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"A Tree Pruner"

INTRODUCTION

Field of the Invention

The invention relates to tools for tree management, particularly for cutting or pruning branches of trees or hedging plants in overhead positions. More particularly, the invention relates to tree pruners of the type having an engine or motor driving a head via a rotating drive shaft.

Prior Art Discussion

It is known to provide a tree pruner having an engine next to a handle which is held by the operator, a stem having a drive shaft surrounded by a sleeve extending from the engine, and a cutting head at the distal end of the stem. They are often referred to as "polesaw" pruners. The stem is long enough to allow cutting of branches which are in the region of 1m to 2m overhead. The engine provides power, rotating the drive shaft within a tube at the necessary speed and torque for driving of the cutting head. The head may take any of a variety of forms, such as a chainsaw, and is interchangeable. Also, the drive shaft is typically interchangeable by the operator, as they typically wear to the extent of requiring replacement after several months' of use.

Examples of such pruners are described in US6112419 (Stihl), US2002/0042997 (Uhl), and JP2003265042 (Kobayashi Tatsuo).

Unfortunately, there have been many instances of serious injury caused by the tool contacting power lines. This is especially so because much tree management activity takes place along road sides where power lines are prevalent.

The invention addresses this safety problem.

Summary of the Invention

According to the invention, there is provided a tree pruner comprising a drive engine or motor, a cutting head, and a stem with a rotating drive shaft linking the engine or motor to the head and a

protective sleeve surrounding the drive shaft, wherein the drive shaft and the protective sleeve are at least partly of electrical insulating material whereby the stem electrically isolates the head from the engine or motor,

wherein the drive shaft includes an insulated section of an insulating material located between proximal and distal sections of the drive shaft, and

wherein the insulated section is connected to said proximal and distal sections of the shaft by bonding at axial interfaces between said sections.

In one embodiment, the sleeve insulating material comprises fibreglass. In one embodiment, the drive shaft insulating material comprises fibreglass.

In one embodiment, said bonding is by resin bonding material.

In one embodiment, at least one interface includes a mechanical male-female coupling. In one embodiment, the interface comprises a plug on one of the intermediate section and the end section and a socket on the other of the intermediate section and the end section. In one embodiment, the plug and the socket are co-axial with the shaft.

In another aspect, the invention provides a rotatable drive shaft for a tree pruner, said drive shaft comprising a coupler at one end for engaging an engine or motor and a coupler at the other end for engaging a pruning head, and wherein the shaft is electrically non-conductive from one end to the other end, wherein the drive shaft comprises a proximal section with said coupler for engaging an engine or motor, a distal section with said coupler for engaging a pruning head, and at least one intermediate section of an electrically conductive material between said proximal and distal sections and being connected to said sections by bonded axial interfaces.

In one embodiment, said bonding is by resin bonding material.

In one embodiment, at least one interface includes a mechanical male-female coupling. In one embodiment, the interface comprises a plug on one of the intermediate section and the end section and a socket on the other of the intermediate section and the end section. In one embodiment, the plug and the socket are co-axial with the shaft.

Additional Statements

According to the invention, there is provided a tree management tool comprising a drive engine or motor, a cutting head and a stem with a drive shaft linking the engine or motor to the head, wherein the stem electrically isolates the head from the engine or motor.

In one embodiment, the stem comprises a protective sleeve surrounding the drive shaft.

In another embodiment, the sleeve is of an insulating material.

In a further embodiment, the sleeve material comprises fibreglass.

In one embodiment, the drive shaft includes a section of an insulating material.

In another embodiment, the drive shaft insulated section is located between proximal and distal sections of the drive shaft.

In a further embodiment, the insulated section is of fibreglass material.

In one embodiment, the insulated section is connected to another section of the shaft by bonding and mechanical engagement.

In another embodiment, the proximal and distal sections include keys or other mechanical features for engagement with the engine or motor and the cutting head respectively.

Detailed Description of the Invention

The invention will be more clearly understood from the following description of some embodiments thereof, given by way of example only with reference to the accompanying drawings in which:-

Fig. 1 is a side view of a tree pruner of the invention;

Fig. 2 is a partly cut-away sectional view of the pruner: and

Fig. 3 is a perspective view of an interface between the intermediate drive shaft section and an end section.

