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Mastaj

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[54] **AUXILIARY TOOL CONTROL CIRCUIT**

[75] Inventor: **Joseph A. Mastaj,** Holyoke, Mass.

[73] Assignee: **Worthington-CEI, Incorporated,** Holyoke, Mass.

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[52] **U.S. Cl.** .... **91/411 R,** 91/461

[51] **Int. Cl.** **F15b 11/16**

[58] **Field of Search** .... 91/411 R, 412, 414, 461

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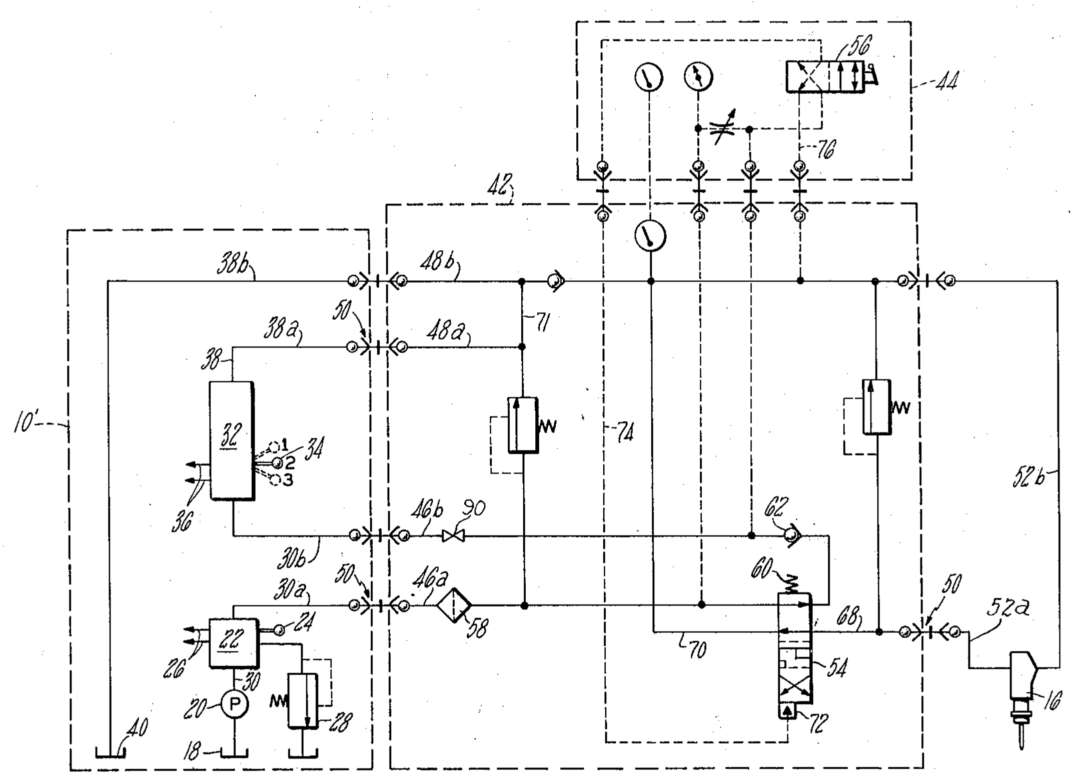
Primary Examiner—Edgar W. Geoghegan

[57] **ABSTRACT**

An auxiliary tool control circuit which can be incorporated into the hydraulic supply lines for various types of construction equipment is presented herein. The auxiliary tool control circuit includes a pilot operated valve and a manually operated control valve which are cooperatively effective to control the delivery of motive fluid to a tool which has been connected into a preexisting fluid circuit for other equipment. The connections and cooperative arrangements between the manual control valve and the pilot operated valve and the operating controls for the other equipment are such that simultaneous operation can not occur between the other equipment and the auxiliary tool.

