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Blake et al.

[11] **3,832,803**

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[54] **MEANS AND METHOD FOR TREATING TREES**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 861,090, Sept. 25, 1969, abandoned.

[52] **U.S. Cl.** **47/57.5,** 21/73, 175/393

[51] **Int. Cl.** **A01g 29/00**

[58] **Field of Search** 47/57.5; 21/73; 175/393

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[57] **ABSTRACT**

A means and method for treating trees, wherein a manually portable motor driven drill is utilized to drill holes in trees in a downwardly declining direction, and wherein fluid is injected into said holes after they are drilled, and may be partially filled with treating fluid by injecting the fluid through a passage in the drill used to drill the hole.

4 Claims, 14 Drawing Figures

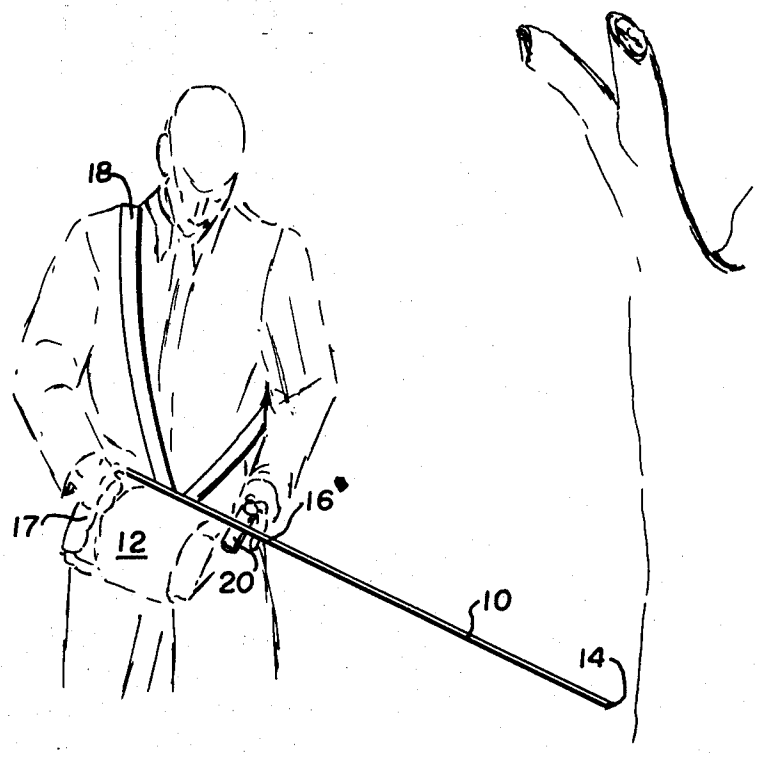
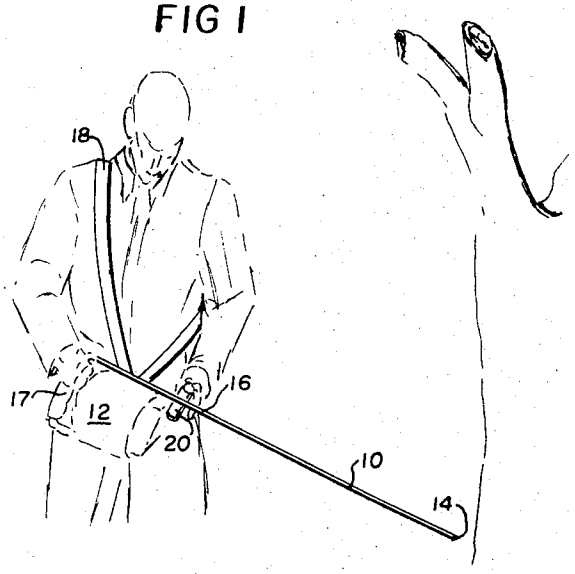


