US00RE40548E

(19) **United States**
(12) **Reissued Patent**
Ryczek et al.

(10) **Patent Number: US RE40,548 E**
(45) **Date of Reissued Patent: Oct. 28, 2008**

(54) **ENGINE OIL HEATER**

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(21) Appl. No.: **11/706,832**

(22) Filed: **Feb. 14, 2007**

Related U.S. Patent Documents

Reissue of:

(64) Patent No.: **7,104,233**
Issued: **Sep. 12, 2006**
Appl. No.: **11/111,266**
Filed: **Apr. 21, 2005**

U.S. Applications:

(60) Provisional application No. 60/564,307, filed on Apr. 22, 2004.

(51) **Int. Cl.**
F02N 17/02 (2006.01)
B60L 1/02 (2006.01)

(52) **U.S. Cl.** ..... **123/142.5 E**; 219/205

(58) **Field of Classification Search** ..... 123/142.5 E; 219/205

See application file for complete search history.

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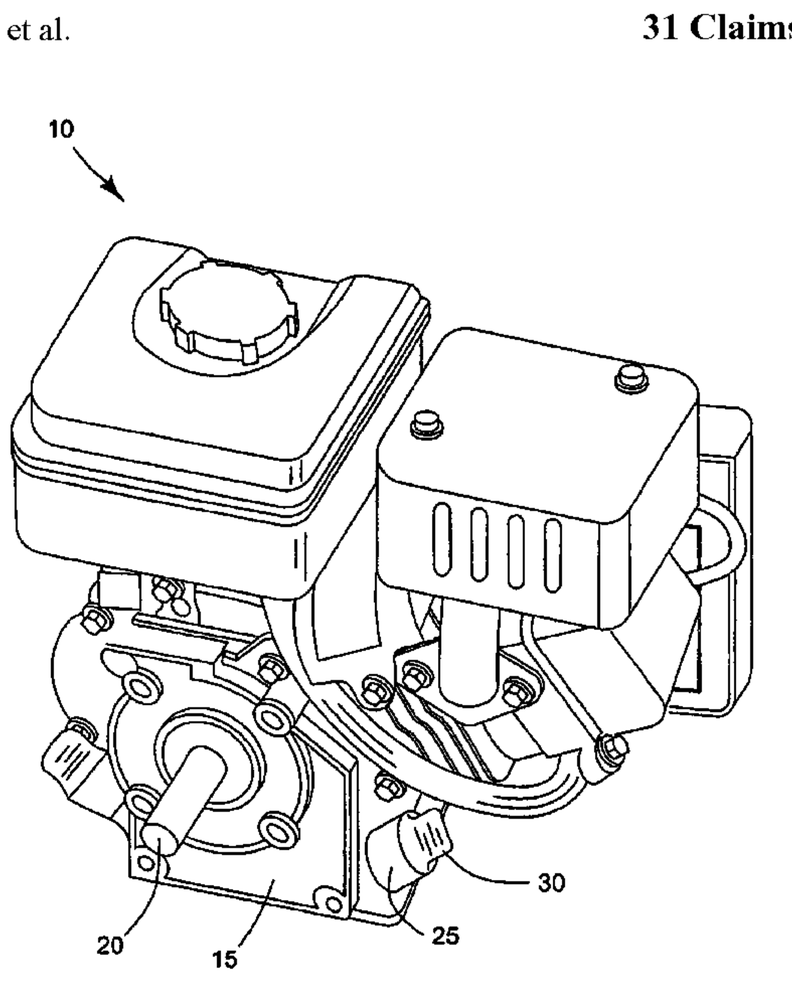
(57) **ABSTRACT**

An engine oil heater suited to use with an engine having an oil fill port in fluid communication with an oil reservoir that is adapted to contain a quantity of oil. The engine heater generally includes a coupling member operable to engage the oil fill port and a heater element interconnected with the coupling member and having a sufficient length such that the heater element is adapted to be at least partially immersed in oil. A temperature sensor is positioned to measure a temperature and a first electrical connector is configured to engage a second electrical connector. The first electrical connector is electrically connectable to the heater element to provide a flow of current and a control circuit is operable to vary the flow of current to the heater element in response to the measured temperature.