14 Claims, 3 Drawing Figures



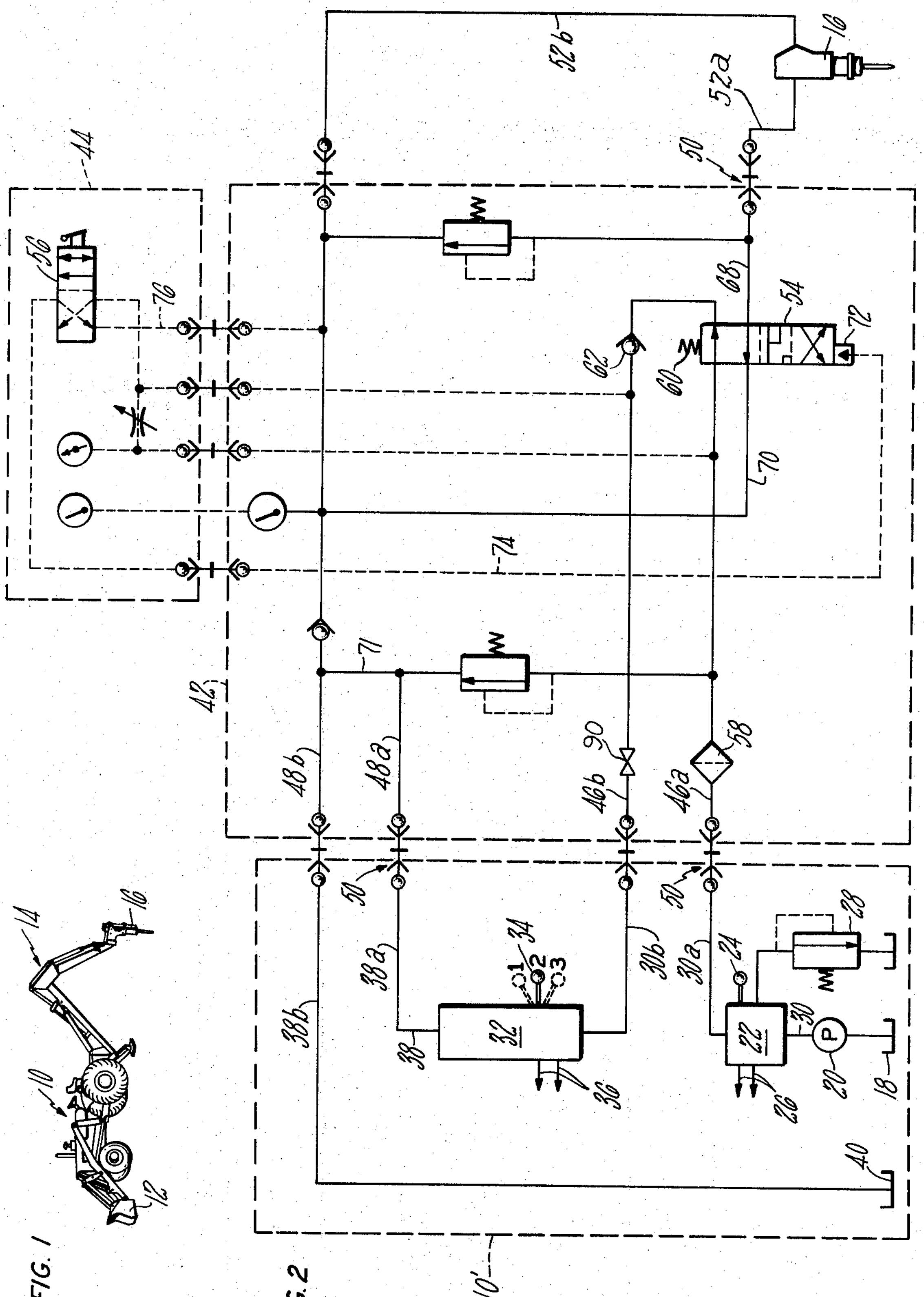

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FIG. 1

FIG. 2

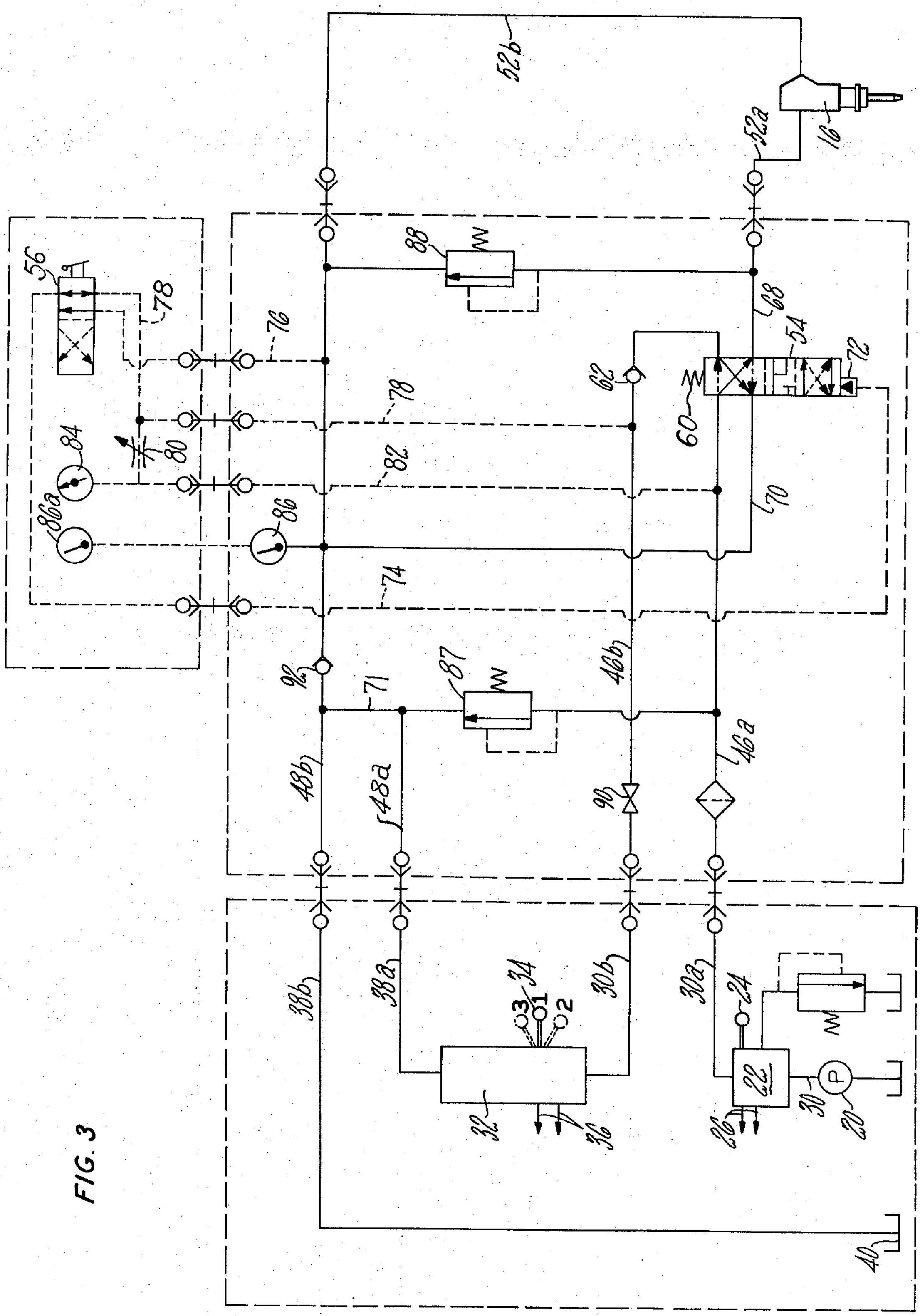
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FIG. 3

AUXILIARY TOOL CONTROL CIRCUIT

BACKGROUND OF THE INVENTION

This invention relates to the field of hydraulic controls for construction equipment tools. More particularly, this invention relates to the field of hydraulic controls for construction equipment tools wherein a tool, referred to herein as an auxiliary tool, is operated by connecting it into the hydraulic circuit for other equipment. The invention will be discussed in the environment of a hydraulic tool, particularly a paving breaker, mounted on backhoe equipment. However, it will be understood that the invention is equally applicable to other types of hydraulic tools mounted on or connected into the hydraulic circuits of other types of equipment.

Many proposals have been made in the past in the field of construction equipment, and hydraulic tools for use in construction equipment, for mounting various kinds of hydraulic tools on tractor type equipment and powering the auxiliary tool by connecting it into hydraulic lines for the tractor. Typical approaches in the prior art have involved dual control systems, i.e., one for the tractor and one for the auxiliary tool, and typical prior art practice has involved the use of manually operated on-off valves to control the auxiliary tool. A common problem with these prior art systems is that a mounted tool, such as a paving breaker, can be lifted off the work by operation of parts of the tractor mechanism while continuing to run. This lifting of the auxiliary tool from its work while it continues to run poses a danger of serious damage to the auxiliary tool. It is also a general practice in the prior art to control hydraulic pressures for such auxiliary tools by means of sequence valves and pressure reducing valves. These valves tend to cause heat generation within the hydraulic circuit thus often requiring the incorporation of auxiliary hydraulic coolers to keep heat build-up at acceptable levels. These problems and other problems known in the art have limited the acceptability and utility of auxiliary tools which are mounted on and/or connected into the hydraulic circuits of tractor equipment.

SUMMARY OF THE INVENTION

The present invention will be discussed in terms of a paving breaker, the auxiliary tool, mounted on a backhoe tractor, a configuration for which the present invention is particularly suitable. However, it will be understood that the invention is equally applicable to other types of auxiliary tools such as tampers, compactors, hand-held paving breakers, augers and shears mounted on backhoes or other tractor vehicles.