FIG 1



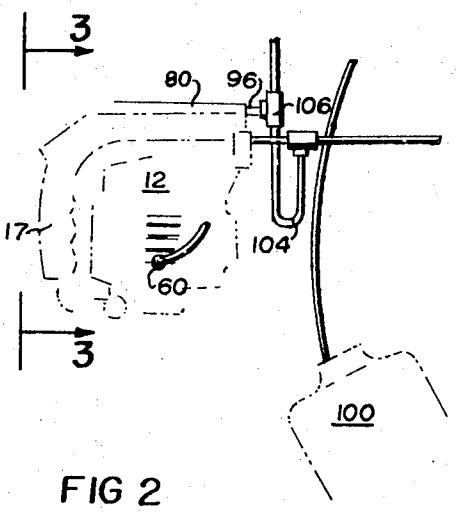


FIG 2

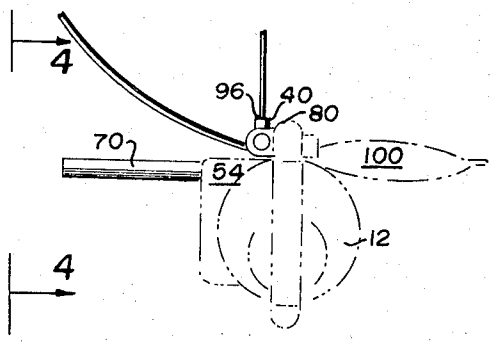


FIG 3

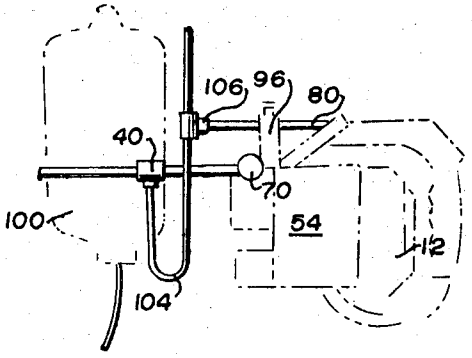


FIG 4

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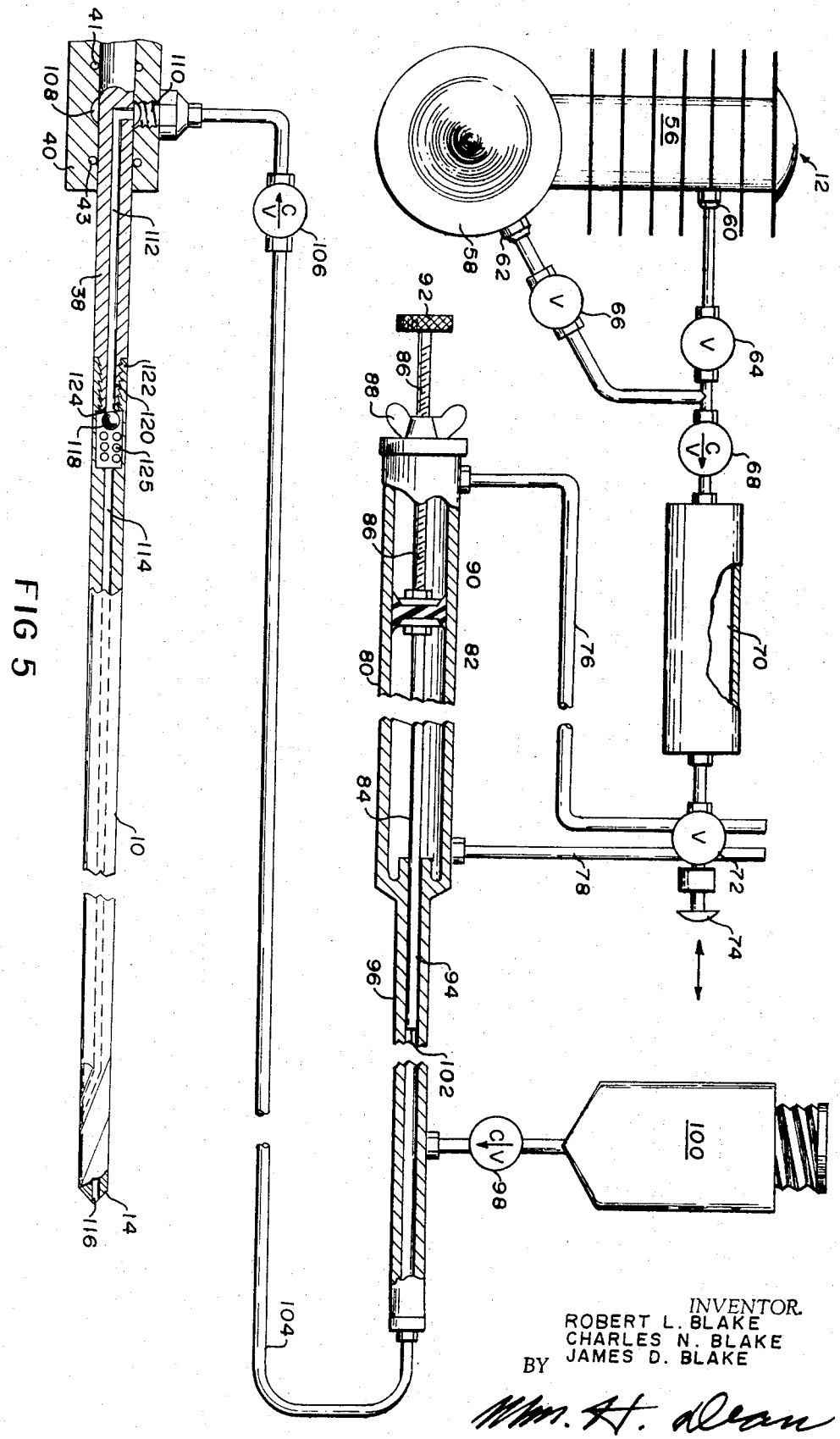