Description of the Embodiments

Referring to the drawings, a tree pruner 1 comprises a petrol engine 2, a stem 3, and a cutting head 4. The stem 3 comprises a rotating drive shaft 15 surrounded by a stem tube 16.

The engine 2 is connected to the stem tube 16 by a coupler 30 incorporating a handle and a user actuating trigger. The stem 3 comprises a connecting socket 31 receiving the tube or sleeve 16, at the distal end of which there is a distal socket 32. The latter is in turn connected to the cutting head 4.

The engine 2, the couplers 30, 31, and 32, and the cutting head 7 are of known construction, in existence in many available tree pruners.

The drive shaft 15 is provided for transferring drive from the engine 2 to the cutting head 4, in a known manner. The shaft 15 extends through the sleeve 16, which provides physical safety from contact with the shaft as it rotates, as is also well known in the art.

The sleeve 16 is of an insulating material, in this case fibreglass. This material is a dielectric and so will not conduct electrical power from a cable which the pruner 1 accidently contacts.

Moreover, the drive shaft 15 is manufactured in three sections:

a proximal metal (aluminium) section 17 having a coupler (in this case keys) for engaging the engine's output shaft,

a distal metal (aluminium) section 18 also having a coupler (in this case keys) for engaging the cutting head 4 to drive the head's cutting blades, and

an intermediate section 19 of fibreglass material which is bonded and mechanically engaged at an interface at each end with the metal sections 17 and 18.

The intermediate section 19 is, like the tube 16, an electrical insulator. Hence, a combination of both the drive shaft 15 and the tube 16 being non-conductive from the head 4 to the engine 2 prevents flow of electrical current which could pose a danger to the operator.

The engagement at the ends of the intermediate section 19 is preferably, as in this embodiment, a combination of resin bonding and male/female mechanical engagement. Referring to Fig. 3, in this example, the intermediate section 19 has a main rod 25 terminating at a shoulder reducing the diameter to provide a narrower plug 26 for insertion in a socket 28 in a rod 27 of the interfacing end section 18. The resin is a two part epoxy resin of type Epiglass HT9000 Fast™ by AkzoNobel. The interface is completed by axial pressure being applied until the resin has cured.

The intermediate section 19 is an electrical insulator. Hence, any contact of the cutting head 4 with a cable will not result in current travelling from the head and through the shaft 3 to the engine 2. There is therefore full electrical isolation of the head 4 from the engine 2, and hence from the user. This is a major improvement over the situation which has existed for many years with such tree management tools.

Moreover, the greatly enhanced safety is achieved without affecting the operation or maintenance of the tool. It performs the cutting actions just as effectively as conventional tools. Also, the user does not need to become acquainted with a different coupling mechanism. The joints are made between the engine, the stem, and the cutting head in the same way as for conventional pruners with an engine or motor driving a drive shaft. The tube 16 and the drive shaft 15 have the same overall physical configuration as is typical and so can be replaced by the user due to wear and tear in the conventional manner.

While the invention is simple, it solves the very difficult technical problem of providing electrical safety for polesaw pruner operators, which problem has existed for many years with deaths occurring in many countries on an annual basis. The inventor has realised that effective electrical isolation can be achieved despite the high torques and/or operating speeds of the drive shaft.

In other examples, the tool may be of a different length, or the stem may have a different width, to suit the application. The material of the sleeve and/or the drive shaft may be different, such as a plastics material of a known type having suitable electrical insulation and mechanical strength properties.

The invention is not limited to the embodiments described but may be varied in construction and detail. The head may alternatively be driven by an electrically-power motor instead of a petrol engine. In this case the power may be provided by a battery on the pruner adjacent the motor. The invention may take the form of a stem and/or drive shaft only, to be fitted to a conventional engine and head by the user. It is preferred that the intermediate section be bonded by adhesives to the end metal sections. The drive shaft section interfaces can take any desired physical form, such as cone-shaped ends fitting into corresponding sockets in the adjoining sections. However, if the torque rating is not excessive, either bonding or mechanical only engagement may be used. It is also envisaged that the complete drive shaft may be of an insulating material, provided it is strong enough for coupling to the engine and head without excessive wear. In this, or any other embodiment, there may be a metal coating on the couplers at the ends for engagement with the engine and/or head. The couplers of the drive shaft may be of any suitable type to suit the configuration of the engine/motor and the head.

