United States Patent [19]

Broyles

[11] **3,868,035**

[45] **Feb. 25, 1975**

[54] **EARTH WORKING MACHINE PROTECTOR**

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[73] Assignee: **Tripple "I" Products, Inc.**, McKinney, Tex.

[22] Filed: **Sept. 21, 1973**

[21] Appl. No.: **399,551**

[52] **U.S. Cl.**..... **214/762**, 37/DIG. 1, 37/DIG. 19, 214/138 R

[51] **Int. Cl.**..... **E02f 9/24**

[58] **Field of Search**..... 214/762, 763, 764; 37/DIG. 1, DIG. 19

[56] **References Cited**

UNITED STATES PATENTS

2,243,876	6/1941	Maddox	37/DIG. 19
2,409,397	10/1946	Sheehan	37/DIG. 19
3,659,734	5/1972	Fuzzell	214/764

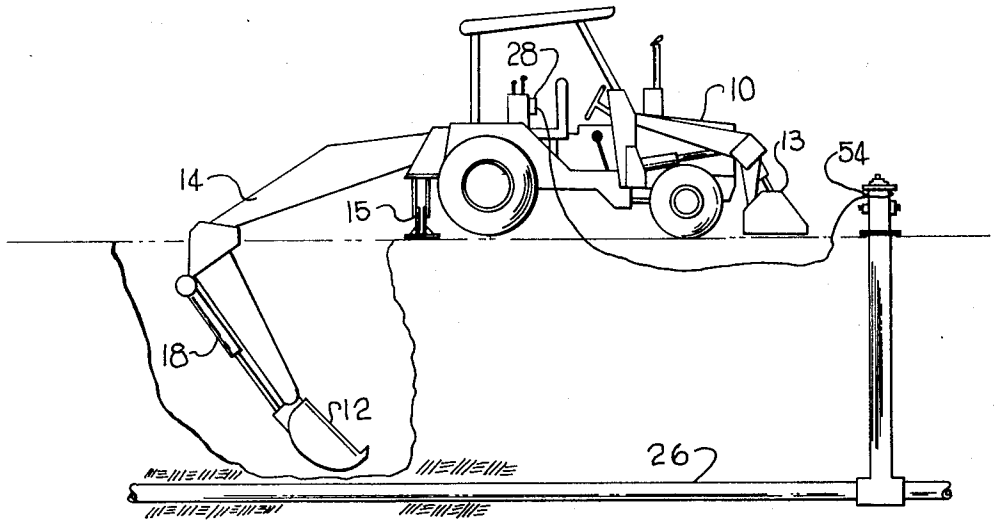
Primary Examiner—Robert J. Spar
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[57] **ABSTRACT**

A bypass solenoid valve connects the high pressure and low pressure hydraulic line of an earth working machine such as a trencher, backhoe or earth borer. The valve is normally open so that the machine is inoperative. The machine is made operative only if a key operated switch in the solenoid valve circuit is closed; therefore, the device acts to prevent thefts.

In addition, if the earth working tool touches a buried pipe, buried cable, or other object to which a detector is attached, a sensitive electronic circuit de-energizes the solenoid valve, thus deactivating the machine to prevent damage to the buried object.