31 Claims, 3 Drawing Sheets



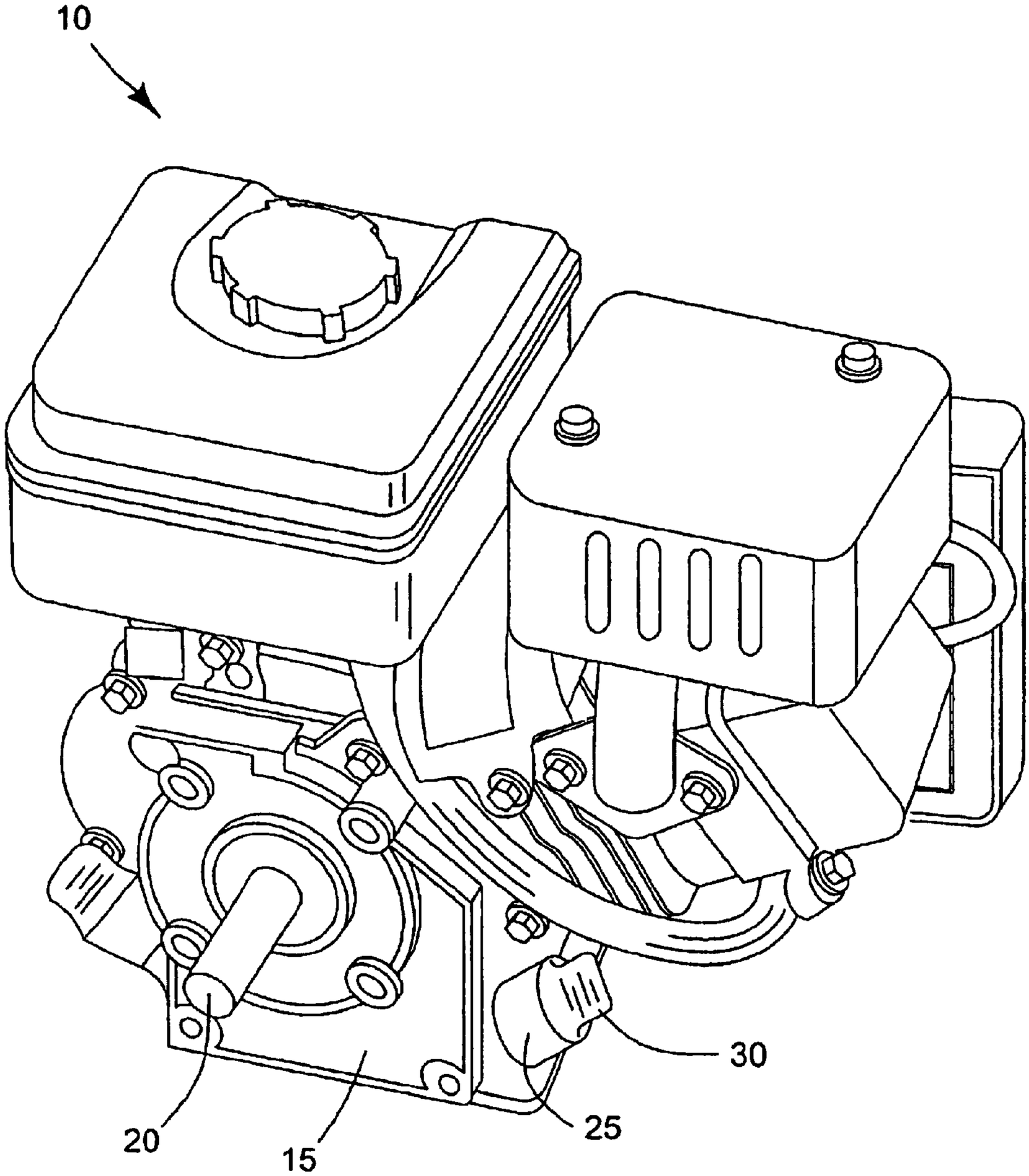


FIG. 1

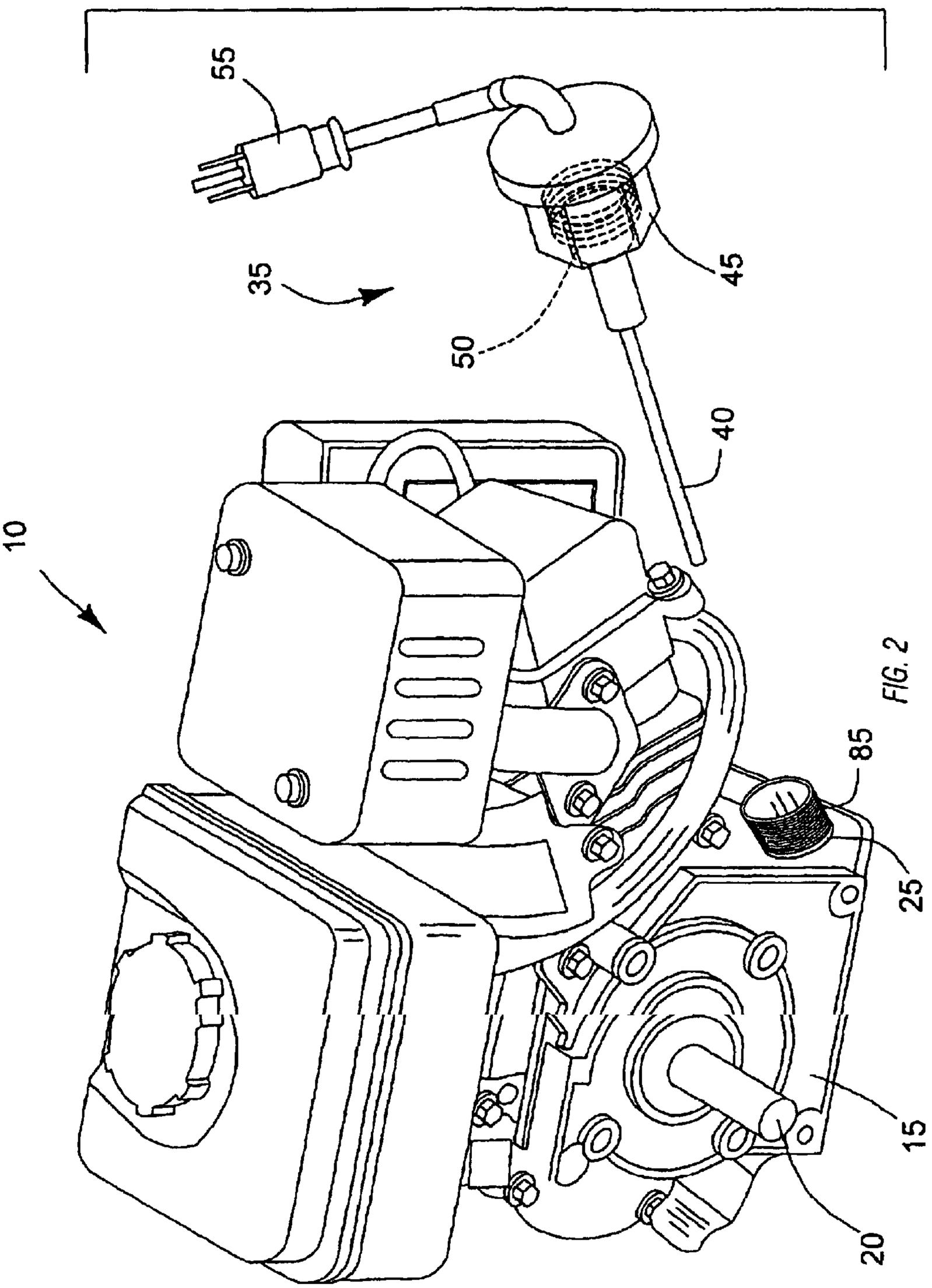


FIG. 2

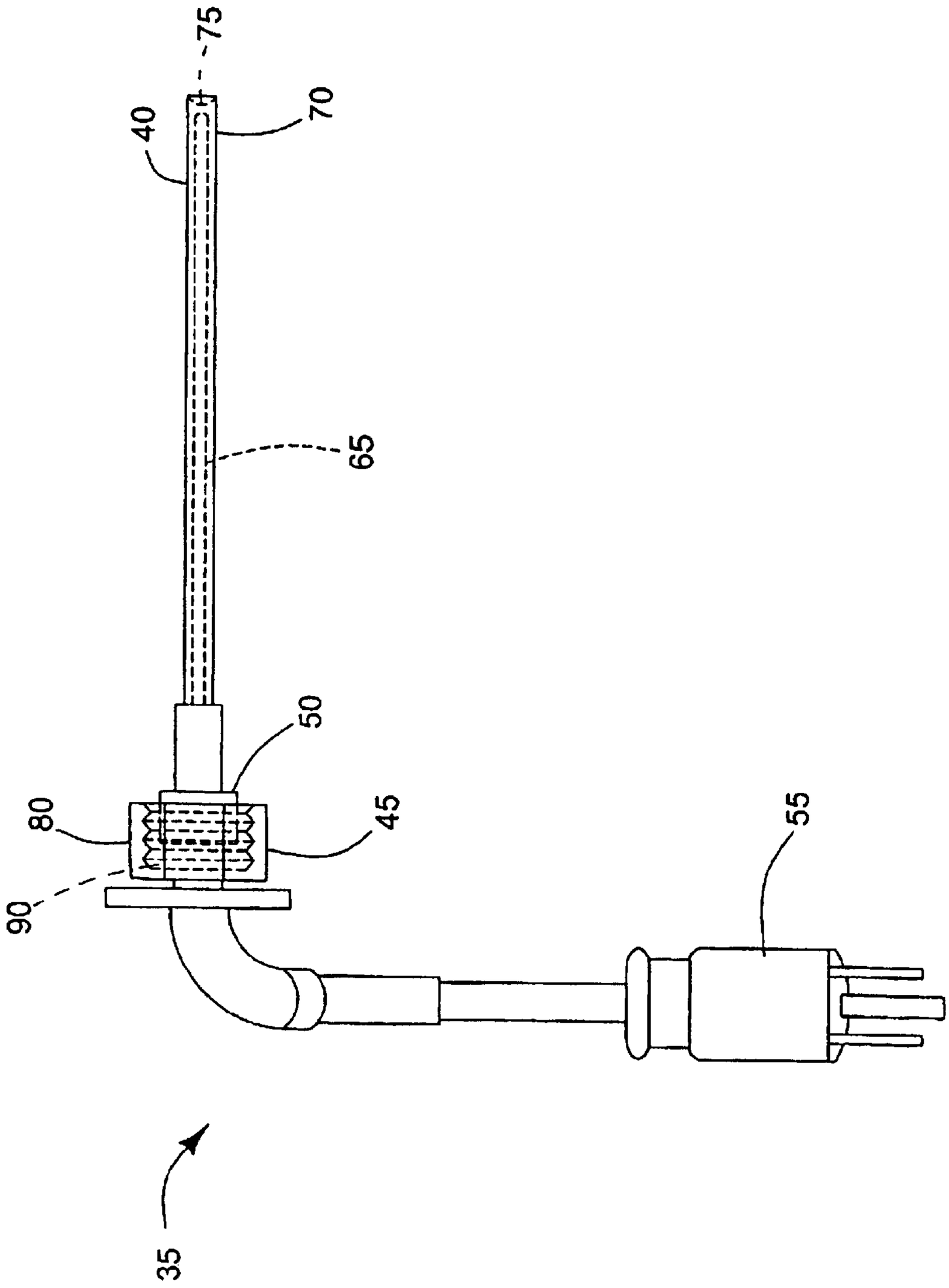


FIG. 3

ENGINE OIL HEATER

Matter enclosed in heavy brackets [ ] appears in the original patent but forms no part of this reissue specification; matter printed in italics indicates the additions made by reissue.

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Patent Application No. 60/564,307, filed Apr. 22, 2004, the entire contents of which are hereby incorporated by reference herein.

BACKGROUND

The present invention relates generally to an engine oil heater. More particularly, the present invention relates to an electric engine oil heater for use with an engine that operates in a cold environment.

Snow throwers and other cold weather equipment often use small engines to provide the necessary power. Typically, these engines use a lubricant, such as oil to lubricate moving parts and to cool parts during operation. However, during long periods of inactivity in a cold environment, the oil collects and the viscosity of the oil is substantially increased. The higher viscosity reduces the ability of the oil to lubricate the moving parts and makes it more difficult to start the engine.

SUMMARY

The present invention provides an engine oil heater suited to use with an engine having an oil fill port in fluid communication with an oil reservoir that is adapted to contain a quantity of oil. The engine heater generally includes a coupling member operable to engage the oil fill port and a heater element interconnected with the coupling member and having a sufficient length such that the heater element is adapted to be at least partially immersed in oil. A temperature sensor is positioned to measure a temperature and a first electrical connector is configured to engage a second electrical connector. The first electrical connector is electrically connectable to the heater element to provide a flow of current and a control circuit is operable to vary the flow of current to the heater element in response to the measured temperature.