Claims

1. A tree pruner (1) comprising a drive engine (2) or motor, a cutting head (4), and a stem (3) with a rotating drive shaft (15) linking the engine or motor to the head and a protective sleeve (16) surrounding the drive shaft, wherein the drive shaft (15) and the protective sleeve (16) are at least partly of electrical insulating material whereby the stem (3) electrically isolates the head from the engine or motor,
wherein the drive shaft (15) includes an insulated section (19) of an insulating material located between proximal (17) and distal (18) sections of the drive shaft (15), and
wherein the insulated section (19) is connected to said proximal and distal sections (17, 18) of the shaft (3) by bonding at axial interfaces between said sections.

2. A tree pruner as claimed in claim 1, wherein the sleeve (16) insulating material comprises fibreglass.

3. A tree pruner as claimed in claims 1 or 2, wherein the drive shaft (15) insulating material comprises fibreglass.

4. A tree pruner as claimed in any preceding claim, wherein said bonding is by resin bonding material.

5. A tree pruner as claimed in any preceding claim, wherein at least one interface includes a mechanical male-female coupling (26, 28).

6. A tree pruner as claimed in claim 5, wherein the interface comprises a plug (26) on one of the intermediate section and the end section and a socket (28) on the other of the intermediate section and the end section.

7. A tree pruner as claimed in claim 6, wherein the plug and the socket are co-axial with the shaft.

8. A rotatable drive shaft (15) for a tree pruner, said drive shaft comprising a coupler at one end for engaging an engine or motor and a coupler at the other end for engaging a pruning head, and wherein the shaft is electrically non-conductive from one end to the other end,

wherein the drive shaft comprises a proximal section (17) with said coupler for engaging an engine or motor, a distal section (18) with said coupler for engaging a pruning head, and at least one intermediate section (19) of an electrically conductive material between said proximal and distal sections and being connected to said sections by bonded axial interfaces.

9. A drive shaft as claimed in claim 8, wherein said bonding is by resin bonding material.

10. A drive shaft as claimed in either of claims 8 or 9, wherein at least one interface includes a mechanical male-female coupling.

11. A drive shaft as claimed in claim 10, wherein the interface comprises a plug (26) on one of the intermediate section and the end section and a socket (28) on the other of the intermediate section and the end section.