In the present invention a pilot operated directional control valve unit is connected into the backhoe supply line and the backhoe return line, and the auxiliary tool, i.e., the paving breaker, is connected to the control unit. A manually operated control valve is also connected to the control unit to selectively actuate the paving breaker. In order to operate the paving breaker the backhoe controls are placed in a neutral position, and the manually operated control valve is actuated whereby the pilot valve is connected to the backhoe supply line. Upon subsequent actuation of a backhoe control lever, the increased pressure in the backhoe supply line results in actuation of the pilot operated control valve whereby actuating fluid is delivered to the paving breaker.

Additional aspects of the present invention include features whereby a flow control valve compensates for leakage in the backhoe system to insure continued actuation of the control valve; and a feature whereby the paving breaker can not be lifted off the work area while it is still operating.

The following several advantages are realized with the present invention:

Full tractor oil flow is available for operation of either the backhoe or the auxiliary tool as desired. In this manner the effective operation of each of the backhoe and the auxiliary tool is unimpaired by the connection of the auxiliary tool into the backhoe circuit.

Only slight additional heat build-up is encountered in the control circuit of the present invention thus eliminating the need for auxiliary cooling equipment.

The paving breaker can not be lifted off the work while running, and the tool will shut off if it breaks through the work, thus eliminating the possibility of serious damage to internal parts of the tool which could otherwise occur.

Operation of the auxiliary tool is triggered by pressure in a line to the backhoe valve bank inlet rather than by pressure in one of the backhoe cylinders; thus, operation of the boom, dipper stick or bucket cyliders of the backhoe in either direction can be made to operate the auxiliary tool, and the tool can be reversed in its mountings, and the tool can be rotated almost a full 360° about the boom bucket pin while still delivering actuating fluid thereto.

The control circuitry of the present invention is easily connected to a backhoe tractor by merely removing the backhoe, and disconnecting the hydraulic supply lines to the backhoe actuators, those lines usually being equipped with quick disconnect couplings or standard hydraulic fittings, and connecting the tractor hydraulic lines to the pilot valve control unit. Other features and advantages of the present invention will be apparent to and understood by those skilled in the art from the following detailed description and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring now to the drawings, wherein like elements are numbered alike in the FIGS.:

FIG. **1** is a simplified perspective view of a backhoe tractor.

FIG. **2** is a schematic representation of the present invention in the "off" position, i.e., where motive fluid is not being delivered to the auxiliary tool.

FIG. **3** is a schematic representation of the present invention in the "on" position, i.e., where motive fluid is being delivered to the auxiliary tool.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, a generalized configuration of a backhoe machine is shown. The machine includes a tractor **10** having a hydraulically actuated front end loader **12** at the front end and a boom structure **14** at the back end. On a conventional backhoe a bucket is mounted at the end of the boom for excavating purposes. In the present invention the bucket is disconnected and removed from the backhoe and is replaced with a paving breaker **16**. The front end loader and the bucket in the standard backhoe machine are hydraulically actuated through a source of pressurized fluid communicating via hydraulic lines to actuating pistons and cylinders. Separate control panels are usually provided on the tractor for the front end loader and the bucket. With most backhoe machines the bucket is easily detactable mechanically, and hydraulic connections between the fluid source and the actuators are easily made and broken through the use of disconnect couplings or standard hydraulic fittings. Accordingly, the paving breaker **16** can be mounted on the boom in place of the bucket with a minimum disturbance of existing tractor hydraulics, as will be more fully discussed hereinafter.

Referring now to FIG. **2**, a combination block diagram and generalized schematic is shown. The backhoe tractor is represented in FIG. **2** in the form of the dotted line **10'**. A hydraulic fluid reservoir **18** is connected via a pump **20** to a bank of control valves **22** for the front end loader. The control bank **22** will usually have a single control lever **24** (although some have more than one) and each control lever will regulate the flow of pressurized fluid through one or more hydraulic lines **26** to actuate the fron end loader. A main relief valve **28** is connected as shown to prevent pressure overloading.

The pump **20** and control valve bank **22** are in a supply line **30**. The supply line continues downstream of control bank **22** in a branch **30a** which is normally connected to branch **30b** leading to a bank of control valves **32** for the backhoe. The phrase "normally connected" means that branches **30a** and **30b** of the supply line would be interconnected, such as by means of a length of flexible hydraulic line, if the standard bucket were mounted at the end of the boom. However, in the present invention an auxiliary control package, which will be discussed in more detail hereinafter, is connected between those two branches of the supply line.

Supply line branch **30b** leads to the bank of control valves **32** for the backhoe. Control valve bank **32** has a plurality of control levers **34** (only one of which is shown for purposes of illustration) which, acting through control valves, control the delivery of pressurized fluid to the actuating cylinders of the backhoe via lines **36** in a known fashion. Control banks **22** and **32** are the separate control banks mounted on the tractor for the front end loader and the backhoe, as discussed above with regard to FIG. **1**. The fluid circuit continues downstream of control bank **32**, at which point it has become a return line **38** having branches **38a** and **38b** leading to a return sump **40**. Under the normal condition where the backhoe bucket is mounted on the tractor, branches **38a** and **38b** of the return line would also be interconnected by a length of flexible hydraulic line.

