Sept. 27, 1966 J. H. KONEFES 3,275,174

AUTOMATIC LEVELING DEVICE

Filed June 7, 1965 2 Sheets-Sheet 1

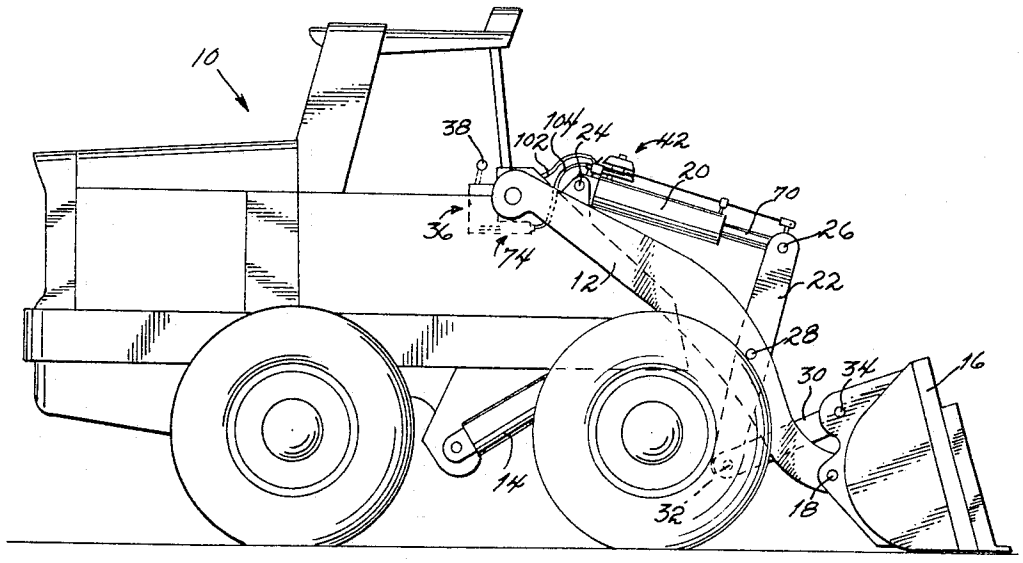


Fig. 1

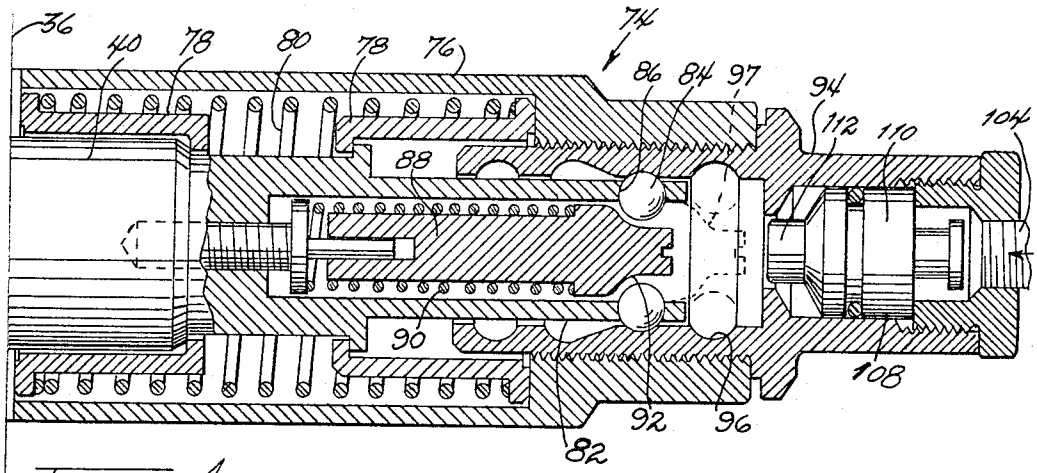


Fig. 4

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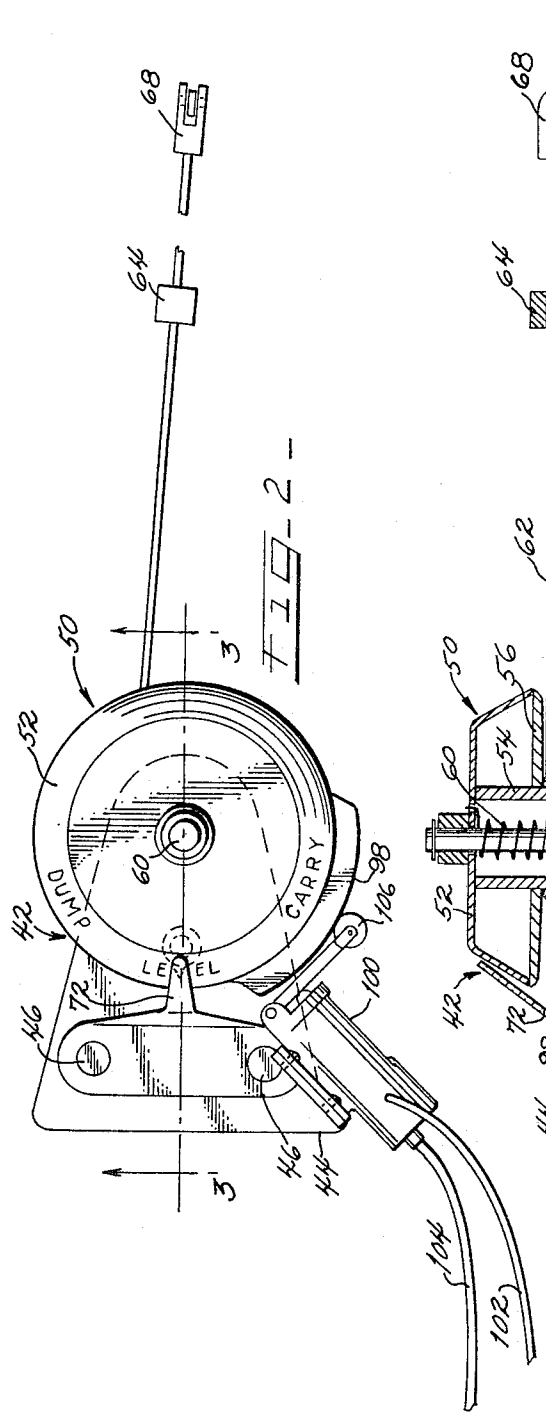


FIG. 2

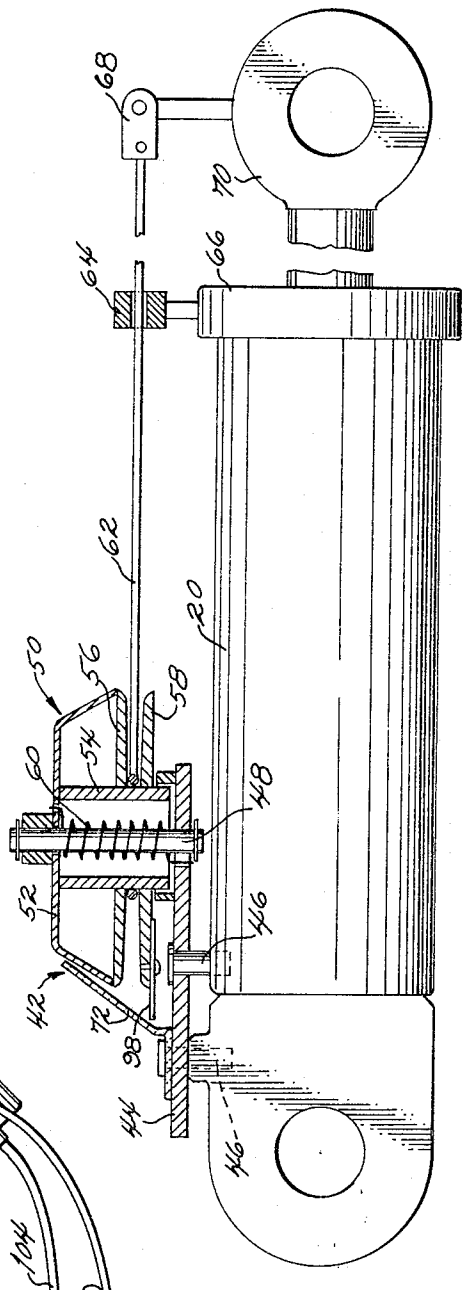


FIG. 3

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United States Patent Office 3,275,174 Patented Sept. 27, 1966

3,275,174

AUTOMATIC LEVELING DEVICE

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Filed June 7, 1965, Ser. No. 461,866
1 Claim. (Cl. 214—761)

This invention relates to a leveling device for a material handling bucket and more particularly relates to an automatic leveling device for a material handling bucket for use in combination with a bucket position indicator on a construction vehicle.