FIG 5

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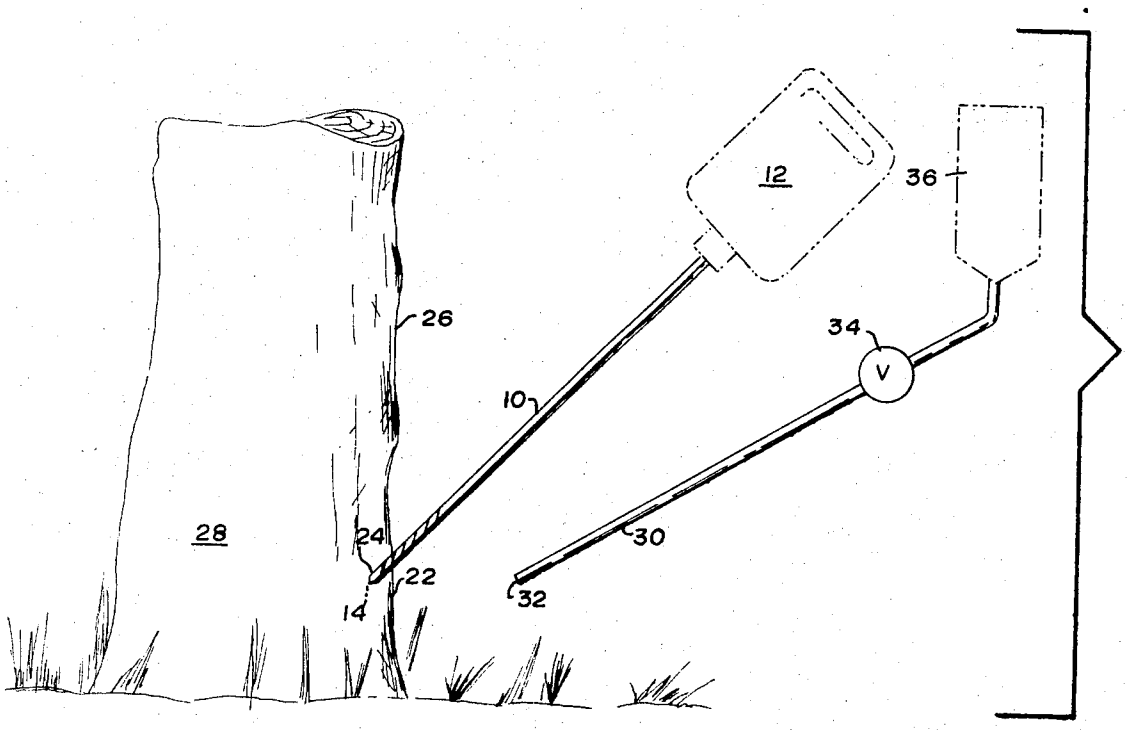


FIG 6

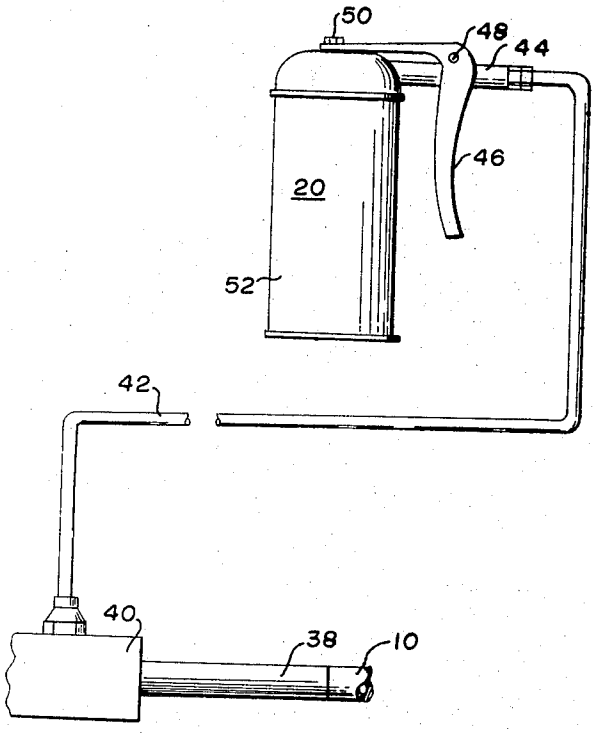


FIG 7

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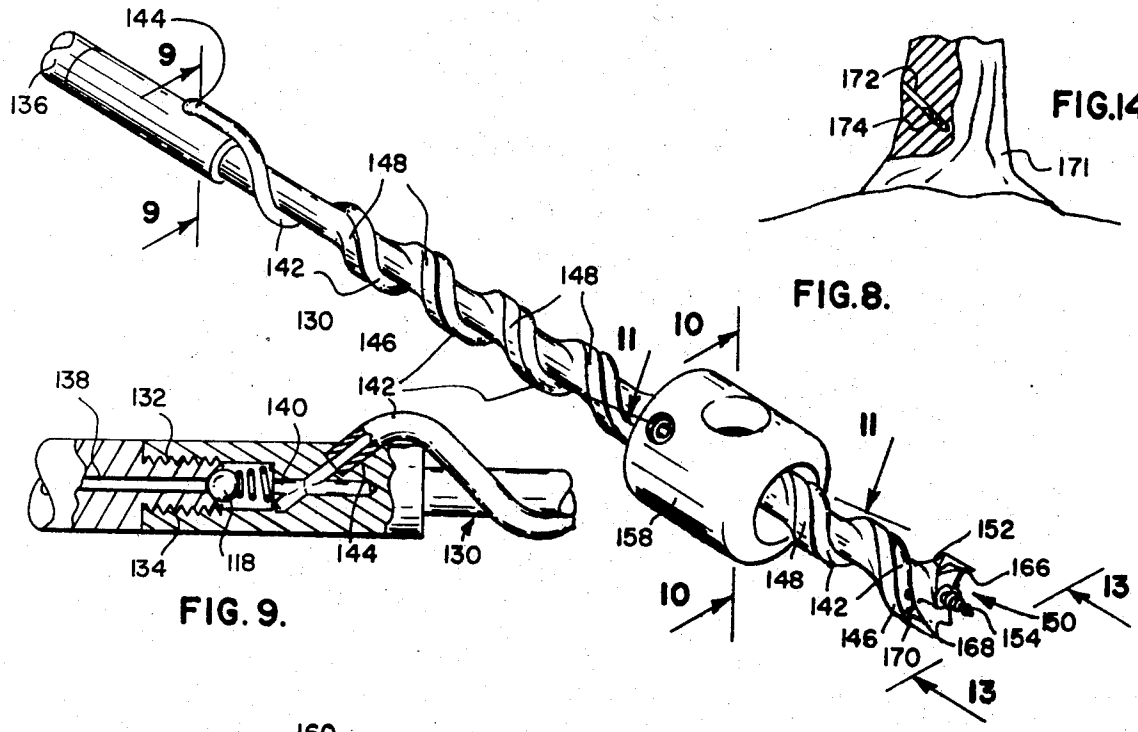