Still referring to FIG. **2**, and in accordance with the present invention the auxiliary tool, typically a paving breaker **16**, is mounted on the boom in place of the regular bucket. The particular mechanical configuration of the mounting is of no particular importance to this invention, and no further discussion of it is necessary.

Hydraulic control apparatus for paving breaker **16** is connected into the hydraulic circuitry, the hydraulic control apparatus including a pilot valve unit **42** hydraulically connected between the tractor and the tool and a manual control unit **44** connected to the pilot valve unit. The pilot valve unit **42** does not require any operator manipulation, and thus it can be remotely mounted in any convenient location. The manual control unit is mounted at some location convenient to the operator. The pilot valve unit has a pair of branch lines **46a** and **46b** which are connected, respectively, to branch lines **30a** and **30b** and a pair of branch lines **48a** and **48b** which are connected to lines **38a** and **38b**, respectively. All of these connections are made by means of quick disconnect couplings **50**. Similarly, a hydraulic inlet line **52a** is connected from the pilot valve unit to breaker **16** to deliver actuating fluid to the breaker, and a return fluid line **52b** is connected from the breaker to return line **48b**, the connections again being made by quick disconnect couplings **50**.

A two-position four-way spring return pilot operated valve **54** in valve unit **42** in flow line **46** directs actuating fluid to breaker **16** upon receipt of an appropriate piloting signal. Manual control unit **44** has a manually operated two-position three-way valve **56** which controls the actuation of pilot valve **54**. Manual control unit **44** is connected to pilot valve unit **42** through a plurality of hydraulic lines and quick disconnect couplings as shown, the purposes of which will be discussed in more detail in describing the operation of the system. It will be understood that the valves **54** and **56** are depicted in a conventional hydraulic notation wherein the alternate flow directions or passages of the two positions are shown by the crossed or parallel arrows in the valve, with connections being shown made for one position of each valve, the "off" or "unactuated" position being shown made in FIG. **2**.

Still referring to FIG. **2**, fluid under pressure from pump **20** flows through line **30** to line **46a** and through a filter **58** in line **46a**. In the absence of any pilot actuating pressure being delivered to valve **54**, a spring **60** in the valve holds the valve in the position shown in FIG. **2** wherein the pressurized fluid flows directly through the valve and to line **46b** through a check valve **62** and a manually operated shut-off valve **90** (positioned in the open position) in line **46b** downstream of valve **54**. At the same time, inlet line **52a** to the tool is connected via line **68** and valve **54** to line **70** and thence to return line **48b** and thence through line **38b** to return sump **40**. Similarly, the hydraulic fluid flowing through line **46** to line **30b** flows through control bank **32** to line **38a** and thence to line **71** to return line **48b** and back to sump **40**. In the configuration just discussed, tool **16** is inoperative, and control valve bank **32** may be selectively actuated to move the boom and position tool **16** at any desired location for eventual actuation.

Still referring to FIG. **2**, it should be noted that the actuator **72** of pilot valve **54** is connected via line **74** to valve **56** and through one passage through valve **56** to line **76** and thence to return line **48b**. Thus, the actuator for the pilot valve is only exposed to return line pressure, and hence spring **60** holds valve **54** in the position shown in FIG. **2** where lines **46a** and **46b** are connected through one flow passage through the valve and lines **68** and **70** are connected through another flow passage through the valve. It should also be noted that the second passage through valve **56** is dead-ended in the FIG. **2** configuration.

In order to activate tool **16**, the equipment operator must first manually actuate control valve **56**. The operating configuration and sequence which occurs upon manual actuation of the valve **56** is shown in FIG. **3**. Upon the manual actuation of valve **56**, line **76** which had previously been connected through a flow passage of the valve to line **74**, is dead-ended; and line **78**, which is connected to line **46b** downstream of check valve **62** and which had previously been dead-ended through a flow passage in valve **56**, is now connected through a flow passage of valve **56** to line **74**, and hence to the actuator **72** of pilot valve **54**. The control valves in front-end loader bank **22** and backhoe bank **32** are typically of the open center type having a neutral central position (with the valves allowing flow through the bank to the return line) and two actuating positions, such as forward and reverse or up and down, illustrated representatively by positions **1, 2** and **3** of the representative control lever **34**. With pump **20** rotating and the circuit components attached, and with valve **56** in the "on" position of FIG. **3**, hydraulic oil will still circulate from pump **20** through line **30***a* through line **46***a*, through the dotted line passage position (i.e., the unactivated position) of valve **54**, through line **46***b* through line **30***b*, valve bank **32**, line **38***a*, line **48***a*, line **71**, line **48***b* and line **38***b* back to sump **40**, providing the control valves in bank **32** are all in the neutral position. Thus, since pilot valve actuating line **74** only contains oil at tank pressure, pilot valve **54** is not actuated and tool **16** remains inoperative. However, pilot valve **54** is in what may be called an armed state since the movement of valve **56** to the position in FIG. **3** permits valve **54** to receive and respond to an actuating signal.

