United States Patent [19]

Jefferts

[11] **3,820,545**

[45] **June 28, 1974**

[54] **TAG IMPLANTING MACHINE**

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[52] **U.S. Cl.** **128/330,** 119/3, 128/217
[51] **Int. Cl.** **A61b 17/00,** A01k 61/00
[58] **Field of Search** 119/3; 128/217, 330

[56] **References Cited**

UNITED STATES PATENTS

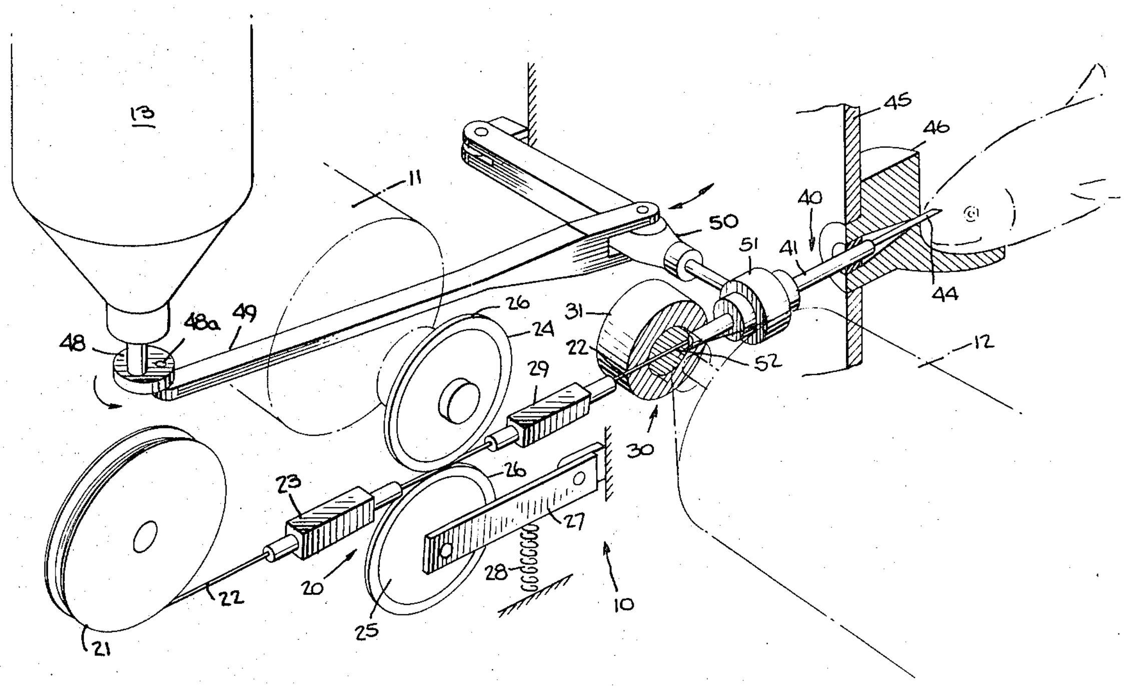
3,058,465	10/1962	Bell	128/217
3,313,301	4/1967	Jefferts et al.	128/330
3,369,525	2/1968	Debrotnic et al.	119/3

Primary Examiner—Aldrich F. Medbery
Attorney, Agent, or Firm—Kenyon & Kenyon Reilly Carr & Chapin

[57] **ABSTRACT**

A method and apparatus are disclosed for implanting identifying tags into a macro-organism so that its movement from one habitat to another may be studied. A supply of wire is incrementally advanced by means of a drive motor along a substantially straight path through a cutting and implanting means. The cutting means serves to cut a short length of wire suitable for implantation from the length of wire, the cut length then by means of the remaining uncut wire being advanced to the impanting means. The implanting means includes a reciprocating hypodermic needle through which the cut segment of wire is advanced by the supply of wire and implanted in the macro-organism.