FIG. 9.

FIG. 14.

FIG. 8.

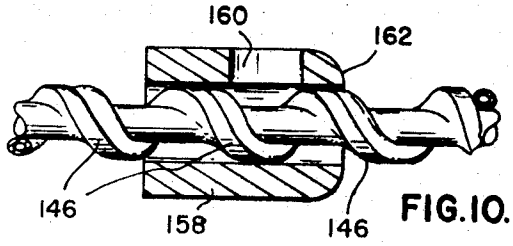


FIG. 10.

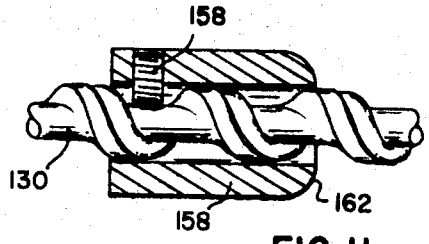


FIG. 11.

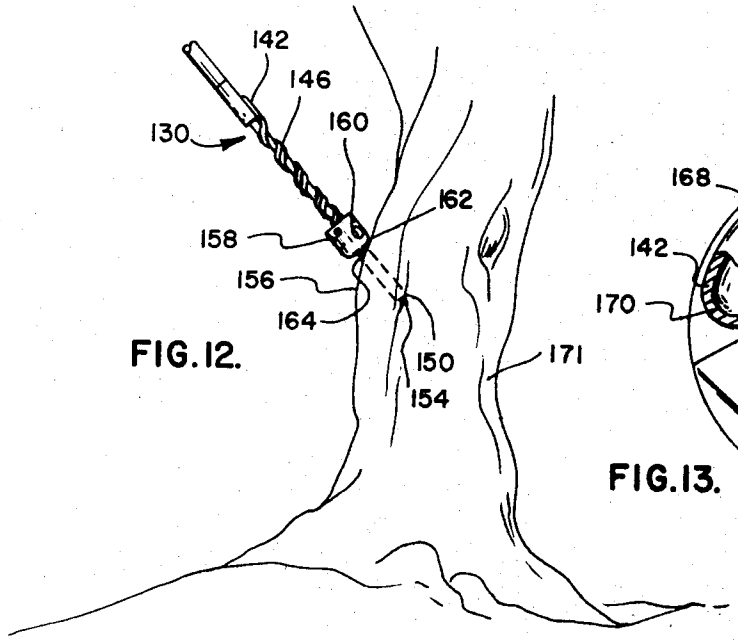


FIG. 12.

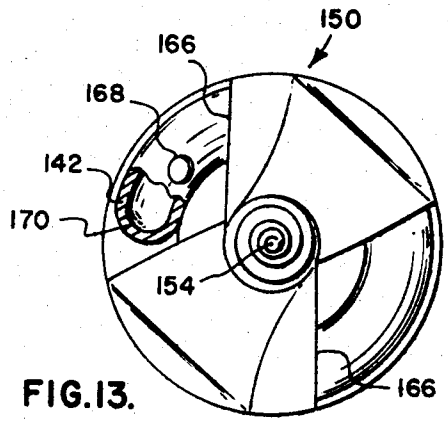


FIG. 13.

MEANS AND METHOD FOR TREATING TREES

This application is a continuation in part of our patent application Ser. No. 861,090 filed Sept. 25, 1969, now abandoned.

BACKGROUND OF THE INVENTION

Various prior art applications of chemicals to trees have been made for the purpose of killing trees or adding nutrients thereto. Materials have been ballistically propelled into contact with trees and other methods have been used to implant materials into tree trunks and into soil in the proximity of the tree roots. These methods have been used for the purpose of killing trees or adding nutrients thereto.

Of particular interest is the killing of trees which have invaded grasslands and grazing areas. In such areas, there are now an abundance of trees which have recently overgrown the grazing areas and the invasion of such grazing areas by various trees such as Junipers or Mesquite have limited the growth of desirable forage as for example, grass or other similar forage needed by cattle or game animals.