When it is desired to operate tool **16**, one of the control levers **34** in bank **32** is operated to connect its associated valve to one of the lines **36** leading to a backhoe cylinder. The pressure will build up in that cylinder when it is holding the tool against the work. This results in an increase in pressure in the hydraulic lines upstream of valve bank **32**. The increased hydraulic pressure in line **46***b* is transmitted via line **78** through the transfer passage in valve **56** to line **74** and then to the actuator **72** of valve **54**. This increased pressure thus delivered to valve **54** results in an actuation of valve **54** so that it switches to the passage configuration denoted by the crossed solid lines. Upon that actuation of valve **54**, hydraulic fluid under pressure is delivered via line **46***a* and through the flow passage in valve **54** to line **68** and thence via inlet line **52***a* to breaker **16** to operate breaker **16** in known fashion.

Upon the switching of valve **54** to the "on" position of FIG. **3**, line **46***b* is connected through a flow passage of the valve to line **70**; however, check valve **62** closes to prevent a flow of hydraulic fluid back through line **46***b*. The necessary pressure level is thus maintained in line **46***b* to retain valve **54** in the actuated position. In order to insure that backhoe valve leakage or backhoe cylinder leakage does not allow the pressure in line **46***b* to fall below the level necessary to maintain valve **54** in the actuated position, a manually adjustable flow control valve **80** is connected between line **78** and line **46***a* via line **82**. Valve **80** is adjusted to compensate for leakage through the valves of bank **32** and the backhoe actuating cylinder so as to maintain the pressure level in line **78**, and hence the actuating pressure in line **74** at the level necessary to maintain valve **54** in the operative position to insure a continued supply of operating fluid to tool **16**. Compensation for such leakage can also be realized by leakage through valve **54** itself into line **46***b*. An appropriate pressure gauge **84** may be employed to check on the pressure level, and a temperature gauge **86** or **86***a* may be employed to monitor hydraulic fluid temperature.

With the control unit positioned as discussed above with respect to FIG. **3**, actuating fluid is delivered via line **52***a* to operate paving breaker **16**, and the actuating fluid is returned to pump **40** via line **52***b* and line **48***b*. Adjustable safety relief valve **88** is also incorporated between line **68** and line **48***b* to protect hydraulic tool **16** from overloading.

Still referring to FIG. **3**, operation of tool **16** can be terminated either by positioning all of the backhoe control valves in a neutral position or by switching valve **56** to the "off" position, i.e., returning valve **56** to the FIG. **1** state. In either of these events, the pressure in line **74** is reduced to tank return line pressure. If valve **56** is switched to the off position, line **74** is connected to return line **48***b* via line **76**; if the backhoe control valves are moved to the neutral position, the pressure in line **46***b* is reduced to return line pressure, and line **74** is connected to the return line pressure in line **46***b* via line **78**. In either event, the reduction of pressure in line **74** results in return of pilot valve **54** to the "off" position of FIG. **1** because of the biasing load of spring **60**.

One of the problems which has in the past plagued the field of auxiliary mounted tools is the continued operation of the tool upon repositioning of the boom to which it is connected. A tool such as a paving breaker can receive serious internal damage if it continues in operation after being removed from the work. That problem is avoided in the hydraulic control configuration of the present invention. As has already been pointed out, if the backhoe control valves are all shifted into the neutral position, the actuating pressure to the pilot valve **54** is reduced and operation of the tool stops. If the backhoe valve which controls raising and lowering of the boom is shifted through neutral to the lifting position with valve **56** in the "on" position, tool **16** will restart before the tool is lifted. The pressure in line **30***b*, and hence the pressure delivered to the backhoe actuating cylinders, will be insufficient to reposition the boom as long as flow control valve **80** is properly adjusted. The same consideration holds true for each of the several backhoe control valves. Thus, no repositioning can be made of the backhoe boom until valve **56** is returned to the "off" position of FIG. **1**, and damage to the tool is avoided since the tool will always remain on the work and the piston of the breaker will strike the moil.