It is an object of this invention to provide an automatic leveling device which operates responsive to the position of a material handling bucket to terminate movement of a hydraulic ram which actuates the bucket.

It is another object of this invention to provide an automatic leveling device for a material handling bucket in which a sheave-drum assembly is utilized as a bucket position indicator whereby movement of the drum to indicate the level position of the bucket will terminate operation of the ram which positions the bucket.

Another object of this invention is to provide an automatic leveling device for use with a material handling bucket in which a sheave-drum assembly indicates the level, carry, or dump positions of the bucket and in which a camming surface on the assembly actuates means to terminate movement of the bucket when the bucket is in the level position.

The foregoing and other objects are realized in accordance with the present invention by providing an air actuated piston which operates in response to movement of a sheave-drum indicator assembly as it indicates the "level" position of a material handling bucket. The piston operates to release a detent mechanism which holds the spool of a hydraulic control valve in an operating position for directing fluid to a bucket tilting ram. Upon release of the detent the spool will return to the neutral position whereby operation of the ram is terminated and the bucket will remain in the level position until further manipulation of the control valve by the operator.

The invention, both as to its organization and method of operation, taken with further objects and advantages thereof, will best be understood by reference to the following description, taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a side elevation view of a tractor loader incorporating an automatic bucket leveling device embodying features of the present invention;

FIGURE 2 is an enlarged top plan view of component units of the present invention;

FIGURE 3 is a side elevational view of a component unit of the invention taken along the line 3—3 of FIGURE 2 in which the unit is mounted on the bucket tilting ram of the tractor loader of FIGURE 1; and

FIGURE 4 is a greatly enlarged cross-sectional view of component parts of the hydraulic control valve and detent mechanism as utilized in the present invention

Referring now to the drawings, and particularly to FIGURE 1, the reference numeral **10** indicates generally a front end tractor loader. A pair of boom arms **12** are pivotally mounted on the tractor loader **10** and a pair of extensible hydraulic rams **14** are provided to raise and lower the boom arms. A material handling bucket **16** is mounted on the free ends of the boom arms by means of pins **18** for pivotal movement about a transversely extending axis.

Pivotal movement of the bucket **16** relative to the boom arms is effected by means of an extensible hydraulic ram **20** and a rocker arm lever **22**. The ram **20** is pivotally connected at its head end to the tractor loader **10** by

means of pivot pin **24**, and is pivotally connected at its rod end **70** to the upwardly extending portion of rocker arm lever **22** by means of pin **26**. The rocker arm lever **22** is pivotally connected intermediate its ends between the pair of boom arms **12** by means of pivot pin **28**. A link **30** is pivotally connected at one end to the lowermost end of the rocker arm lever by means of pin **32** and at its other end to the bucket **16** by means of pin **34**.

Extension of hydraulic ram **20** through operation of hydraulic control valve **36** will pivot the bucket **16** backward with respect to the boom arms **12** about pivot pins **18**; retraction of the ram **20** will pivot the bucket **16** forward with respect to the boom arms **12**.

The hydraulic control valve **36** is positioned within the cab of tractor loader **10** so that its associated control lever **38** is within easy reach of the operator. The control valve **36** is broadly conventional and details of its construction will be well known to those skilled in the art. Suffice it to say that manipulation of the control lever **38** operates to direct hydraulic fluid from a source of fluid pressure (not shown) through hydraulic conduits (not shown) for selective extension and retraction of ram **20**. The control valve **36** has a spool **40** (FIGURE 4) which is movable from a neutral position to first and second operating positions upon manipulation of the control lever **38**. When the control lever **38** is manipulated to move the spool **40** to the left of the neutral position fluid under pressure will be directed to the rod end of ram **20** to retract the ram and dump the bucket **16** forwardly. When the control lever **38** is manipulated to move the spool **40** to the right of the neutral position, the control valve **36** will direct fluid under pressure to the head end of ram **20** to extend the ram and pivot the bucket **16** backwards to the level and carry positions.