16 Claims, 5 Drawing Figures



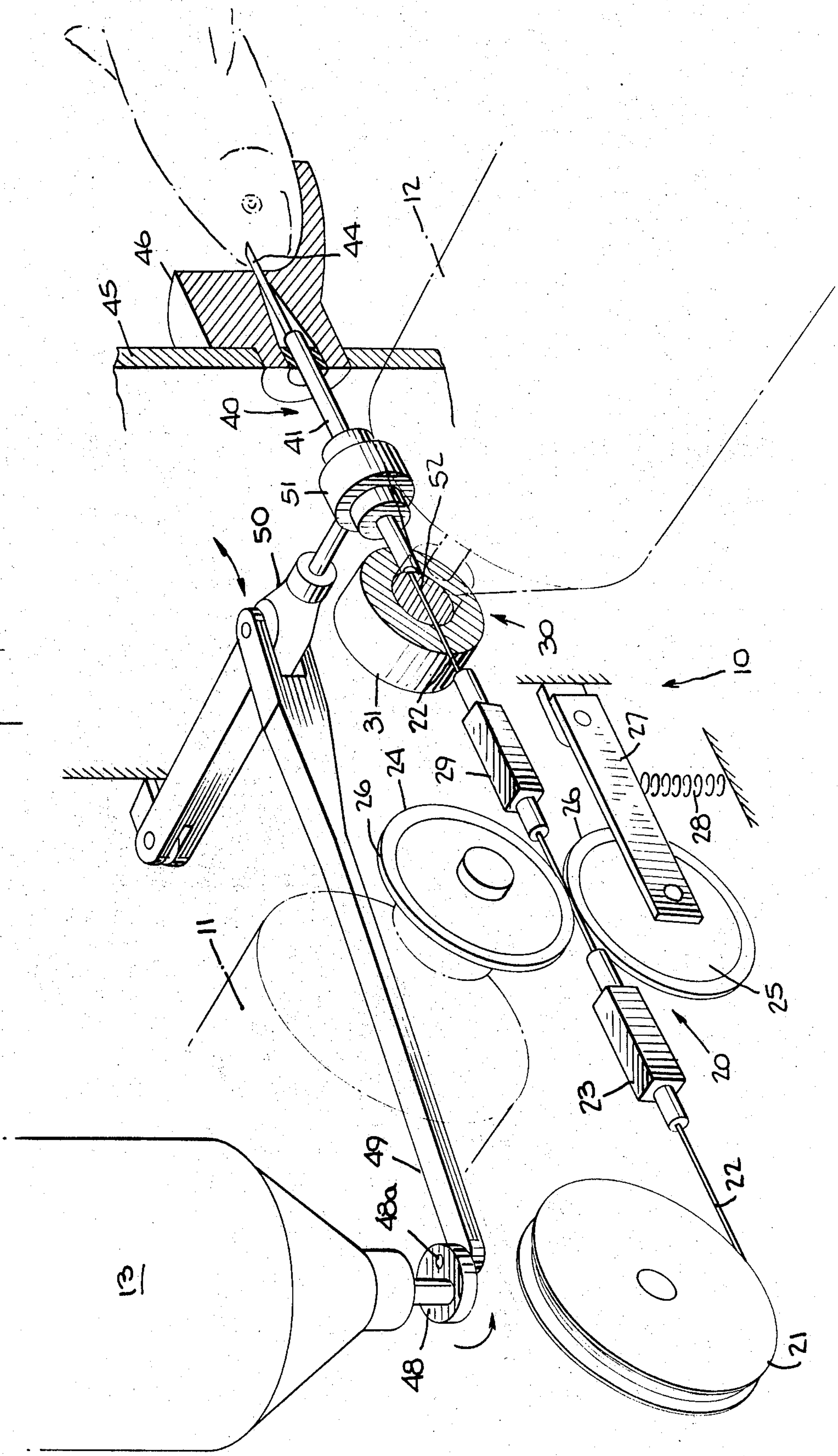

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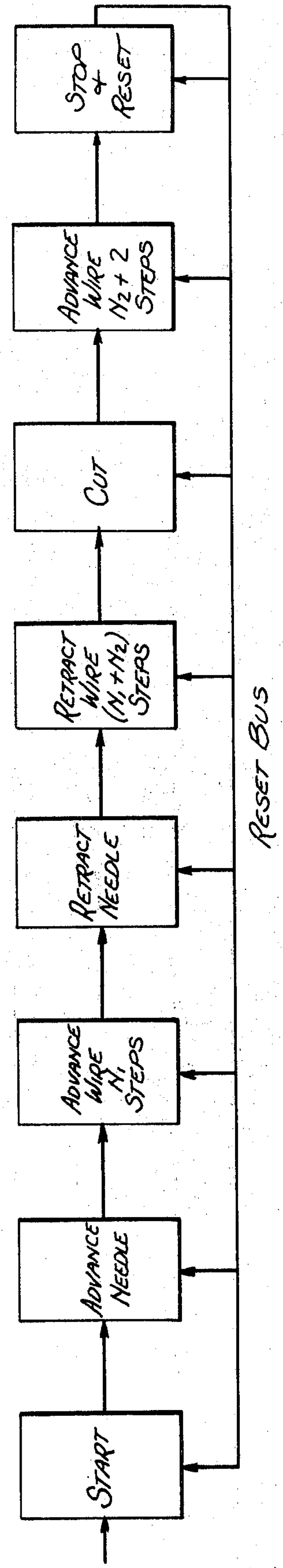
Fig.1.

FIG. 3.