12. A drive shaft as claimed in claim 11, wherein the plug (26) and the socket (28) are co-axial with the shaft.

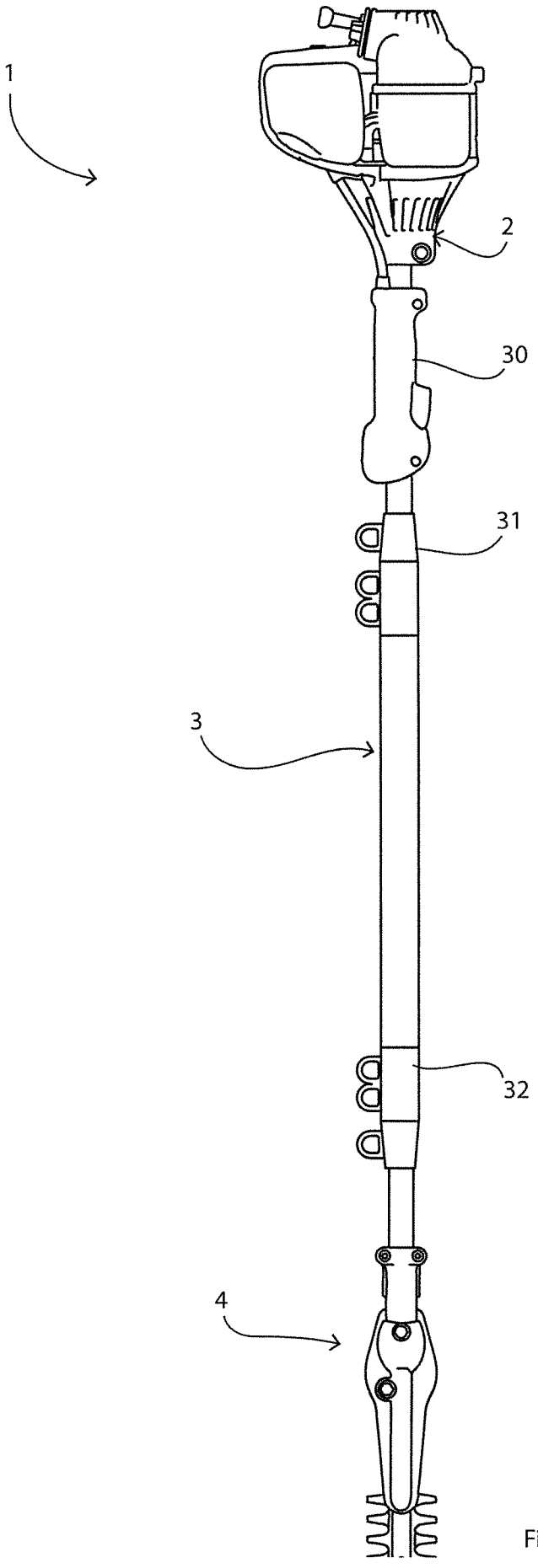


Fig. 1

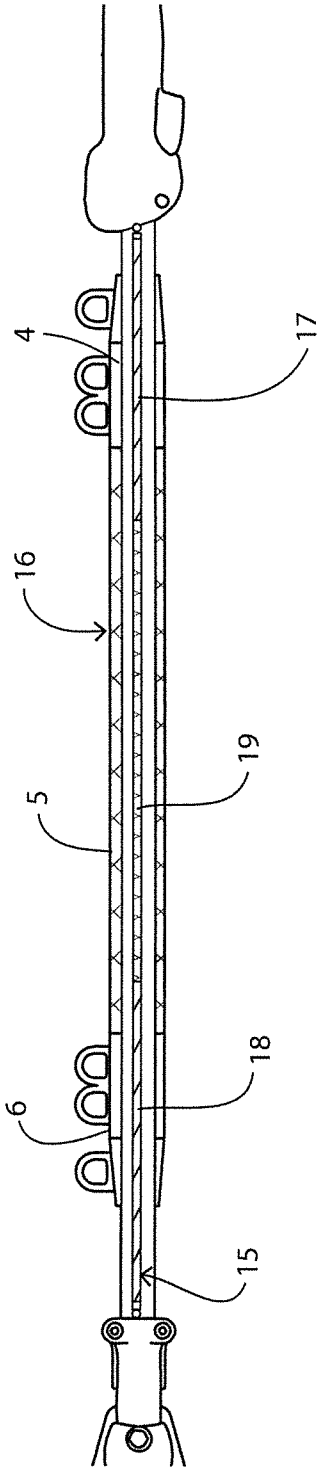


Fig. 2

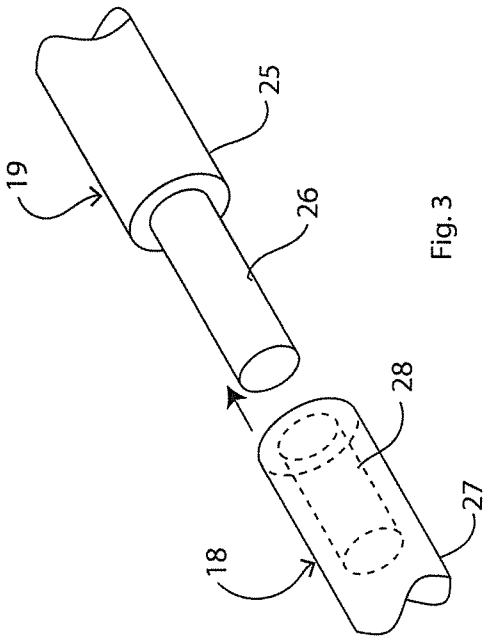


Fig. 3