3 Claims, 3 Drawing Figures



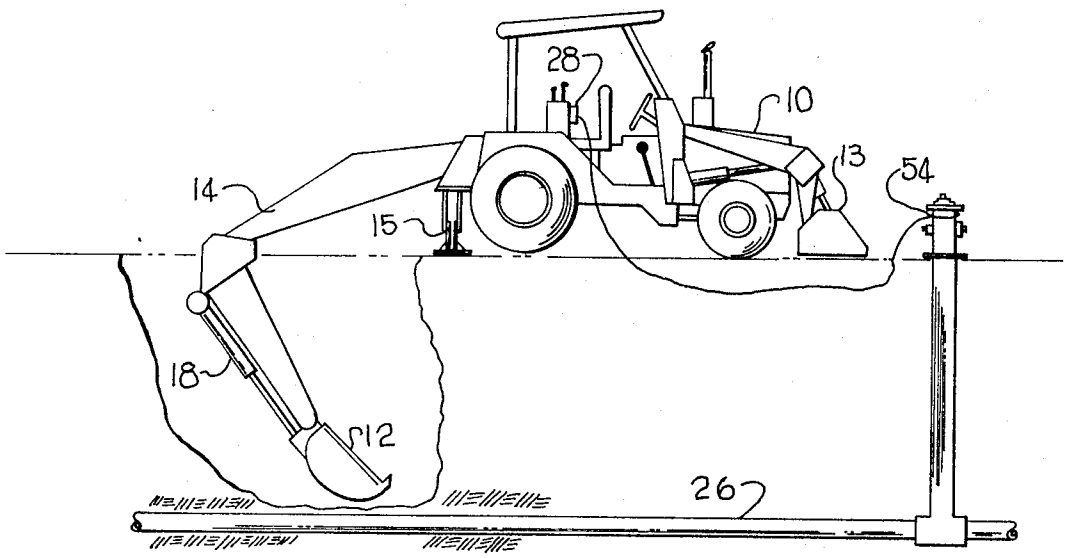

28
10
13
54
14
15
18
12
26

FIG. 1

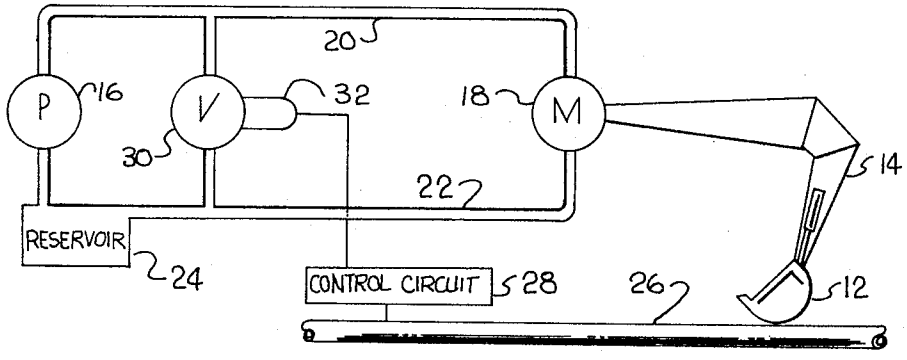

20
P
16
V
32
18
M
30
22
14
RESERVOIR
24
CONTROL CIRCUIT
28
26
12

FIG. 2

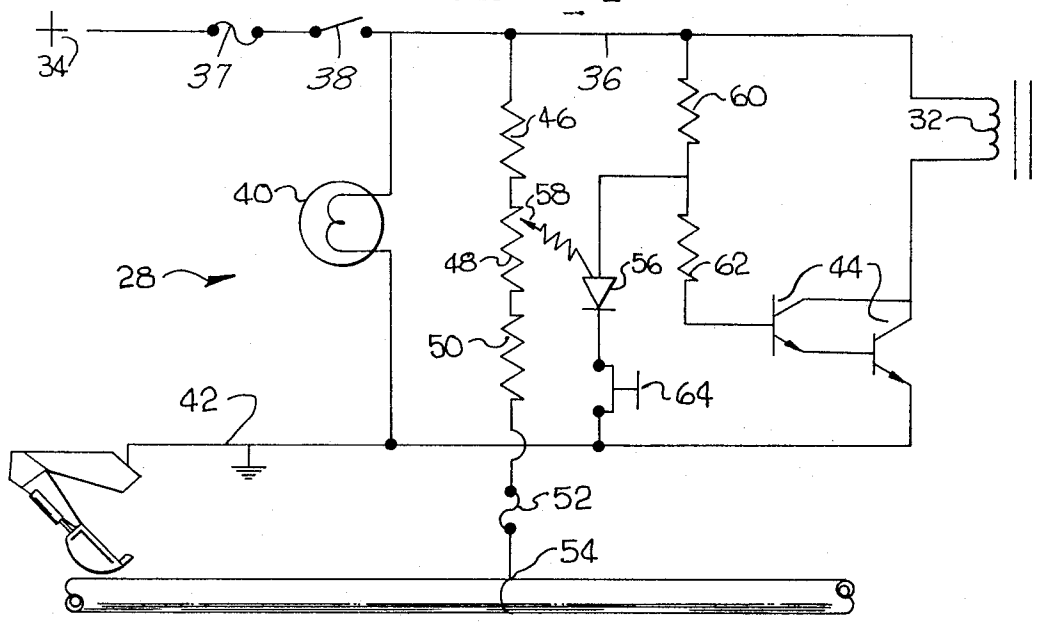


FIG. 3

EARTH WORKING MACHINE PROTECTOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to earth working equipment having hydraulically controlled elements and more particularly to devices to prevent the theft of such equipment and to prevent such equipment from cutting buried pipes or cables.

2. Description of the Prior Art

Before my invention, various pipe or cable locators were well known. They were used to locate the position of underground pipes and one common system generated a 20 cps (cycle per second) alternating electrical signal and applied the signal to the pipe. A detector was used to search for this signal and thus the pipe. Other systems were to attach a wire to the pipe and then check for electrical continuity when a probe or earth working tool touched the pipe.

Also, before my invention, it was known that when an underground pipe was detected by an earth working tool, an alarm could be given or the hydraulic system of an earth working machine could be blocked. By blocked, I mean that a valve in the high pressure line could cut off the high pressure line.

The following are examples of prior art devices known to me before filing this patent application:

Pavlik	1,805,412
Maust	2,131,291
Sheehan et al	2,409,397
Stryker	2,561,152
E. Smith et al	3,190,476
Other examples of the prior art are:	
Albrecht	2,615,969
Winters	2,789,282
Popelier	3,170,579
Strenger, Jr., et al	3,296,494
Humphreys, Jr.	3,418,572
Long-Short	3,653,523

Further prior art are HANSENBALG U.S. Pat. No. 3,407,895 and KELLY U.S. Pat. No. 3,648,282, however, they appeared not to be concerned with my invention.

SUMMARY OF THE INVENTION

New and Useful Function

I have discovered that by bleeding or draining or relieving the pressure in a hydraulic line that I achieve several desirable objectives.