In another aspect, the invention generally provides an engine including a cylinder and a piston positioned to reciprocate within the cylinder. An air/fuel mixing device is operable to receive a flow of air and a flow of fuel and deliver a flow of an air/fuel mixture to the cylinder. The engine also includes a lubrication system including an oil reservoir having an oil fill port and a quantity of oil. The lubrication system is operable to provide lubricating oil to at least one of the piston and the cylinder. A heater element is coupled to the fill port such that the heater element is at least partially immersed in the quantity of oil. A temperature sensor is positioned to measure a temperature and a first electrical connector is configured to engage a second electrical connector. The first electrical connector is directly connectable to the heater element to provide a flow of power and a control circuit is operable to vary the flow of power to the heater element in response to the measured temperature.

In still another aspect, the present invention generally provides an engine heater suited to use with an engine having an oil fill port in fluid communication with an oil reservoir that is adapted to contain a quantity of oil. The engine heater includes a coupling member operable to engage the engine and a heater element interconnected with the coupling member such that the heater element is adapted to be at least partially immersed in oil when the coupling member engages the engine. A sensor is positioned to measure an engine temperature and a first electrical connector is configured to engage a second electrical connector. The first electrical connector is directly connectable to the heater element to provide a flow of power and a control circuit is operable to vary the flow of power to the heater element in response to the measured temperature.

Additional features and advantages will become apparent to those skilled in the art upon consideration of the following detailed description of preferred embodiments exemplifying the best mode of carrying out the invention as presently perceived.

BRIEF DESCRIPTION OF THE DRAWINGS

The detailed description particularly refers to the accompanying figures in which:

FIG. **1** is a perspective view of an engine;

FIG. **2** is an exploded view of the engine and engine oil heater; and

FIG. **3** is a side view of the engine oil heater of FIG. **2**.

DETAILED DESCRIPTION

With reference to FIG. **1**, a horizontal shaft engine **10** is illustrated. The engine **10** includes a cylinder and a housing **15**. The cylinder supports a piston for reciprocation and at least partially defines a combustion chamber. The piston drives a crankshaft **20**, which extends out of the housing **15** to provide usable power. A lubricant, such as motor oil, circulates throughout the engine **10** and lubricates the various moving parts. The lubricant both reduces engine wear and cools the moving components. The lubricant drains into the bottom of the housing **15** and is pumped to the various locations that require lubricant. During idle periods, the lubricant collects in the bottom of the housing **15**.

The engine **10** includes an oil fill port **25** having an aperture **27** that receives a cap **30** that covers the aperture **27** during engine operation. In some engines **10**, the cap **30** also functions as a lubricant dipstick that allows the user to measure the quantity of lubricant in the housing **15**. The oil fill port **25** provides access to the housing **15** to allow for the addition and/or removal of lubricant.

With reference to FIG. **2**, the engine **10** is illustrated with the oil fill cap **30** removed to receive an engine oil heater **35**. The engine oil heater **35**, illustrated in FIG. **3**, includes a heater element **40**, an attachment member **45**, a control element **50**, and an electrical connector **55**. The heater element **40** includes a conductor **65** that gets hot in response to a flow of current therethrough. A casing **70** surrounds the conductor **65** and at least partially forms a seal that inhibits contact between the lubricant and the conductor **65**. The casing **70** is heated by the hot conductor **65** disposed within the casing **70**, which in turn heats the lubricant. In other constructions, the conductor **65** is formed as part of the casing **70**, or the casing **70** itself acts as the conductor **65**. In some constructions, the casing **70**, or the conductor **65** and casing **70** combination, is flexible thereby allowing the user to shape it to fit within the particular engine **10**.

To heat the casing **70**, an electrical current is provided to the conductor **65**. In most constructions, a single phase AC current (e.g., 120 V, 240 V) provides the current flow to the conductor **65**. However, other constructions may use three-phase power or a DC power supply to provide the necessary current.

A temperature sensor, such as a thermocouple **75** is positioned within the casing **70** to measure a temperature. In most constructions, the thermocouple **75** measures the temperature of the casing **70**, which is then used to estimate an actual lubrication temperature. However, other constructions may position the thermocouple **75** adjacent an outer surface of the casing **70** to allow it to directly measure the lubricant temperature. While a thermocouple **75** has been described, other temperature sensors (e.g., thermistors, RTDs, bimetallic thermometers, and the like) are also suited for use with the present invention.