Tool **16** will also shut off if the breaker penetrates through the work and encounters a hollow area. If that happens, the resistance to the boom load is removed and the pressure in the boom actuating cylinder drops to return line pressure. Therefore, the pressure in line **46***b* drops and valve **54** returns to the "off" position, thus terminating the flow of actuating fluid to tool **16**.

A manually operated shut-off valve **90** in line **46***b* makes it possible to run many other tools from this basic control circuit. For example, a hand held paving breaker can be connected to the quick disconnects at the ends of lines **68** and **48***b*, and this hand held paving breaker can be operated by closing manually operated shut-off valve **90**. The closing of valve **90** simulates the operation of a backhoe control valve by imposing a load in line **46***b* whereby the pressure in line **46***b* increases. Upon actuation of valve **56** to the "on" position, the increased pressure in line **46***b* results in movement of valve **54** to the "on" position as previously described, thus resulting in the delivery of actuating fluid to the hand held paving breaker or such other tool as is connected into the line. Valve **90** also terminates backhoe operation, thus adding a safety feature in that the boom can not be inadvertently operated to injure the operator of the hand held tool.

The control circuit of this invention can also be applied to tractor circuits containing backhoe valves with "pressure beyond" features, i.e., one which there is a pressure requirement downstream of the backhoe valves. For example, if the front end loader valve bank **22** is in line **38***b* downstream of backhoe valve bank **32**, a check valve **92** in line **48***b* will prevent pressurization of tool return line **52***b* with "power beyond" backhoe valves and relief valve **87** connected between lines **46***a* and **48***b* will protect against overloading of the pump.

With the hydraulic control system as described above it can be seen that full tractor oil flow, i.e., the full output of pump **20**, is available for operation of either the backhoe or the auxiliary tool **16**. Heat build-up in the system is very minimal, thus eliminating the need for additional oil coolers. The auxiliary tool can not be lifted off the work while running, thus preventing damage to tools such as paving breakers which may suffer internal damage if lifted off the work while running. The operation of auxiliary tool **16** is triggered by pressure in line **46***b* upstream of the backhoe valve bank **32** rather than by pressure in one of the backhoe cylinders. Thus, the tool **16** can be reversed in its mounting on the backhoe boom if such reverse mounting is desired in order to demolish more effectively, and operation of boom, dipper stick, or bucket cylinders in either direction can be made to operate the auxiliary tool. Accordingly, the system of the present invention has a distinct advantage in that it controls the mounted auxiliary tool in both normal and reversed mounting positions and it provides the flexibility of being able to apply the auxiliary tool in a full 360° angle about the boom bucket pin. The hydraulic and control circuitry can be incorporated in separate units **42** and **44** which can easily be connected into the tractor hydraulic circuit by quick disconnect couplings or standard hydraulic fittings. In addition, since only unit **44** requires manual operation, unit **42** can be mounted in any remote place.

While preferred embodiments have been shown and described various modifications and substitutions may be made thereto without departing from the spirit and scope of the invention. Accordingly, it is to be understood that the present invention has been described by way of illustration and not limitation.

What is claimed is:

1. A control circuit for an auxiliary tool adapted to be operatively associated with control means for another tool having a source of operating fluid and means for delivering the operating fluid under pressure, the control circuit including:

a first fluid conduit means for connecting fluid delivery means to the control means for the other tool, the pressure level in said first fluid conduit means being influenced by the operative state of the control means for the other tool;

pilot operated valve means in said first fluid conduit means;

second fluid conduit means from said pilot operated valve means to the inlet of an auxiliary tool to be powered;

third fluid conduit means for returning fluid from the discharge from an auxiliary tool to be powered to a reservoir;

said pilot operated valve means having a first position interconnecting the parts of said first fluid conduit means upstream and downstream of said pilot operated valve means and connecting said second fluid conduit means to said third fluid conduit means, and said pilot operated valve means having a second position connecting said first fluid conduit means to said second fluid conduit means to deliver operating fluid to the auxiliary tool;

selectively operable control means for arming said pilot valve means for switching from the first position thereof to the second position; and

means responsive to the pressure level of fluid in said first fluid conduit means downstream of said pilot valve means for delivering an operating signal to said pilot valve means and switching said pilot valve means between said first and second positions thereof in the armed state of said pilot valve means.

2. A control circuit as in claim **1** wherein:

said selectively operable control means includes a control valve having first and second positions; and wherein

said means for delivering the operating signal to the pilot valve means includes fourth fluid conduit means from said control valve to said pilot valve means, and fifth fluid conduit means from said first fluid conduit means to said control valve means; and further including

sixth fluid conduit means from said third fluid conduit means to said control valve means;

said control valve in the first position connecting said fourth and sixth fluid conduit means, and said control valve in the second position connecting said fourth and fifth conduit means, said second position of said control valve being the position for arming said pilot valve means.