The invasion of such areas by trees such as Juniper or Mesquite, for example, has been caused by cattle in many instances. The cattle injest the tree seeds but do not digest them and carry the seeds on to the grassland areas. When the cattle deficate, they leave large piles of manure containing the seeds and the seeds grow in the piles of manure and become large trees. Game animals digest tree seeds and accordingly do not promote the tree invasion of grasslands; such trees have large root systems which take the moisture from the soil which is normally needed for the growth of grass. Juniper trees also give off a growth retarding hormone that prevent grass from growing. While the trees prevent the growth of grass they also cause soil erosion and other harmful effects in many areas.

Many areas have been sprayed to kill trees and other flora, however, spraying is ecologically undesirable do to its great dissemination of herbicides.

In the past trees have been burned, however, for ecological reasons burning is undesirable do to the smoke, and burning also is hazardous do to the fact winds may cause overburning of the forest areas. Additionally, burning wastes the wood which may normally be used as pulp if the trees are otherwise disposed of. Furthermore, the removal of trees should be done only as a thinning operation rather than to annihilate a complete forested area.

Relative to the foregoing, there has been considerable research and the results of such research are discussed in a book entitled the "Changing Mile" by Hastings and Turner, and published by the University of Arizona Press at Tucson, Arizona. Reference is hereby made to the foregoing publication and the references cited therein.

In accordance with the foregoing, it has been a substantial and difficult problem to economically kill large trees in great numbers and to accomplish this in a harmless manner so as to be compatible with the ecology and also to render the trees useful for wood or pulp after they are dead. All of which promotes the use of invaded grasslands for the production of beef or game animals as desired.

SUMMARY OF THE INVENTION

The present invention relates to a means and method, wherein holes are drilled into large, hard trees in a downwardly declining direction from the outside toward the inside, and wherein liquid chemicals are injected into such holes, and may be injected through a passage in motor driven manually portable drill having a cutting end used to drill the respective holes. The invention comprises a lightweight portable drill and fluid injection equipment which may be manually carried from tree to tree so that holes may be quickly drilled and partially or completely filled with liquid herbicides whereupon the drill is immediately withdrawn from each hole. The motor for driving a drill may be of any suitable type, however, small internal combustion engines have proven to be quite light in weight and sufficiently powerful to rapidly drill holes in various large, hard trees by removing material to form such holes so as to receive an injection of liquid chemicals which may remain in the bottom of said holes and so that the chemicals may be thereby used to treat the respective tree and completely defoliate it in order that the entire structure of the tree including the root system will die and may later be used for wood or pulp production as desired.

The invention is used for selectively killing trees without annihilating a forested area or killing desirable flora in the proximity of trees being killed.

The invention comprises novel means for power operated injection of fluid into the holes drilled in the trees. This means includes motor operated pneumatically operable metering and injection equipment.

Specifically, pneumatic power may be taken from a fluid pressure chamber of an internal combustion engine used to drive a drill, and compressed fluid may thus be used by means of a manually operable control valve to actuate an actuating cylinder so as to power a liquid injection plunger which receives liquid poison from a source carried in connection with the drilling motor of the invention, and a conduit is connected to the output of the injector cylinder and is coupled to a slip ring operable around rotary mechanism which drives the drill of the invention. The slip ring assembly thus conducts liquid to a passage in the drill so that the liquid may be power injected through the drill and into the bottom of the hole drilled in the tree, while the drill is in the hole.

The method of the invention comprises drilling a hole in a downwardly declining direction from the outside toward the inside of the tree and forming the hole by cutting and removing material from the tree, and then injecting liquid through the cutting end of the drill and into the bottom of the hole.

The invention comprises novel drill structure similar to a conventional work auger and having stop means thereon, adapted to limit the penetration of the drill into a tree, and also adapted for readily removing materials from the tree and carrying the chips outwardly of the hole so that liquid herbicides may be introduced through a tubular element wound on the helical convolutions of the drill and extending into the proximity of the cutting end of the drill.

Accordingly, it is an object of the invention to provide a novel means and method for treating trees for various purposes.

Another object of the invention is to provide a novel motor driven drill having a fluid passage therein adapted to be used for the purpose of injecting materials through the drill after it has been motor driven to drill a hole in a tree, and while the drill is still in the hole.

Another object of the invention is to provide a novel manually portable drill and driving motor which is readily usable for movement about and among a plurality of trees for successively drilling holes in them and filling or partially filling such holes with suitable materials for the treatment of the trees.

Another object of the invention is to provide a means and method, including various ways of injecting liquid herbicide or other materials into downwardly declining holes in trees.

Another object of the invention is to provide a novel drill structure similar to a conventional wood auger and having a tubular conduit extending to the cutting end thereof, and also provided with a penetration stop collar having a means for adjusting it longitudinally relative to the cutting end of the drill for controlling the depth of penetration as well as to allow chip relief of material removed from the tree to form a hole therein.