First, it is quite effective as a buried object protector. I.e., it works quite effectively to protect buried telephone lines, buried gas pipes and water pipes, etc., by bleeding the high pressure line if the tool is proximate an obstruction.

Second, it works for safety. Industrial accidents occasionally occur because sometimes the equipment is left with the backhoe raised when the workmen go home for the evening or the weekend. If children come to play around the equipment and they touch a lever, they permit the backhoe to fall, sometimes causing injury.

Third, my system has the additional advantage as an antitheft device. I.e., normally, this equipment is left unattended for periods of time, making it subject to theft. Thieves of this type equipment are familiar with normal factory installed locks and how to wire around them or otherwise steal the equipment with this type lock. My lock provides additional difficulty because power must be supplied to the valve or the equipment is relaxed. The outriggers and earth working tools are lying on the ground and unless the device is unlocked by its key, thus activating the valve, the equipment cannot be raised so the machine could be moved. If the wires are cut, then this again makes it more difficult to activate the equipment.

OBJECTS OF THIS INVENTION

An object of this invention is to protect earth working machines.

Another object is to prevent such machines from cutting cables, being stolen, or inadvertently being left with pressurized hydraulic lines.

Further objects are to achieve the above with equipment that is sturdy, compact, durable, lightweight, simple, safe, efficient, versatile, and reliable, yet inexpensive and easy to manufacture, install, adjust, operate, and maintain.

Other objects are to achieve the above with a method that is versatile, rapid, efficient, and inexpensive, and does not require skilled people to install, adjust, operate, and maintain.