FUNCTIONAL BLOCK DIAGRAM OF PROGRAMMABLE CONTROLLER FOR WIRE TAG INJECTOR



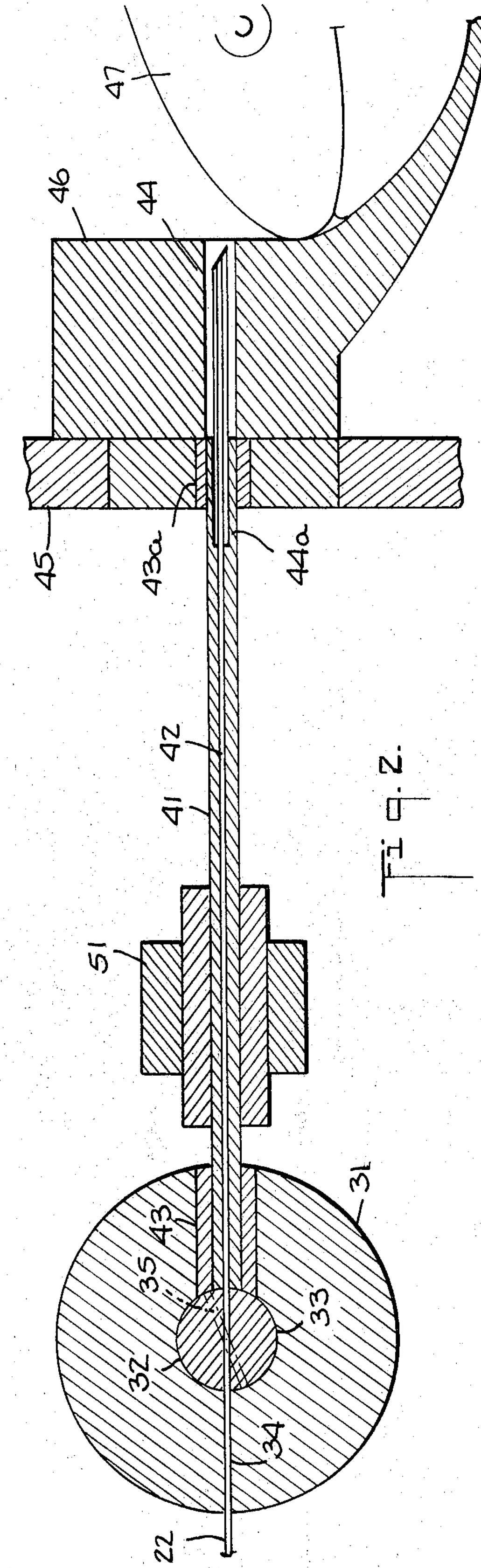
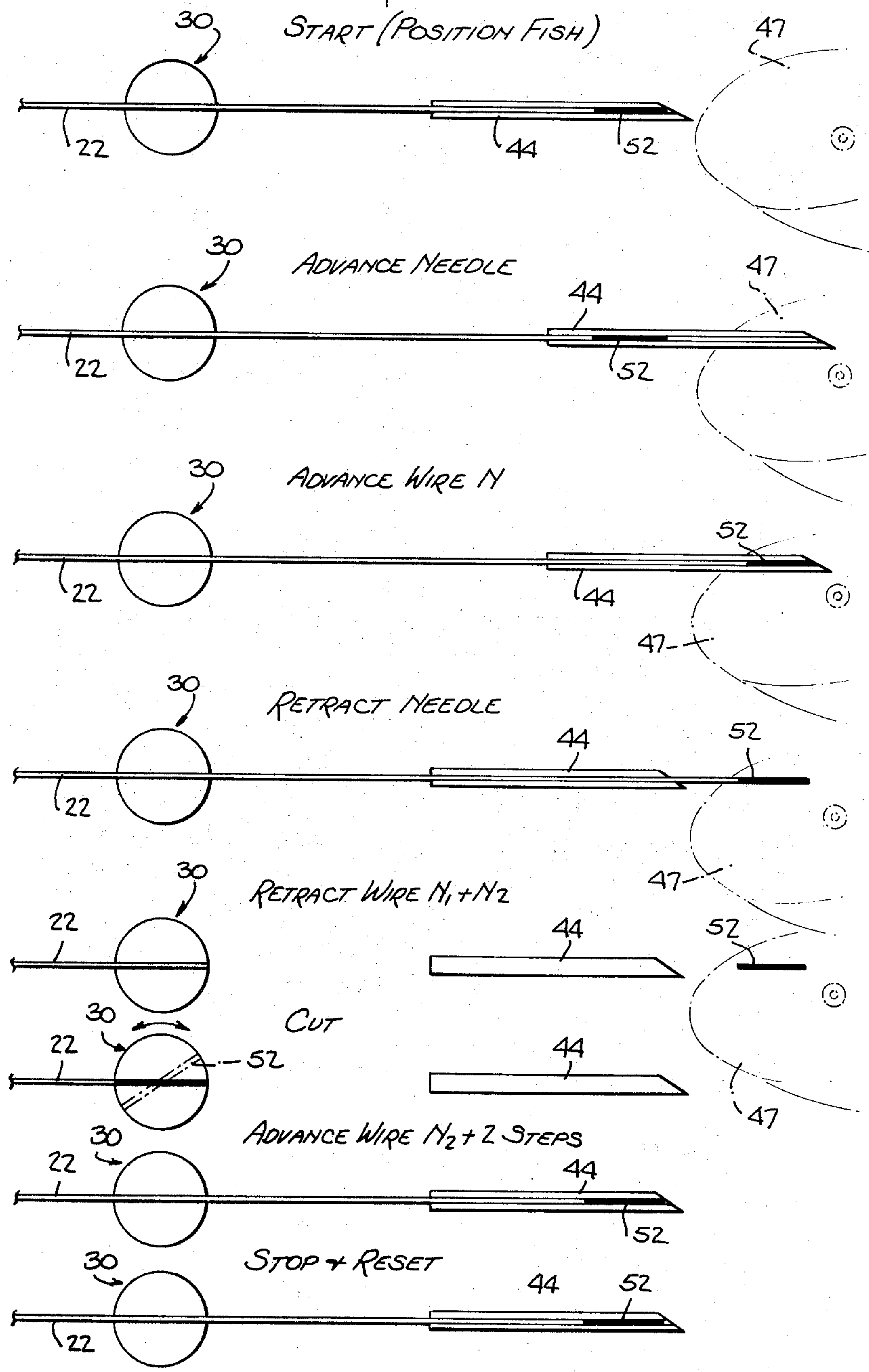


FIG. 2.

Fig. 4


START (POSITION FISH)
30
22
44
52
47
ADVANCE NEEDLE
30
22
44
52
47
ADVANCE WIRE N
30
22
44
52
47
RETRACT NEEDLE
30
22
44
52
47
RETRACT WIRE N1 + N2
30
22
44
52
CUT
30
22
52
44
47
ADVANCE WIRE N2 + 2 STEPS
30
22
44
52
STOP + RESET
30
22
44
52