A bucket position indicator **42** is mounted on the upper side of the head end of the ram **20** within the range of vision of the operator. FIGURES 2 and 3 show details of the bucket position indicator **42**. A flat mounting bracket **44** is secured to the head end of the ram **20** by means of pins **46**. A spindle **48** is rigidly secured to the forward end of the bracket **44** and extends in an upward direction from the ram **20**. A sheave-drum assembly **50** is rotatably mounted on the distal end of spindle **48**. The assembly **50** comprises cover member **52** rotatably mounted on spindle **48**, a drum **54** coaxial with and radially spaced from spindle **48**, and a pair of spaced-apart disks **56** and **58** secured to the drum **54** to define a sheave therewith. A coil spring **60** is mounted around the spindle **48** and is secured at its one end to bracket **44** and at its other end to cover member **52**. The spring **60** urges the assembly **50** to rotate in the counterclockwise direction as viewed in FIGURE 2. A length of cable **62** is secured at one end to the sheave-drum assembly **50** and is partially wound between the disks **56** and **58**. The cable is threaded through the eye of guide member **64** which in turn is secured to flange **66** of ram **20**. The end of cable **62** is secured to a bracket **68** which in turn is secured to the rod end **70** of the ram **20**. Appropriate indicia such as "Level," "Dump," and "Carry" are provided on the outer surface of cover member **52** to indicate the bucket position. A pointer member **72** is secured to the bracket **44** and extends upwardly in juxtaposition to the indicia on the cover member **52**.

As the ram **20** is retracted so that bucket **16** is dumped forward coil spring **60** will rotate the sheave-drum assembly **50** counterclockwise, thus winding the cable **62** on the sheave. The assembly **50** will rotate until the indicia "Dump" is aligned with the pointer member **72**. Upon extension of the ram **20** to pivot the bucket **16** backwards to the level and carry positions, the cable **62** will move outward and unwind from the sheave-drum assem-

bly **50** which will rotate in a clockwise direction. The indicia "Level" and "Carry" respectively will then move into alignment with the pointer member **72**.

After the operator has dumped the material from the bucket **16** and has operated the control lever **38** to direct fluid to extend ram **20** and return the bucket to the level position, it is desirable that means be provided to automatically terminate operation of control valve **36** when bucket **16** reaches the level position. This will enable the operator to independently operate the controls to lower the boom arms and maneuver the tractor loader **10** into the next loading position. To provide this feature a detent mechanism **74** (FIGURE 4) is mounted adjacent the control valve **36**. The mechanism **74** includes a tubular housing **76** which encloses the end of spool **40** projecting outwardly from the valve **36**. A pair of centering sleeves **78** are slidably mounted within the annular space between the spool **40** and the inner surface of housing **76**. A compression spring **80** resiliently urges the sleeves apart. The sleeves **78** are in contact with shoulders on spool **40** and urge the spool to the neutral position from either of the first or second operating positions. A tubular extension **82** is formed on the end of spool **40** and has a pair of apertures **86** formed in its outer margin. A ball or detent **84** is positioned in each of the apertures **86**. A plunger **88** is slidably mounted within the tubular extension **82** and is resiliently urged toward the detents by means of a coil spring **90**. A camming surface **92** is formed at the free end of plunger **88** and operates to urge the detents **84** outwardly through the apertures **86**. An end member **94** is secured to the outermost end of housing **76** and has an annular groove **96** formed within its inner surface. With the spool **40** moved to the right, as indicated by the broken-line position **97** in FIGURE 4, the detents **84** will be cammed outwardly into the groove **96**. The detents will hold the extension **82** and spool **40** against the force of spring **80** and thus the control valve **36** will continue to operate to extend ram **20** until the holding force of the detents is overcome and the spool is returned to the neutral position.