The specific nature of the invention, as well as other objects, uses, and advantages thereof, will clearly appear from the following description and from the accompanying drawing, the different views of which are not necessarily to the same scale.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a side elevational view of an earth working machine with an embodiment of this invention shown thereon schematically.

FIG. **2** is a schematic representation of the hydraulic system of the machine according to this invention.

FIG. **3** is a schematic representation of the electrical control system according to this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

An earth working machine as used herein includes vehicle **10** with connected earth working tool **12.** In the particular embodiment illustrated, the earth working tool **12** is in the form of a backhoe. The earth working tool is connected to the vehicle by movable structures **14** in the form of arms extending from the vehicle **10** to the backhoe. Hydraulic pump **16** is mounted on the vehicle **10** and driven thereby. The pump is connected by hydraulic hoses **20** and **22** to hydraulic motor **18.** The hydraulic motor **18** is in the form of a hydraulic cylinder attached to the movable structure **14** whereby the earth working tool **12** is manipulated to dig the earth, the intended purpose of the machine.

The hydraulic hoses include high pressure line **20** and low pressure line **22.** As will be understood by those familiar with the art, the pump **16** pumps the hydraulic fluid from reservoir **24** into the high pressure line **20.** The fluid is utilized in the motor **18** and is returned in the low pressure line **22** to the reservoir **24.** Those skilled in the art will understand that there are various control valves to control the hydraulic fluid to the motor **18.** In fact, there are a plurality of motors **18** to activate different articulation of the structure **14** attached to the tool **12** and, also, to attach to different tools. I.e., one vehicle might well have a frontloading scoop **13** attached to it as well as a backhoe. Traditionally, backhoe machines have outriggers **15** to steady the vehicle **10** while the tool **12** is being used.

Those skilled in the art will understand that the machine as has been described to this point is conventional, well known, and commercially available on the market. Prior art patents teach detecting means provided for detecting that the tool **12** is proximate obstruction **26**, such as an underground pipe or cable. These means for detecting may be of various forms, such as described above, either an alternating signal may be placed upon the pipe and in such case, detection can occur before there is actual contact between the tool **12** and the obstruction **26.** In other cases, they take the form of direct electrical continuity in which case the tool **10** touches the obstruction **26.** As described in MAUST U.S. Pat. No. 2,131,291, a signal is produced when the tool gets near the obstruction. Therefore, in this application, the term "proximate" is used to indicate that the tool **12** is close enough to the underground obstruction **26** that it may be detected by those means which are known to the prior art. These means may detect while there is still a distance between the tool **12** and the obstruction **26,** or they may detect only upon contact. However, as used herein, the term "proximate" is used to include actual contact.

To this system which is known, I have included control circuit **28** operating bleed valve **30** by solenoid **32.** The valve **30** might also be called a bypass valve or relief valve. The valve **30** is normally open. This means that normally the high pressure line **20** is connected to line **22** back to the reservoir **24.** In effect, this inactivates the entire hydraulic system of the machine and there can be no hydraulic operation or lifting of the tool **12** or the outriggers **15** or other items operated by the hydraulic system. Also, there can be no pressure trapped in the various elements because of this bypass or bleed.

When the solenoid **32** is energized, the valve **30** is closed and, therefore, it is possible to have high pressure in the high pressure line **20** so the motor **18** may be operated to manipulate tool **12** by the structure **14.**

Electric energy is connected from source of electric energy **34** by main line **36** to the solenoid **32** with the control circuit **28** more particularly seen in FIG. **3.** The main line **36** includes fuse **37** for protection of the parts. Also, the main line **36** includes key switch **38.** If the switch **38** is locked in the open position, there can be no electrical energy transmitted to the solenoid **32** and, therefore, there can be no operation of the tool **12** by the motor **18** in the hydraulic system. Indicator light **40** from the main line **36** to ground line **42** indicates that electrical power is furnished to the control circuit **28.** The ground line **42** is, in fact, the frame of the vehicle **10** and, therefore, the tool **12** is part of or electrically connected to the ground line **42.**

As illustrated, the solenoid **32** is connected between the main line **36** and the ground line **42** through transistors **44.** Therefore, if the key switch **38** is closed and the transistors are conducting, the solenoid **32** will be energized, thereby closing the valve **30** and making the machine operative. However, if the transistors **44** are not connecting, the solenoid **32** will not be energized just the same as though the fuse **37** or the key switch **38** were open.