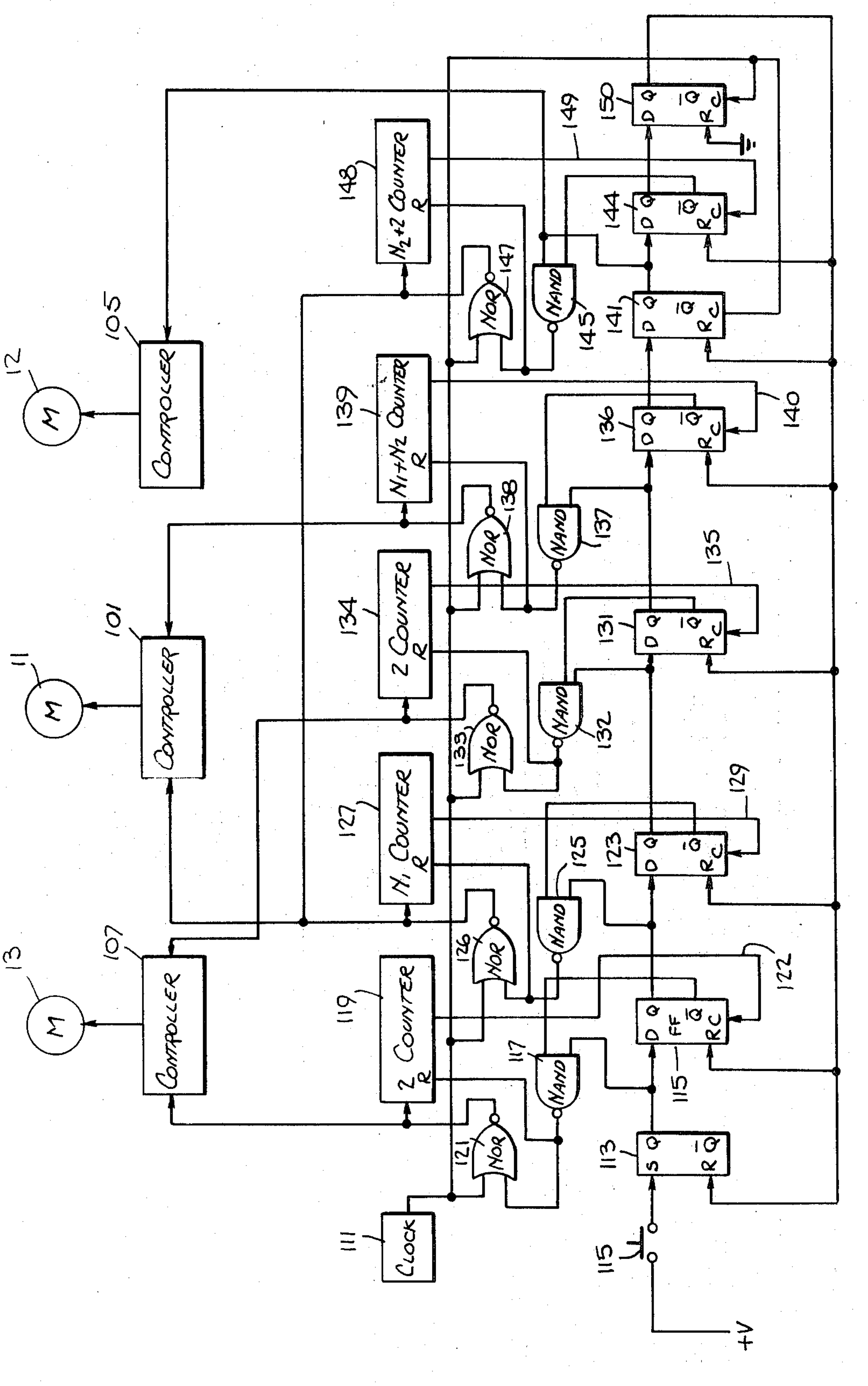

CONTROLLER
CONTROLLER
CONTROLLER
M
M
M
CLOCK
2 COUNTER
N_1 COUNTER
2 COUNTER
N_1+N_2 COUNTER
N_2+2 COUNTER
NOR
NAND
+V

Fig. 5.

TAG IMPLANTING MACHINE

BACKGROUND OF THE INVENTION

This invention relates to a method and apparatus for implanting tags into an object, and more particularly to one wherein the tags are severed from a supply of wire and incrementally advanced to an implanting means.

U.S. Pat. No. 3,128,744, issued to Peter K. Bergman and myself on Apr. 14, 1964, discloses a method for investigating the migratory habits of macro-organisms by implanting therein a relatively small tag containing identifying data thereon. The organism, which after implantation is released to its normal environment, when subsequently recovered along with other organisms is passed through a detecting means which is capable of identifying those containing a tag therein. This detecting means is preferably a magnetic detecting apparatus which is suitable for sensing the presense of an identifying tag formed of magnetic material. An implanting means of a portable type is described in my earlier patent and uses a hypodermic injector. This portable injector is adapted to operate with precut segments of wire which are placed in the machine and by means of the manually actuated plunger are implanted into the macro-organism.

More recently, an identification tag implanting machine was disclosed in U.S. Pat. No. 3,369,525 issued to Debrotnic et al. on Feb. 20, 1968. This device is somewhat more automatic than my earlier hand plunger in that it cuts segments of wire from a large spool and by means of a reciprocating bar transports the cut segment to a tag injector. Tag injection is accomplished by using pressure placement of the fish against a bonnet with the fish being forced onto a needle so that an identifying tag may be implanted therein.

In my later U.S. Pat. No. 3,545,405, issued on Dec. 8, 1970, is disclosed an improved identifying tag. Identifying tags used in conjunction with the investigation of the migratory habits of organisms must be small for biological reasons. In this respect, it has been found that a tag with a geometry of .010 inch diameter by .040 inch long is most satisfactory. My improved identifying tag has on its circumference binary coded information in the form of indentations arranged in a predetermined pattern rather than the earlier types of tags which included different colors or stripes painted thereon. The method and apparatus of this invention is particularly well suited for usage with identifying tags of the type described in my earlier patent. However, other types of tags might be utilized if so desired.

SUMMARY OF THE INVENTION

Briefly stated, the apparatus of the invention described herein is directed at a means for implanting wire segments into an object and in this connection employs a supply of wire which is incrementally advanced along a predetermined substantially straight path. Cutting means are disposed along the predetermined path and serve to cut segments of wire from the supply. Adjacent the cutting means and also along the predetermined path is a means for receiving the severed length of wire. The severed length of wire is incrementally advanced through the apparatus along with the supply of wire, the former thereby being positioned for implantation into the object.

In a more specific aspect of the invention, the cutting means includes a rotary cutting member which has an aperture extending therethrough. This aperture is positioned in line with the predetermined straight path along which the supply of wire is advanced. Means are provided for rotating the cutting member and thereby moving the aperture away from the predetermined straight path to cut the segment of wire within the aperture from the remainder of the supply of wire. As described, the cutting member includes an outer housing which has an opening in which a member is rotatably mounted. Both the outer housing and the rotatably mounted member have an aperture extending therethrough, the aperture being in line with the predetermined path. Means are further provided to incrementally rotate the rotatable member both in a clockwise and counterclockwise direction so as to effect severing of the wire segment and also to return the member to its original position ready to repeat the cycle.

Advancement of the supply of wire, as described in the preferred embodiment, includes a pair of oppositely disposed friction drive wheels with the supply of wire positioned therebetween. In this manner, the supply of wire is linearly moved when the drive wheels are rotated by means of an incrementally rotatable drive motor.

The apparatus, as described, further includes a needle which is adapted to be inserted into the object, the needle having an aperture disposed in line with the predetermined path of the supply of wire. Means are provided to advance the needle a predetermined distance so as to penetrate the object for implantation purposes. Means are further provided for retracting the needle from the object while allowing the severed segment of the wire to remain implanted in the object. A drive motor for advancing the needle has mounted on its output shaft an eccentric member which has the end of a linkage bar attached thereto. The other end of the linkage bar is coupled to the needle so that upon rotation of the drive motor, the needle is caused to reciprocate in a linear direction.