3. A control circuit as in claim **2** including:

check valve means in said first fluid conduit means between said pilot operated valve means and said fifth fluid conduit means.

4. A control circuit as in claim **2** including:

seventh fluid conduit means from a point in said first fluid conduit means upstream of said pilot operated valve means to said fifth fluid conduit means;

and adjustable flow control means in said seventh fluid conduit means for compensation of leakage from said first fluid conduit means downstream of said pilot operated valve means.

5. A control circuit as in claim **2** wherein:

the pressure level in said first fluid conduit means increases in response to actuation of the control means for the other tool to an active state whereby said operating signal is delivered via said fifth fluid conduit means, the second position of said control valve and said fourth fluid conduit means to operate said pilot valve means and operating fluid is delivered via said first fluid conduit means, the second position of said pilot valve means, and said second fluid conduit means to the auxiliary tool.

6. A control circuit as in claim **5** whrein:

said pilot operated valve means returns to the first position thereof to terminate operation of the auxiliary tool upon reduction in pressure in said first fluid conduit means below a predetermined value with said control valve in the second position thereof.

7. A control circuit as in claim **6** wherein:

the pressure in said first fluid conduit means downstream of said check valve is insufficient to actuate the another tool when the auxiliary tool is operative.

8. A control circuit for an auxiliary tool adapted to be operatively associated with control means for another tool mounted on a vehicle and having hydraulic actuating means, said vehicle having a source of operating hydraulic fluid, pump means for delivering the operating fluid under pressure to the hydraulic actuating means for the another tool, and control means for the another tool having at least one active position for delivering hydraulic fluid to said actuating means and a neutral position for returning hydraulic fluid to a reservoir, the control circuit including:

first hydraulic conduit means for connecting the pump means to the control means for the another tool, the fluid in said first conduit means being at an elevated pressure level when said control means for the another tool is in an active position and a load is imposed on hydraulic actuating means for the another tool, and the pressure of fluid in said first conduit means being at a lower pressue level when the control means for the another tool is in a neutral position;

pilot operated valve means in said first conduit means;

second hydraulic conduit means from said pilot valve means to the inlet of an auxiliary tool to be powered;

third hydraulic conduit means for returning hydraulic fluid from the discharge of the auxiliary tool to a reservoir;

said pilot operated valve means having a first position interconnecting the parts of said first conduit means upstream and downstream of said pilot valve means to provide fluid communication from the pump means to the control means for the another tool and connecting said second conduit means to said third conduit means to vent said third conduit means to the reservoir, and said pilot valve means having a second position connecting said first fluid conduit means to said second conduit means to deliver operating fluid to the auxiliary tool;

selectively operable control means including a control valve having first and second positions;

fourth fluid conduit means from said control valve to said pilot operated valve means for delivering an operating signal to switch said pilot operated valve means between said first and second positions thereof;

fifth hydraulic conduit means from said first conduit means to said control valve; and

sixth hydraulic conduit means from said third conduit means to said control valve;

said control valve in the first position interconnecting said fourth and sixth conduit means and dead ending said fifth conduit means, and said control valve in the second position interconnecting said fourth and fifth conduit means to deliver the operating signal to said pilot operated valve means and dead ending said sixth conduit means.

9. A control circuit as in claim 8 including:

check valve means in said first fluid conduit means between said pilot operated valve means and said fifth fluid conduit means.

10. A control circuit as in claim 9 including:

seventh hydraulic conduit means from a point in said first conduit means upstream of said pilot operated valve means to said fifth conduit means;

and adjustable flow control means in said seventh conduit means for compensation of leakage from said first fluid conduit means downstream of said pilot operated valve means.

11. A control circuit as in claim 9 wherein:

the pressure level in said first conduit means increases in response to actuation of the control means for the other tool to an active position whereby said operating signal is delivered via said fifth fluid conduit means, the second position of said control valve and said fourth fluid conduit means to operate said pilot valve means and operating fluid is delivered via said first conduit means, the second position of said pilot valve means, and said second conduit means to the auxiliary tool.

12. A control circuit as in claim 11 wherein:

said pilot operated valve means returns to the first position thereof to terminate operation of the auxiliary tool upon reduction in pressure in said first conduit means below a predetermined value with said control valve in the second position thereof.

13. A control circuit for an auxiliary tool as in claim 12 wherein:

the pressure in said first conduit means downstream of said check valve is inadequate to power the hydraulic actuators for the another tool when the auxiliary tool is operative.

14. A control circuit as in claim 8 including:

shut off valve means in said first conduit means downstream of the connection with said fifth conduit means.

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