The attachment member **45** facilitates the secure attachment of the engine oil heater **35** to the engine **10**. The attachment member **45** includes a free spinning nut **80** with internal threads sized and pitched to engage threads **85** on the oil fill port **25**. In other constructions, a cammed nut is employed. The cammed nut requires less than a full turn to lock the engine oil heater **35** to the engine **10**. The attachment member **45** may also include a soft member **90** that engages the nut **80** and oil fill port **25** at their interface to provide a seal. The seal inhibits the entry of moisture or dirt into the oil and/or the spilling or loss of oil from the housing **15**. Suitable soft materials include but are not limited to rubber, cloth, and nylon. In some constructions, no soft member **90** is employed. Rather, the connection between the nut **80** and the oil fill port **25** is relied upon to maintain the seal.

A conductor **95** extends beyond the attachment member **45** and interconnects the electrical connector **55** and the heating element **40**. The electrical connector **55** is formed to fit another electrical connector (e.g., three-pronged 120 V grounded outlet). Of course, other connectors **55** may be used to allow the engine oil heater **35** to connect to other sources of power (e.g., three-phase power, high-voltage power, DC power, and the like).

The control element **50**, disposed within the electrical circuit between the electrical connector **55** and the heating element **40**, functions in response to the temperature of the lubricant to vary the current flow to the heater element **40**. In one construction, the control element **50** simply interrupts the power flow (e.g., reduces the voltage or the current to the heater element) when the temperature sensed by the thermocouple **75** exceeds a predetermined value (e.g., 150 degrees F.). The control element **50** reinitiates power flow when the temperature sensed by the thermocouple **75** falls below a predetermined value (e.g., 100 degrees F.). Thus, the control element **50** acts as a switch that is either on or off. In another construction, the control element **50** actively varies the power flow to the heater element **40** in an effort to maintain the temperature sensed by the thermocouple **75** near a predetermined value (e.g., 120 degrees F.). In this construction, the power flow (i.e., the current and/or the voltage) is reduced in response to a temperature above the target value and is increased in response to a measured temperature below the target value. Rather than turning power on or off, the power flow varies between zero and a predetermined maximum. Thus, the actual temperature of the lubricant is maintained within a small operational range that assures that the oil provides adequate lubrication and cooling for the engine **10**.

To use the engine oil heater **35**, the cap **30** covering the aperture **27** in the oil fill port **25** is removed. The engine oil heater **35** is then partially inserted into the aperture **27** such that at least a portion of the casing **70** and/or the conductor **65** is disposed within the oil. The free spinning nut **80** is tightened to provide an adequate seal between the engine oil heater **35** and the engine **10**. The connector **55** is then connected to a power supply and the engine oil heater **35** beings heating the engine oil. No monitoring of the engine oil heater **35** is required, as the control element **50** will assure that the engine oil is not overheated. With the engine oil heated to a suitable temperature, the engine **10** can be started easily and the oil provides the desired lubrication and cooling to the moving parts.

Although the invention has been described in detail with reference to certain preferred embodiments, variations and modifications exist within the scope and spirit of the invention as described and defined in the following claims.

What is claimed is:

1. An engine oil heater suited to use with an engine having an oil fill port in fluid communication with an oil reservoir that is adapted to contain a quantity of oil, the engine heater comprising:

a coupling member operable to engage the oil fill port;

a heater element interconnected with the coupling member and having a sufficient length such that the heater element is adapted to be at least partially immersed in oil;

a temperature sensor positioned to measure a temperature;

a first electrical connector configured to engage a second electrical connector, the first electrical connector electrically connectable to the heater element to provide a flow of current; and

a control circuit disposed substantially within the oil reservoir that is operable to vary the flow of current to the heater element in response to the measured temperature.

2. The engine heater of claim **1**, wherein the coupling member includes a free-spinning nut that threadably engages the oil fill port.

3. The engine heater of claim **1**, wherein the oil fill port includes threads, and the coupling member includes threads sized to engage the oil fill port threads.

4. The engine heater of claim **3**, wherein the coupling member includes a free-spinning nut that threadably engages the threads of the oil fill port.