In practicing the invention, a segment of wire is cut from the supply of wire and advanced to a predetermined position with respect to an implanting means. The implanting means is advanced so as to become partially embedded in the macro-organism while the cut segment of wire is advanced by means of the supply of wire a distance approximately equal to the advancement of the implanting means. The implanting means is next retracted out of the macro-organism while the cut segment of wire is allowed to remain implanted therein. Subsequently, the supply of wire is retracted a distance sufficient to position a portion thereof within the cutting means so as to allow for the cycle to be repeated. By following the procedure and utilizing the apparatus described herein, an effective implantation is accomplished automatically in a manner suitable for handling large quantities of macro-organisms in a short period of time.

Accordingly, it is an object of this invention to provide an improved tag implanting means which is adapted to effectively and automatically accomplish implantation.

It is a further object of this invention to provide a novel method and means for implanting identifying tags into macro-organisms so that their migratory habits may be studied.

It is still another object of this invention to provide a method and apparatus for severing small segments of wire suitable for implantation from a supply of wire and advancing them to an implanting mechanism which is adapted to implant the severed segment of wire into a macro-organism.

These and other objects, advantages and features of the invention will become more apparent from the following description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of the implanting machine of this invention;

FIG. **2** is an enlarged elevation view, partly in cross-section, of the cutting and implanting means of this invention;

FIG. **3** is a block diagram illustrating the operational steps utilized in the practice of this invention;

FIG. **4** is a diagramatic illustration of the manner in which implanting of the macro-organism is accomplished in accordance with this invention; and

FIG. **5** is a schematic diagram of the electronic circuitry of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to the drawings, and particularly FIG. **1**, the implanting apparatus **10** includes three individual stepper motors **11, 12,** and **13.** The stepper motors are of a type which have an incremental rotational output and are also capable of being driven in either a clockwise or counterclockwise direction. A suitable motor of this type is manufactured by Sigma Instruments Company, Braintree, Massachusets.

The implanting apparatus **10** includes three principal assemblies, namely a wire drive assembly **20**, a rotary cutter assembly **30** and an implanting assembly **40**. Each of these assemblies is driven respectively by stepper motors **11, 12** and **13.**

The wire drive assembly **20** includes a spool of wire **21** which is preferably of a magnetic character and has a diameter of approximately .010 inch suitable when cut into segments, for implantation into macro-organisms. The wire itself denoted as **22,** is routed through a guide **23** and into the drive members. The drive members include a pair of oppositely disposed wheels **24** and **25,** the former being driven by stepper motor **11.** Each of the wheels **24** and **25** is provided with a friction type surface at **26,** rubber being a preferred material, so that the wire is effectively gripped and moved when the wheels rotate. The lower or idler wheel **25** is mounted on an arm **27** which is biased upwardly by the spring **28** so as to urge the wheel **25** into engagement with the wire **22.** The wire **22** as it exits from the drive assembly **20** is routed through another guide **29.**

From guide **29,** the wire **22** continues along a straight path into cutter assembly **30.** Cutter assembly **30,** illustrated in FIGS. **1** and **2,** includes an outer housing **31** which has a circular opening **32** at its center. Within the opening **32** is mounted a rotatable spindle **33** which is coupled to and driven by stepper motor **12.** Both the housing **31** and spindle **33** are preferably of a tungsten carbide or other hard material and have an aperture **34** and **35** respectively extending therethrough. As more fully described below, segments of wire are cut from the continuous length of wire **22** by rotating spindle **33** with respect to the stationary housing **31.**

The implanting assembly **40** is located at the downstream side of the spindle **33** and includes an elongated guide **41** which has an aperture **42** extending therethrough. The wire as it exits from the cutter assembly **30** accordingly enters aperture **42.** Tube **41** has one end abutting the spindle **33** when in the inactive position, the tube **41** being slidably mounted within housing **31.** On the other end of tube **41** is mounted a hypodermic needle **44** which serves to implant the identifying tag into the macroorganism. Tube **41** is further supported by sleeve **43**a mounted in wall **45.** Again, the fit between sleeve **43**a and tube **41** is such that the tube is free to be reciprocated therewithin. Also mounted on wall **45** is a receptacle **46** wherein the salmon **47** or other object under study is positioned.

The implanting assembly **40** is driven by stepper motor **13** which as illustrated in FIG. **1,** has on its output shaft an eccentric member **48** which is coupled to linkage bar **49** by means of a pin **48**a. The linkage bar **49** at its other end is connected by means of lever **50** and coupling **51** to the slidably mounted tube **41.** In this manner, as the stepper motor **13** is driven, linkage **49** causes bar **50** to reciprocate in the direction indicated by the arrow in FIG. **1.** This in turn causes the tube **41** and hypodermic needle **44** to reciprocate.

The supply of wire **21** is preferably provided with identifying data such as the type described in my earlier U.S. Pat. No. 3,454,405. Of course, means could be provided as a part of this apparatus to impart the identifying data onto the wire **22** prior to cutting. The supply of wire, driven by the wire drive assembly **20,** is routed along a straight path to the cutting assembly **30** in incremental steps so that a precise 0.040 inch long tag is cut. The continuous supply of wire **22** is then used to push the cut tag through the hypodermic needle and into the presented macro-organism. This operation is described below in greater detail. Stepper motor **11,** which drives friction wheels **24** and **25,** advances its shaft in precise 1.8° steps or increments. Accordingly, the diameter of roller **24** thus determines the linear travel of the wire **22.** By using a diameter of 1.273 inches, the linear travel of the wire for each incremental advancement of stepper motor **11** is .020 inch or one half of the desired tag length.

The cutter assembly **30** effects cutting of individual segments from the supply of wire **21** by means of the rotating spindle mounted in housing **31.** Spindle **33** is rotated by stepper motor **12** which rotates both clockwise and counterclockwise in precise 15° increments. In this manner, the wire **22** is cut by rotating the spindle **33** for 15° with respect to the stationary housing **31.** The severed segment of wire is repositioned by rotating the spindle **33** 15° in a direction opposite to that used to effect cutting. The cut tag **52** is located within spindle **33** and in the path of movement of the uncut wire **22.** The cut segment of wire **52** is then advanced to the hypodermic needle **44** by means of the supply of wire **22.** One additional feature of the rotary cutting spindle **33** is that the cutting edges when they become dull, may be simply replaced by rotating the spindle 180°. This presents a new set of cutting edges.