The operator may override the detents by merely manipulating control lever **38** so that spool **40** is moved to the left to urge the detents out of the annular groove **96**. The spool **40** is also automatically returned to the neutral position when the bucket **16** reaches its level position by means responsive to rotation of the bucket position indicator **42** to the "Level" position. This means is illustrated in FIGURES 2 and 3 and includes a camming surface **98** which is rigidly secured to the disk **58** on the sheave-drum assembly **50**. An air control valve **100** is rigidly secured to the bracket **44** in juxtaposition to the camming surface **98**. The air control valve **100** includes an air supply conduit **102** which receives air under pressure from a pump (not shown), and an air conduit **104** which delivers air under pressure to the detent mechanism **74** upon operation of the air valve **100**. A cam follower **106** is pivotally mounted on the air valve **100** and is in operating contact with the camming surface **98**. The cam follower **106** will operate valve **100** to provide open communication from conduit **102** into conduit **104** when the sheave-drum assembly **50** is rotated to the "Level" position as shown in FIGURE 2.

A cylinder **108** is provided in the end member **94** and is in open communication with the air conduit **104**. A captive piston **110** is slidably mounted within the cylinder **108** and has an inwardly extending projection **112**. Air pressure in cylinder **108** will operate to move piston **110** so that projection **112** will contact the end of plunger **88**.

This will provide sufficient force to release camming surface **92** from detents **84**, thus allowing said detents to move out of the annular groove **96** so that the compression spring **80** and sleeve **78** will return spool **40** to the neutral position.

In operation, assuming that the operator has filled the bucket and elevated the boom arms to the desired dumping height, the control lever **38** is manipulated to move the spool **40** to the lefthand position so that control valve **38** will direct fluid to retract ram **20**. The ram **20** will operate rocker arm linkage **22** to pivot bucket **16** forwardly to dump the load. Concurrently with this the indicator **42** will rotate to indicate the "Dump" position. Cam **98** will be out of contact with cam follower **106**, thereby shutting off air pressure in air conduit **104**. The operator will now manipulate control lever **38** so that spool **40** is moved to the righthand position indicated by the broken-line position **97** in FIGURE 4. Detents **84** will be seated in groove **96** to hold spool **40** in this position. The hydraulic control valve **36** will now operate to extend ram **20** so that rocker arm linkage **22** will pivot bucket **16** backwards toward the level position. At this time the operator is free to manipulate the boom arm control valve (not shown) to lower the boom into a digging position. As the ram **20** is extended the sheave-drum assembly **50** will rotate clockwise and carry the cam **98** into contact with cam follower **106**. This will actuate air valve **100** so that air pressure is delivered to conduit **104**. Piston **110** will now move to release the detents **84** and spool **40** will return to the neutral position. The flow of hydraulic fluid to the ram **20** will terminate and the bucket **16** will be stopped in the level position. When the boom arms **12** reach their lowermost position the bucket **16** will therefore be automatically positioned for the next digging operation. When the operator extends ram **20** further to move the bucket from the level to the carry position, cam **98** will function to close valve **100** so that the piston **110** will be inactivated.

It will be understood that various changes in the details, steps and arrangement of parts, which have been described and illustrated in order to explain the nature of the invention, may be made by those skilled in the art within the principle and scope of the invention as expressed in the appended claim.

What I claim is:

In an automatic leveling device for a material handling bucket operated between level, carry, and dump positions by means of a hydraulic ram, the combination including: a bucket position indicator assembly mounted on the ram, the assembly including a drum having bucket position indicia thereon and being rotatably mounted on the head end of the ram and means to rotate the drum in response to extension and retraction of the ram; a camming surface on the drum; a cam follower in operating contact with the camming surface; first valve means selectively operable to direct hydraulic fluid to the ram for pivoting the bucket between the level, carry and dump positions; a source of air pressure; air operated motor means to neutralize the first valve means and terminate pivoting of the bucket; and second valve means in operating relationship with the cam follower to connect the source of air pressure with the motor means for operation thereof when the bucket reaches the level position.

References Cited by the Examiner

UNITED STATES PATENTS

2,589,896	3/1952	Toland.	
3,122,247	2/1964	Beck	214—140

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