunger, and means for indicating the number of bodies accommodated within the chamber at any instant of time, said means comprising indicia carried by the plunger and arranged to show through said sight opening as the plunger moves.

3. In an implanting device of the character described, a tubular chamber adapted to accommodate, in tandem relation, a series of rod-like bodies intended to be discharged through the forward end of said chamber, said forward end being sharply beveled to define a flesh-piercing point and having yieldable convergent springy wall portions adapted to prevent said bodies from escaping from the chamber except under deliberate expulsion, a housing at the rear end of said chamber, a plunger extending into said chamber through said housing, a handle carried by said housing and provided with a trigger, and means controlled by each actuation of the trigger for advancing the plunger by a predetermined increment, said means comprising an intermittent-advance mechanism arranged in said housing and interposed between said trigger and said plunger, said mechanism being so designed that each increment of advance of said plunger is an even multiple of the length of one of said rod-like bodies.

4. In an implanting device of the character described, the combination with the elements set forth in claim 3, of means for indicating the number of bodies accommodated within the chamber at any instant of time, said means comprising a sight opening in said housing and indicia carried by the plunger and arranged to show through said sight opening as the plunger moves.

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