The main line **36** is connected through resistors **46,** rheostat **48** and resistor **50** and fuse **52** to a probe or clamp **54** and thus to the obstruction **26.** Therefore if the resistors **46** and **50** and the rheostat **48** were sufficiently low in ohmage, the contact between the tool **10** and the obstruction **26** would in itself provide a sufficiently low resistant circuit from the main line **36** to the ground line **42** to short or inactivate the solenoid **32** so that it was not sufficiently energized to hold the bleed valve **30** closed, thereby protecting the obstruction. However, more important is the non-conducting state of transistors **44.** Triac **56** is connected to tap **58** on the rheostat **48.** The triac is connected to the center point between high valve resistors **60** and **62.** It will be understood by those skilled in the electronics art that when the tool **10** touches or is proximate the obstruction **26,** this change of voltage upon the triac **56** will cause it to conduct through normally closed reset switch **64.** This, of course, changes the voltage upon the transistors **44** and causes them to become non-conductive and which results in de-energization of the solenoid **32.** The sensitivity of the control circuit may be controlled by the setting of the rheostat **48.**

After the triac **56** has fired to cause the transistors **44** to be non-conductive, it is necessary to open the circuit by opening the reset switch **64** so the control circuit is again ready to operate after the contact of the tool **12** with the obstruction **26.** Again, those skilled in the art will understand that when the reset switch **64** is depressed, this in itself will also energize the solenoid **32** which will close the valve **30**; therefore, permitting the equipment to be operated to move the tool **12** away from the obstruction **26.** Those skilled in the art will understand the necessity of being able to operate the equipment, otherwise, a great deal of difficulty would be encountered in moving the tool **12** away from the obstruction **26.** This could also be achieved by temporarily disconnecting the clamp **54** from the obstruction **26** or by removing the fuse **52.** However, to get the triac back in proper operation, the reset button is also desirable.

The embodiment shown and described above is only exemplary. I do not claim to have invented all the parts, elements or steps described. Various modifications can be made in the construction, material, arrangement, and operation, and still be within the scope of my invention. The limits of the invention and the bounds of the patent protection are measured by and defined in the following claims. The restrictive description and drawing of the specific example above do not point out what an infringement of this patent would be, but are to enable the reader to make and use the invention.

I claim as my invention:

1. In an earth working machine having

a. a vehicle,

b. an earth working tool connected to the vehicle by

c. movable structure,

d. a hydraulic pump mounted on the vehicle,

e. hydraulic hoses connecting said pump to at least one

f. hydraulic motor attached to the movable structure whereby the earth working tool is manipulated,

g. said hoses including a high pressure line from the pump to the motor, and

h. detecting means for detecting that the tool is proximate an obstruction,

j. the improved structure comprising:

k. a bleed valve attached to the high pressure line,

m. said valve connecting the high pressure line to a low pressure point,

n. an electric solenoid controllingly attached to said valve,

o. said valve open unless the solenoid is energized, and

p. a key operated switch electrically connected to said solenoid,

q. said switch forming means for de-energizing said solenoid responsive to operation of said switch.

2. The invention as defined in claim **1** with additional limitations of

r. a source of electrical energy attached to said solenoid through

s. a control circuit,

t. said control circuit being a control means for de-energizing said solenoid responsive to a signal from said detecting means.

3. The invention as defined in claim **2** with an additional limitation of

u. said control circuit utilizing solid state electronic elements.

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