Further objects and advantages of the invention may be apparent from the following specification, appended claims and accompanying drawings:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view of a manually portable drill and driving motor, together with a fluid injector, all manually carried by a sling disposed over the shoulder of a human operator;

FIG. **2** is an enlarged side view of a drill and driving motor of the invention, together with fluid injection means, powered by the drill operating motor;

FIG. **3** is a view of the structure shown in FIG. **4**, but taken from the line **3—3** of FIG. **2**;

FIG. **4** is a fragmentary view of the means of the invention taken from the opposite side from that as shown in FIG. **2**;

FIG. **5** is a diagrammatic view showing fluid injection means of the invention in connection with the drill operating motor and the drill of the invention, and showing parts and portions of the structure broken away and in section, and showing portions of the structure fragmentarily;

FIG. **6** is a disclosure of a modified means and method of the invention illustrating a fragmentary portion of a tree being drilled and means for injecting fluid into a hole drilled in said tree;

FIG. **7** is an enlarged view showing fragmentarily a manually operable fluid injection pump means, as illustrated in FIG. **1**;

FIG. **8** is a perspective view of a modified drill structure of the invention;

FIG. **9** is an enlarged fragmentary sectional view taken from the line **9—9** of FIG. **8**;

FIG. **10** is an enlarged fragmentary sectional view taken from the line **10—10** of FIG. **8**;

FIG. **11** is an enlarged fragmentary sectional view taken from the line **11—11** of FIG. **8**;

FIG. **12** is a reduced side elevational view of the modified drill shown penetrating a tree trunk; and,

FIG. **13** is an enlarged end view of the drill taken from the line **13—13** of FIG. **8**;

FIG. **14** is a fragmentary sectional view of a tree with a hole drilled in it and with a liquid material partially filling the hole.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in FIG. **1**, the invention comprises a drill bit **10** which is driven by a small manually portable motor **12** which is preferably a lightweight internal combustion engine, or the like. The drill bit **10** is provided with an extending end **14** adapted to drill holes in trees, and a driven end **16** of the bit **10** is coupled to the driving motor **12**, as will be hereinafter described in detail.

A shoulder sling **18** is provided for carrying the motor **12** and bit **10** from the shoulder of a human operator, and the motor is provided with a suitable manual control handle **17** to facilitate handling of the drill driving motor **12**, all as will be hereinafter described in detail.

The drill **10** is provided with a passage therethrough terminating in the proximity of the cutting end **14**, and a manually operable liquid injector pump **20** is hand operable and communicates through a sealed slip ring assembly with a passage internally of the drill **10** so that when the cutting end **14** of the drill is disposed in a hole drilled in a tree, as shown in FIG. **6** of the drawings, that liquid herbicide or other treating materials may be injected into the hole in the tree.

With reference to FIG. **6**, it will be seen that a tree trunk **22** may be provided with a hole **24** drilled therein in a downwardly declining direction from the outside **26** of the tree toward the inside **28** thereof, and that when the cutting end **14** of the drill **10** is in the hole **24**, the manually operable pump **20** may be utilized to inject fluid therein.

It will be noted, however, that the disclosure of FIG. **6** includes a modified system, wherein the motor **12** drives the drill **10** and a separate hollow tubular wand structure **30** is provided with an open end **32** adapted to be placed in the hole **24** subsequent to the drilling thereof, and a manually operable valve **34** is adapted to allow liquid materials to pass through the wand at its end **32** from a liquid poison or treating materials container **36** which may be carried by a human operator from a sling similar to the sling **18**.

Referring particularly to FIG. **7** of the drawings, it will be seen that a rotary shaft driven by the motor **12** is designated **38** and the driven end of the drill bit **10** is secured thereto, as will be hereinafter described. A slip ring fluid coupling **40** is on the motor shaft **38** and the details of this slip ring coupling are shown in FIG. **5**, and will be hereinafter described. This slip ring coupling receives liquid chemicals through a small conduit **42** from a manually operable pump **44** operable by a hand squeeze lever **46** pivoted at **48** and operating a conventional plunger pump structure **50** in a herbicide container **52**. This structure, as shown in FIG. **7**, is the manually operable pump structure generally indicated at **20** in FIG. **1** of the drawings.

In the species of the invention, as shown in FIGS. **2, 3, 4** and **5**, the liquid injection pump means is powered by the motor **12**, as shown in detail in FIG. **5** of the drawings.

It will be understood that various motors may be used and therefore the motor **12** may be an internal combustion engine, an electrically driven motor, or may be ac-

tivated by other suitable energy. However, the motor **12,** as shown, is a conventional two cycle light-weight internal combustion engine operable by means of conventional hydrocarbon fuels. This motor **12** carries a suitable fuel tank **54** and is readily adapted for hand starting most common to small light-weight engines of this type.

As shown diagrammatically in FIG. **5** of the drawings, the engine or motor **12** is provided with a cylinder **56,** wherein a conventional piston reciprocates. Additionally, the engine is provided with a crank case **58** and may be an aspiration-type crank case used on conventional two cycle internal combustion engines, wherein carburetion and crank case compression result in a substantial pneumatic compression in the crank case.