The implanting assembly **40** effects linear reciprocating movement of hypodermic needle **44** so as to cause implantation of the cut segment of wire **52** into the fish **47.** Implantation by means of the reciprocal needle **44** insures that the tag will be inserted without tearing the specimen and also allows for precise placement of the tag. The hypodermic needle **44** employed in the illustrated assembly has a .022 inch outside diameter and is 2 inches long. The needle **44** is carried in a .125 inch diameter needle carrier **44***a* which is in turn mounted in the implanting end of tube **41**. The inactive or neutral position of the tube **41** has one end thereof abutting the spindle **33** in cutter assembly **30**. After the identifying tag **52** is cut, it is advanced into the hypodermic needle **44** via tube **41** by means of the supply of wire **22**. The tube **41** and needle **44** are in turn advanced by stepping motor **13** in a programmed manner. In the preferred embodiment, full advancement of needle **44** is approximately 3/16 inch and is accomplished in each cycle. The amount of needle penetration depends upon the size and position of the fish support receptacle **46** and may be modified in accordance with the particular requirements. Once needle **44** is fully extended, the tag **52** is advanced through the needle aperture and into the fish an amount dependent upon the advancement of the supply of wire **22**. Once the tag **52** and supply of wire **22** are sufficiently advanced and the cut segment **52** is properly implanted, the needle **44** is retracted. Subsequently, the supply of wire **22** is retracted thereby leaving the cut segment of wire **52** implanted in the macro-organism. This particular sequence of operation, which is more fully described below, avoids the problems associated with retracting the implanted tag along with the needle assembly during withdrawal.

To review the operation of this invention, specific reference is made to FIGS. **3** and **4**. FIG. **3** is a functional block diagram outlining the various movements whereas FIG. **4** graphically illustrates the movement of the hypodermic needle **44**, supply of wire **22**, cut segment of wire **52**, and cutter assembly **30**. In normal operation, the sequence is started by positioning the fish within the receptacle **46**. The hypodermic needle **44** is then advanced by means of stepper motor **13** to the fully forward position to penetrate the fish being implanted. The third step in the sequence of operation calls for advancing the supply of wire **22** a predetermined distance N1 steps, so that the previously cut segment of wire **52** is positioned with its end adjacent the end of the needle and therefore within the body of the fish being tagged. The hypodermic needle **44** is then retracted from the fish and returned to its inactive or original starting position. The supply of wire is then also retracted, the distance of retraction being N1 + N2 steps, thereby leaving the identifying tag **52** at its implanted position in the fish **47**. This sequence of first withdrawing the implanting needle **44** and then the supply of wire **22** avoids possible inadvertent removal of the tag **52** from the fish. The wire, retracted a distance of **N1** + **N2**, is thereby positioned such that its end portion is two steps within the cutter **30**; this incremental length is cut upon rotation of spindle **33** in cutter assembly **30** and becomes the next tag. The wire is then advanced a distance of **N2** + 2 increments so as to position the cut segment of wire **52** at the end of the hypodermic needle **44**. This completes the cycle and returns the various components to a position from which the cycle may be repeated.

A block-logic diagram of a suitable embodiment of a programmable controller which may be used to provide the sequencing described above in connection with FIGS. **3** and **4** is shown in FIG. **5**. Each of the motors **11, 12** and **13** has a controller circuit associated therewith to provide the necessary voltage outputs to cause the motors to step in the desired manner. Such controllers for use with stepper motors are well known and such circuits or details of how to construct them may be obtained from the stepper motor manufacturer. Thus, these portions of the system are indicated in block diagram form. Each of the circuits includes means which will respond to input pulses to provide output pulses at proper voltages to cause the motors to step in the desired manner. Associated with motor **11**, the motor which provides for advancing and retracting the wire, is shown a controller **101**. Motor **12**, which provides the cutting action is driven through controller **105**. The controller for motor **13** is indicated by block **107**. This drives the motor **13** to advance and retract the hypodermic needle **44** of FIGS. **1** and **2**.

The remainder of FIG. **5** illustrates the logic circuits which provide the necessary inputs to the controllers **101, 105,** and **107** to provide the previously described sequence of operation. These logic elements comprise known devices which are available in microcircuit form from manufacturers such as Fairchild, Texas Instruments and so on. A system such as that illustrated in FIG. **5** has been constructed using logic elements which operate at the logic levels where logic 0 equals 0 volts and logic 1 equals + 15 volts. It will be recognized that the system is not limited to these levels in that other voltages may be used.

The sequencing is performed under the control of a clock **111**. Typically, the clock may provide a square wave output at a frequency of 200 Hz. Once the fish or other macro-organism is positioned to have the wire implanted, the sequence may be started by providing an input to a latch **112** which may be a convenetional set-reset flip flop. This input may be provided, for example, by a push button switch **115**. A positive input to the set input of flip flop **113** will cause its Q output to go to the 1 state. The Q output of flip flop **113** is provided as the D input to a D type flip flop **115**. The nature of a D type flip flop is such that when an input at a logic 1 level is provided to its C input, the level present at its D input will be transferred to its Q output. As is normal with flip flops the Q and $\overline{Q}$ outputs of a D flip flop are complementary. Prior to beginning the implanting sequence, all of the flip flops are reset and thus flip flop **115** will have a 1 level out of its $\overline{Q}$ output terminal This output provides one input to a Nandgate **117** which obtains its second input from the Q output of flip flop **113**. At this point in time, both of these inputs will be a 1. The nature of a Nandgate is such that with two 1 s at its input, it will provide a 0 at its output. With any other combination of inputs, i.e. if either or both inputs are 0, its output will be a 1. Thus, as soon as flip flop **113** is set, Nandgate **117** will have two 1 inputs and will provide a 0 output. The output of Nandgate is provided as a reset input to a digital counter **119** arranged to provide an output after two input pulses, i.e. a two counter. Prior to flip flop **113** being set, the 1 from Nandgate **117** was holding counter **119** in a reset condition. When the output of Nandgate **117** goes to 0, counter **119** becomes enabled to count pulses at its input. The output of Nandgate **117** is also provided to a Norgate **121** which has as its second input the output of clock **111**. The nature of a Norgate is such that only when both of its inputs are at a 0 level will its output be a 1. With a 1 at either input, its output will remain at 0. Thus, for as long as Nandgate **117** had an output which remained at 1, the output of Norgate **121** remained at 0. Now with a 0 input from Nandgate **117**, Norgate **121** will be enabled so that each time a clock pulse at a 0 level appears at its other input, the output of Norgate **121** will go to 1. This output is provided to the input of counter **119** and also to the controller **107.**