5. The engine heater of claim **1**, wherein the temperature sensor includes a thermocouple.

6. The engine heater of claim **1**, wherein the temperature sensor measures an oil temperature.

7. The engine heater of claim **1**, wherein the control circuit substantially reduces current flow to the heater element when the measured temperature exceeds a predetermined value.

8. The engine heater of claim **7**, wherein the measured temperature is an oil temperature, and wherein the control circuit substantially reduces current flow to the heater element when the oil temperature exceeds about 140 degrees F.

9. The engine heater of claim **1**, wherein the control circuit reduces the current flow to the heater element in response to an increase in the measured temperature.

10. The engine heater of claim **1**, wherein the control circuit varies a voltage applied to the heater element in response to the measured temperature.

11. An engine comprising:

a cylinder;

a piston positioned to reciprocate within the cylinder;

a fuel/air mixing device operable to receive a flow of air and a flow of fuel and deliver a flow of an air/fuel mixture to the cylinder;

a lubrication system including an oil reservoir having an oil fill port and a quantity of oil, the lubrication system

operable to provide lubricating oil to at least one of the piston and the cylinder;

a heater element coupled to the fill port such that the heater element is at least partially immersed in the quantity of oil;

a temperature sensor positioned to measure a temperature;

a first electrical connector configured to engage a second electrical connector, the first electrical connector directly connectable to the heater element to provide a flow of power; and

a control circuit disposed substantially within the oil reservoir that is operable to vary the flow of power to the heater element in response to the measured temperature.

12. The engine of claim **11**, wherein the heater element includes a coupling member that engages the fill port.

13. The engine of claim **12**, wherein the coupling member includes a free-spinning nut that threadably engages the fill port.

14. The engine of claim **12**, wherein the oil fill port includes threads and the coupling member includes threads sized to engage the oil fill port threads.

15. The engine of claim **14**, wherein the coupling member includes a free-spinning nut that threadably engages the threads of the oil fill port.

16. The engine of claim **11**, wherein the temperature sensor includes a thermocouple.

17. The engine of claim **11**, wherein the temperature sensor measures an oil temperature.

18. The engine of claim **11**, wherein the control circuit substantially reduces power flow to the heater element when the measured temperature exceeds a predetermined value.

19. The engine of claim **18**, wherein the measured temperature is an oil temperature, and wherein the control circuit substantially reduces power flow to the heater element when the oil temperature exceeds about 140 degrees F.

20. The engine of claim **11**, wherein the control circuit varies a current flow to the heater element in response to the measured temperature.

21. The engine of claim **11**, wherein the control circuit varies a voltage applied to the heater element in response to the measured temperature.

22. An engine heater suited to use with an engine having an oil fill port in fluid communication with an oil reservoir that is adapted to contain a quantity of oil, the engine heater consisting essentially of:

a coupling member operable to engage the engine;

a heater element interconnected with the coupling member such that the heater element is adapted to be at least partially immersed in oil when the coupling member engages the engine;

a sensor positioned to measure an engine temperature;

a first electrical connector configured to engage a second electrical connector, the first electrical connector directly connectable to the heater element to provide a flow of power; and

a control circuit disposed substantially within the oil reservoir that is operable to vary the flow of power to the heater element in response to the measured temperature.

23. The engine heater of claim **22**, wherein the coupling member includes a free-spinning nut that threadably engages the oil fill port.

24. The engine heater of claim **22**, wherein the oil fill port includes threads and the coupling member includes threads sized to engage the oil fill port threads.

25. The engine heater of claim **24**, wherein the coupling member includes a free-spinning nut that threadably engages the threads of the oil fill port.

26. The engine heater of claim **22**, wherein the temperature sensor includes a thermocouple.

27. The engine heater of claim **22**, wherein the temperature sensor measures an oil temperature.

28. The engine heater of claim **22**, wherein the control circuit substantially interrupts the flow of power when the measured temperature exceeds a predetermined value.

29. The engine heater of claim **28**, wherein the measured temperature is an oil temperature, and wherein the control circuit substantially reduces power flow to the heater element when the oil temperature exceeds about 140 degrees F.

30. The engine heater of claim **22**, wherein the control circuit varies a current flow to the heater element in response to the measured temperature.

31. The engine heater of claim **22**, wherein the control circuit varies a voltage applied to the heater element in response to the measured temperature.

* * * * *