The invention contemplates the use of a pressure fluid tap **60** communicating with the interior of the combustion chamber in the upper part of the cylinder **56,** and alternatively a fluid pressure tap **62** communicating with the crank case **58** so that either source of fluid pressure may be utilized through respective valves **64** and **66** communicating with a check valve **68** and a fluid pressure accumulator **70.** Thus, compressed gas may be accumulated in the accumulator **70** in communication with a double action manually operable valve **72** adapted to receive compressed fluid from the accumulator **70.** This valve **72** being provided with a manually operable actuating plunger **74** and the valve **72** is coupled by means of conduits **76** and **78** with opposite ends of a pneumatic actuating cylinder **80** having a piston **82** therein carried by a plunger **84.**

A screw threaded adjustable stop screw **86** is screw threaded in the end of the cylinder **80** and provided with a suitable manually operable lock nut **88** adapted to lock screw **86** in adjusted position so that its end **90** will serve as a stop for the piston **82.**

A knurled knob **92** on the outer end of the stop screw **86** is provided for manual adjustment in combination with the manually operable lock nut **88.**

The plunger shaft **84** extends into a bore **94** of an injector cylinder **96** coupled to the actuating cylinder **80.** Communicating with the bore **94** of the injector cylinder **96** is a check valve **98** adapted to receive liquid poison or other treating fluid from a source container **100.**

An end **102** of the injector plunger **84** is adapted to be reciprocated in the bore **94** and the cylinder **96** to force liquid fluids through a conduit **104** and through a check valve **106** into a rotary slip ring assembly **40,** as hereinbefore disclosed in FIG. **7** of the drawings.

This slip ring assembly is provided with a pair of axially spaced seals **41** and **43** surrounding the shaft portion **38** of the motor **12.**

An annular groove **108** is disposed between the slip rings **41** and **43** and communicates with an inlet fitting **110** which receives fluid from the check valve **106.** The annular groove **108** communicates with a passage extending radially and axially in the shaft portion **38.** This passage being designated **112,** and it communicates with a fluid conducting passage **114** in the drill bit **10** which is provided with a cutting end **14,** as hereinbefore described. The passage **114** terminates in an open end **116** in the proximity of the end extremity **14** of the drill bit **10.**

A spring loaded check valve **118** is disposed in the drill bit **10** adjacent to its connection with the motor driven shaft **38.** This motor shaft **38** is rotatably driven by the motor and the conduit **104** holds the slip ring assembly **40** stationary, while the shaft **38** rotates.

The shaft **38** is provided with an externally screw threaded stub **120** over which an internaly screw threaded portion **122** of the drill bit **10** is screw threadably secured.

The check valve **118** is loaded against a seat **124** at the end of the shaft **38** by means of a coil spring **124.**

This check valve **118** prevents liquid from drooling through the passage **114** and out the open end **116** thereof after fluid has been injected through the passage **114,** as will be hereinafter described.

The light loading of the spring **124** permits the check valve ball **118** to readily move off the seat **124** and allow fluid to pass from the passage **112** in the shaft **38** through the passage **114** and the drill bit **10,** and to be injected through the open end **116** into a hole **24,** as shown in FIG. **6,** and as hereinbefore described.

With reference to FIGS. **2, 3** and **4,** it will be seen that the equipment diagrammatically shown in FIG. **5** is carried in connection with the motor **12.**

In operation of the means of the invention, and in accordance with the method thereof, an operator carrying the means of the invention, as shown in FIG. **1,** may proceed as follows:

The operator may approach a tree trunk **26** and drill a hole **24** therein, and may utilize the wand **30** for injection of liquid into the hole **24** or may use the manually operable pump, shown in FIG. **7,** and as hereinbefore described in connection with FIG. **1** of the drawings, or the valve plunger **74,** shown in FIG. **5,** may be utilized for power injection of liquid through the drill bit **10** and into the hole **24,** as desired.

The modified drill of the invention comprises a drill body **130,** and this drill body is similar to a conventional auger-type wood drilling bit.

This body **130,** shown in FIG. **9** is provided with an internally threaded sleeve portion **132,** screw-threadably engaged with an externally screw-threaded portion **134** of a motor-driven drill shank **136.** The shank **136** is provided with a fluid passage **138** therein, and this passage **138** communicates with a passage **140** in the shank **130.** A fluid conducting tube **142** is provided with an end portion **144** fixed in communication with the passage **140.** The tube **142** is helically wound around the body **130** as shown in FIG. **8** of the drawings and this tube **142** is disposed closely adjacent helical convolutions **146** which extend radially outward from the body **130.** These convolutions **146** are provided with first sides **148** facing toward a cutting end **150** of the drill, and the tube **142** is closely adjacent the sides **148** so as to allow the opposite sides **152** of the helical convolutions **146** to operate for moving wood out of the hole cut by the cutting end **150.** The cutting end **150** is provided with a tapered helical lead screw **154** adapted for starting the drill into the wood in the side of a tree when the drill as shown in FIG. **12** is rotatably projected into a treetrunk **156** as shown in FIG. **12** of the drawings.

A stop collar **158** is adjustably mounted on the body **130** by means of a set screw **158** as shown in FIG. **11** of the drawings and as shown in FIG. **10** of the drawings the collar **158** is provided with a chip relief opening **160** communicating between the helical convolutions **146** so as to allow material to be removed from the hole

in the tree and to be dispelled from a position between the helical convolutions **146** as the drill rotates.