As described above, each time a pulse is provided into controller **107,** it will provide an appropriate output pulse to drive motor **13** one step. With Norgate **121** enabled, a first pulse will be allowed to pass therethrough and cause counter **119** to advance **1** count and motor **13** to advance one step. Similarly, the next count will cause motor **13** to advance another step and counter **119** to advance one more count. At this point, counter **119,** since it is a two counter, will provide an output on line **122** to the clock input of flip flop **115** and cause the **1** at the D input to be transferred to the Q output. When this happens the $\overline{Q}$ output will go to 0 causing the output of Nandgate **117** to go from a 1 to a 0 and disable Norgate **121** from permitting further clock pulses to be provided to counter **117** or controller **107.** The output of Nandgate **117** will also reset counter **119** so it is ready for the next sequence. The needle is now inserted into the fish as shown on FIG. **4** under the heading "advance needle." It should be noted that in the present example, two steps of the motor are used to advance the needle to penetrate the fish. This is only used as an example and in other applications, more or less of a needle advancement may be used. In such a case, it is only necessary to adjust the modulo of counter **119** to provide the required number of advance steps to obtain the needed penetration.

The output of flip flop **115** is provided to the D input of a second D type flip flop **117** and as one input to a Nandgate **118.** In the manner described above in connection with Nandgate **117,** Nandgate **125** will have an output which goes from 0 to 1 since it now has two 1 s on its input and will enable Norgate **126** to permit clock pulses to enter the N_1 counter **127** and also to permit pulses to be provided to the controller **101.** Counter **127** will be arranged to provide an output on line **129** after N_1 pulses. Thus, N_1 pulses will be allowed to pass through Norgate **126** into counter **127** and to controller **101** causing motor **11** to advance N_1 steps as shown by FIG. **4.** At this point, the length of wire **22** is in engagement with the cut segment **52** which is within the fish **47.** The output from counter **127** now provides an input on line **129** to the C input of flip flop **123** causing the 1 at its D input to be transferred to the Q output. This in turn causes the $\overline{Q}$ output to go to 0 and the output of Nandgate **125** to go to 1 disabling Norgate **126** and resetting counter **127.**

In similar fashion, the Q output of flip flop **123** is provided to a D type flip flop **131** and a Nandgate **132** permitting pulses to pass through a Norgate **133** to a two counter **134** and to the controller **107.** The two counter will allow two pulses to be counted and motor **13** to be moved two steps to retract the needle **44** before counter **134** provides an output on line **135** to the C input of flip flop **131** which will cause Nandgate **132** to disable Norgate **133** and reset counter **134.** The needle is now retracted with the tag **52** remaining in the fish **47** and wire **22** still extended and in engagement with the tag **52.** The Q output of flip flop **131** now provides a 1 input to the D input of flip flop **136** and to Nandgate **137.** In the manner described above, this enables Norgate **138** to provide pulses to a counter **139** and to controller **101** to cause motor **11** to retract the wire. Counter **139** is a N1 + N2 counter and will permit N1 + N2 pulses to enter and to be provided to motor **11** causing that number of retraction steps before it provides an output on line **140** to transfer the 1 at the D input of flip flop **136** to its Q output causing Nandgate **137** to disable Norgate **138** and reset counter **139.** The wire **22** has now been retracted so that its end portion is within the cutter **30.** The setting of flip flop **136** provides a 1 to the D input of flip flop **141.** Flip flop **141** has its C input tied to the clock line from clock **111.** Thus on the next clock pulse, the 1 at its D input will be transferred to its Q output. The Q output is coupled by line **143** to controller **105** which will provide outputs to motor **12** to cause the piece of wire to be used for the next insertion to be cut as described above. The 1 at the Q output of flip flop **141** is provided to another D type flip flop **143** and to a Nandgate **145** causing that gate to enable a Norgate **147** to pass clock pulses to an N2 + 2 counter **148** and to controller **101** to cause the wire **22** shown on FIG. **4** to advance N2 plus **2** steps to push the cut tag to the end of the needle **44** in preparation for the next insertion sequence. After N2 + 2 counts an output on line **149** causes the 1 at the D input of flip flop **144** to be transferred to its Q output disabling Norgate **147** and causing counter **148** to be reset by the 1 output of Nandgate **145** in the manner described above. The 1 at the Q output of flip flop **144** is provided at the D input of another D type flip flop **150** which has its reset input grounded so that it is always enabled and its C input connected to the output of clock **111.** On the next clock pulse the one at the D input will be transferred to the Q output of flip flop **150.** This 1 is provided as a reset input to flip flops **113, 115, 123, 131, 136 141,** and **144** and will cause them all to be reset. Now flip flop **144** will have a 0 at its Q output and on the next clock pulse input this 0 will be transferred from the D input of flip flop **150** to its Q output removing the one level on the reset line. The system is now completely reset with all flip flops having been reset as described and all counters reset at the end of their count by their associated Nandgates. Now, as soon as a new fish is positioned, the push button switch **115** is activated and the sequence repeated.

Thus there has been described an effective automatic tag implanting machine adapted particularly for useage in connection with the study of the migratory habits of macro-organisms. Moreover, by the method and means disclosed herein, implantation is accomplished rapidly and without any undue harm to the macro-organism.

Although the above description is directed at a preferred embodiment of the invention, it is noted that other variations and modifications will be apparent to those skilled in the art and, therefore, may be made without departing from the spirit and scope of the present invention.