The collar **158** is provided with a curved stop end **152** adapted to abut against the side of the treetrunk as shown in FIG. **12** of the drawings and this also allows th escape of wood chips at **164** below the stop portion **152** when the drill is projected downwardly in a declining direction as shown in FIG. **12** of the drawings.

As shown in FIGS. **8** and **13** of the drawings, the cutting end **150** of the drill, is provided with cutting edges **166** which are disposed at the sides **152** of the helical convolutions **146.**

When the end **162** of the collar **158,** gets buried in the bark of a treetrunk the opening **160** affords the foregoing chip relief passage thereby allowing removal of the chips from the hole drilled in the tree.

The liquid conducting tube **142** as shown in FIGS. **8** and **13** is provided with a liquid delivery opening **168** in close proximity to the cutting end **150** of the drill, and this opening **168** is in the side of the tube **142** near its closed end **170** so that the opening **168** does not tend to become plugged or shut off. Further, it will be understood that high pressure generated by liquid delivery means of the invention forces liquid outwardly through said opening **168** against the materials tending to plug the hole **168** and inasmuch as the tube **142** is disposed in spaced relation to the sides **152** of the helical convolutions **146,** the wood removed from the tree passes on the sides **152** of the convolutions **146** generally in spaced relation to the tube **142.**

The method of the invention for treating a plurality of trees with liquid materials comprises the preparation of the manually portable motorized rotary drill hereinbefore described and the drill is provided with a cutting end at its extremity and with a fluid passage extending to the proximity of the cutting end. The drill, according to the method of the invention is carried from tree to tree and a hole is drilled in each of the plurality of trees with said rotary drill by operating the motor in connection therewith ane thereby power rotating the cutting end of the drill and cutting a hole in each tree in a direction downwardly inclined from the outside toward the inside of the tree and thereby removing material from the tree to form the hole and liquid is then forced through a passage in the drill into each hole and into the bottom of the hole, the liquid being forced through the passage in the drill at the cutting end of the drill in close proximity to said cutting end, and the drill is then immediatelyy and quickly withdrawn from each hole and the liquid is allowed to remain in each hole in the bottom thereof after the drill is removed. The method employs a drill which removes the material from the bottom of the hole so that there will be sufficient room to contain the injected liquid material and such that the liquid material will not be drawn out of the hole when the drill is removed. The drill may be partially withdrawn from the hole before the liquid is injected thereinto.

In accordance with the method of the invention, the hole is drilled in the tree in a downwardly declining direction from the outside toward the inside of the tree, and then liquid is either injected through a passage in the drill or is placed therein by other methods so that the liquid gravitates down into the hole and remains in the tree trunk and is absorbed by the tree.

It will be appreciated that the operator may travel from tree to tree and manually carry the equipment of the invention and practice the method very rapidly for the purpose of either poisoning or otherwise treating trees. It will also be appreciated that the drill may be utilized in drilling of holes in other bodies, such as soil and/or root structures of trees or other materials. The invention may be used on private tree farms for the foregoing reasons. As shown in FIG. **14,** a hole **172** is drilled into a tree trunk **171** and liquid **174** injected through the drill and may remain in the hole until absorbed by the tree.

We claim:

1. A drill for drilling holes in trees and injecting liquid into said holes comprising: said drill having a cutting end; said drill having a central body portion; a helical auger structure projecting radially outward from said central body portion; said auger structure having a plurality of helical convolutions said convolutions having a first side generally facing said cutting end and a second side opposite to said first side; a liquid conducting tube secured to said drill adjacent said first side of said auger structure; said tube having a liquid delivery opening in the proximity of said cutting end of said drill; said cutting end having a cutting edge portion; said cutting edge portion disposed at said second side of said helical auger structure; an enlarged diameter stop collar is provided with a bore surrounding said helical auger structure; a set screw, threaded in said collar and engaging said body portion for fixing said collar on said body portion in various positions spaced from said cutting end.

2. The invention, as defined in claim **1,** wherein: said stop collar is provided with a rounded peripheral portion adapted to abut the side of a tree trunk when said drill is rotatably projected thereinto in a downward incline relative to said side of said tree trunk.

3. A drill for drilling holes in trees and injecting liquid into said holes comprising: said drill having a cutting end; said drill having a central body portion; a helical auger structure projecting radially outward from said central body portion; said auger structure having a plurality of helical convolutions; said convolutions having a first side generally facing said cutting end and a second side opposite to said first side; a liquid conducting tube secured to said drill adjacent said first side of said auger structure; said tube having a liquid delivery opening in the proximity of said cutting end of said drill; said cutting end having a cutting edge portion; said cutting edge portion disposed at said second side of said helical auger structure; a stop collar is disposed on said body portion and spaced from said cutting end; said stop collar provided with a rounded peripheral portion adapted to abut the side of a tree trunk when said drill is rotatably projected thereinto at a downward incline relative to said side of said tree trunk; said collar having a chip relief opening therein; said opening communicating with a space between said tube and said second side of a respective convolution of said auger structure.

4. The invention, as defined in claim **3,** wherein: said collar is provided with a set screw and slidably mounted on said body portions so that said set screw may be used to fix said collar on various positions longitudinally of said body to vary the spaced relation of said collar with said cutting end of said drill.

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