What is claimed is:

1. An apparatus for implanting wire segments into an object which comprises:

a. a supply of wire adapted to be advanced along a predetermined substantially straight path;

b. means disposed along said predetermined straight path for cutting a segment of wire from said supply of wire;

c. means disposed adjacent said cutting means and along said substantially straight path for receiving the severed length of wire from said cutting means and implanting said severed length in the object; and

d. means for incrementally advancing said supply of wire along said predetermined substantially straight path through said cutting and implanting means so as to cause said severed length of wire to be advanced a similar amount thereby in cooperation with said implanting means, causing the latter to be implanted into the object.

2. An apparatus in accordance with claim **1** wherein said cutting means comprises a rotary cutting member having an aperture extending therethrough, said aperture in a first position being in line with said predetermined path and being adapted to receive said supply of wire, and means for rotating said rotary cutting member to move said aperture to a second position at an angle with said predetermined path and thereby cut the segment of wire within said aperture from the remainder of said supply of wire.

3. An apparatus in accordance with claim **2** wherein said rotary cutting member includes an outer housing having an opening therein, a rotatable member mounted within said opening of said outer housing and having extending therethrough said aperture which in said first position is in line with said predetermined path, and means for incrementally rotating said rotatable member in a clockwise and counterclockwise direction.

4. An apparatus in accordance with claim **1** wherein said advancing means comprises a pair of oppositely disposed friction drive wheels having said supply of wire positioned therebetween so as to cause said supply of wire to be linearly moved upon rotation of said drive wheels, and means for incrementally driving one of said drive wheels.

5. An apparatus in accordance with claim **1** wherein said implanting means comprises:

a. a needle adapted to be inserted into the object, said needle having an aperture therethrough disposed in line with said predetermined path for receiving said supply of wire and said cut segment of wire;

b. means for advancing said needle and cut segment of wire a predetermined distance sufficient to penetrate the object and cause said cut segment of wire to be implanted therein; and

c. means for retracting said needle from the object while said cut segment of wire remains implanted therein.

6. An apparatus in accordance with claim **5** which further includes a drive means adapted to be incrementally rotated, an eccentrically mounted member attached to said drive means, a linkage bar attached at one end to said eccentrically mounted member and at the other end coupled to said needle so that upon rotation of said drive means said needle is caused to reciprocate in a linear direction.

7. The invention according to claim **1,** wherein said implanting means, said cutting means and said advancing means are driven by a controller adapted to cause in sequence:

a. said implanting means to advance a distance Y;

b. said supply of wire to be advanced a distance X;

c. said implanting means to retrace said distance Y:

d. said supply of wire to be retracted a distance of X + Z;

e. said cutting means to cut an increment of wire; and

f. said advancing means to advance said wire a distance equal to Z + the length of the cut segment.

8. The invention according to claim **7** wherein said advancing means, said cutting means and said implanting means are driven respectively first, second and third stepper motors and said controller comprises a digital controller.

9. The invention according to claim **8** wherein the length of said cut segment corresponds to two steps of said first motor X is equal to N_1 steps of said motor and Z is equal to N_2 steps of said motor.

10. The invention according to claim **9** wherein Y corresponds to two steps of the motor driving said implanting means.

11. The invention according to claim **10,** wherein said controller provides in sequence:

a. two advance pulses to said first motor;

b. N_1 advance pulses to said second motor;

c. two retraction pulses to said first motor;

d. $N_1 + N_2$ retraction pulses to said second motor;

e. a cut command to said third motor; and

f. $N_2 + 2$ advance pulses to said second motor.

12. The invention according to claim **11** wherein said digital controller comprises:

a. a clock oscillator;

b. a plurality of storage means, one being provided for each of the steps (a) through (f) of claim **11;**

c. a plurality of counters one being provided for each of the steps a), b), c), d) and f) of claim **11;**

d. gating means coupling said storage means; said counters and said clock;

e. means to reset all of said storage means upon completion of a sequence; and

f. means to initiate a sequence.

13. An apparatus for implanting identifying tags into a macro-organism for the purpose of determining its movement from one habitat to another which comprises:

a. a supply of wire;

b. means for incrementally advancing said supply of wire along a predetermined substantially straight path;

c. a rotary cutting means having an aperture therethrough, said aperture in a first position being in line with said predetermined path and being adapted to receive said supply of wire;

d. means for rotating said rotary cutting means to move said aperture to a second position at an angle with said predetermined path and thereby sever the segment of wire within said aperture from the remainder of said supply of wire and to rotate the cutting means and its aperture back to said first position;

e. a needle adapted to be inserted into the macro-organism, said needle having an aperture therethrough disposed in line with said predetermined path for receiving said supply of wire and said severed segment of wire;

f. means for advancing said needle and severed segment of wire a predetermined distance sufficient to penetrate the macro-organism and cause said severed segment of wire to be implanted therein; and

g. means for retracting said needle from the macro-organism and allow said severed segment of wire to remain implanted therein.

14. An apparatus in accordance with claim **13** wherein said rotary cutting means includes an outer housing having an opening therein, a rotatable member mounted within said opening of said outer housing and having extending therethrough said aperture which in said first position is in line with said predetermined path, and means for incrementally rotating said rotatable member in a clockwise and counterclockwise direction.

15. A method of implanting identifying wire tags into a macro-organism for the purpose of determining its movement from one habitat to another which comprises:

a. operating a wire support and cutting means to cut a segment of wire from a supply of wire;
b. advancing the cut segment of wire to a predetermined position with respect to an implanting means;
c. advancing the implanting means so as to be embedded in the macro-organism a distance at least equal to the length of the cut segment of wire;
d. advancing the cut segment of wire and supply of wire approximately the same distance as that of said implanting means to position the cut segment adjacent the end of said implanting means;
e. retracting the implanting means from the macro-organism a distance to allow the cut segment of wire to remain implanted therein; and
f. retracting the supply of wire a distance sufficient to position a portion thereof within the cutting means.

16. A method in accordance with claim **15** wherein said step of cutting a segment of wire from a supply of wire includes the steps of routing the supply of wire through a rotatably mounted cutting means having an aperture extending therethrough and rotating the rotary cutting means to move the aperture away from the path of travel of the supply of wire so as to sever the segment of wire within the aperture from the remainder of the supply of wire.

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