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Cecchi

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[54] **AUTOMATIC SCOOP POSITIONING DEVICE FOR MECHANICAL SHOVEL**

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[52] **U.S. Cl.** **214/764,** 214/776

[51] **Int. Cl.** **E02f 3/87**

[58] **Field of Search** 214/764

[56] **References Cited**

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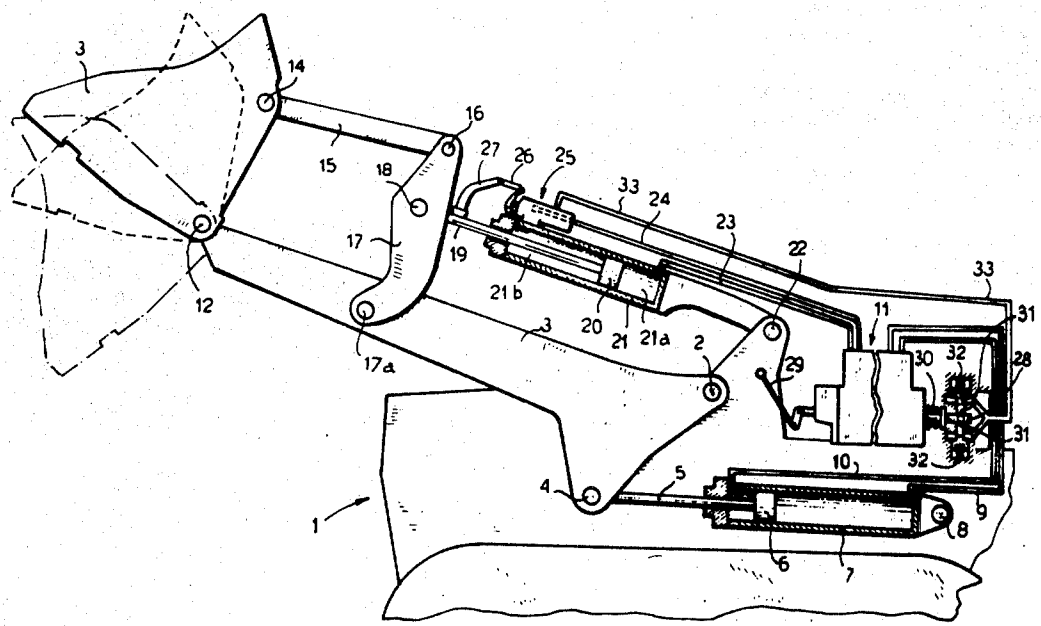
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Assistant Examiner—John Mannix
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[57] **ABSTRACT**

A mechanical shovel having an automatic scoop positioning device is disclosed. The scoop of a mechanical shovel must, for many operations, be positioned in one of two operational positions when returning from a tipping position. An auxiliary distributor is positioned hydraulically between a scoop control ram and a main distributor and feeds the ram when in a first position. Latching means hold the appropriate valve of the main distributor in the return position when it is moved to that position and the auxiliary distributor is set up to sense when the scoop reaches the predetermined operating position and thereupon to divert the hydraulic fluid to lock open the latching means thereby releasing the valve of the main distributor and shutting off the flow of fluid to the scoop control ram. The distributor holds the latching means open, so that the movement of the scoop is unrestricted, until a further emptying operation is performed, whereupon the latching means is released and reset for a subsequent operating cycle.

4 Claims, 6 Drawing Figures

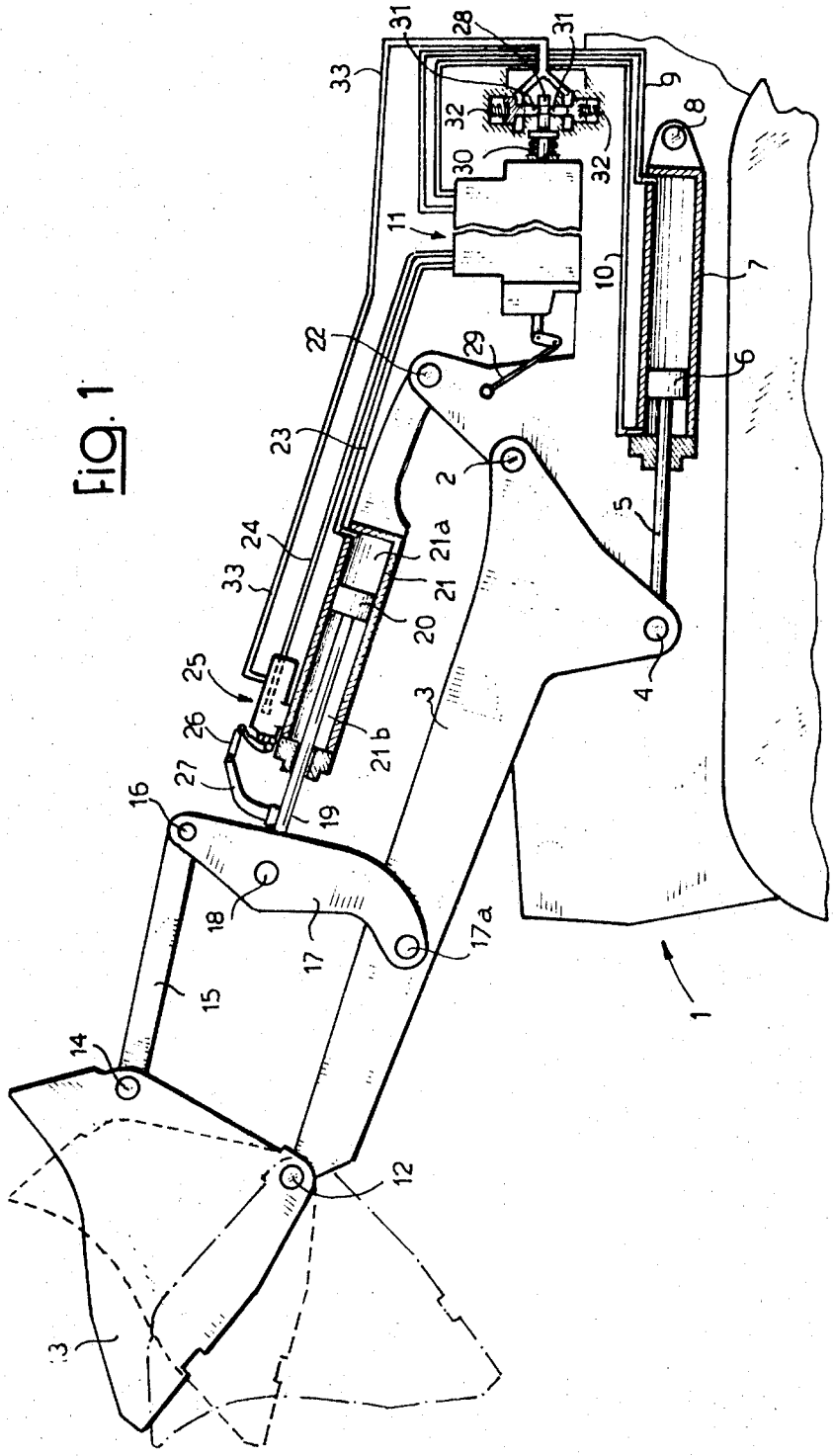


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SHEET 1 OF 5

Fig. 1



INVENTOR

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ATTORNEYS

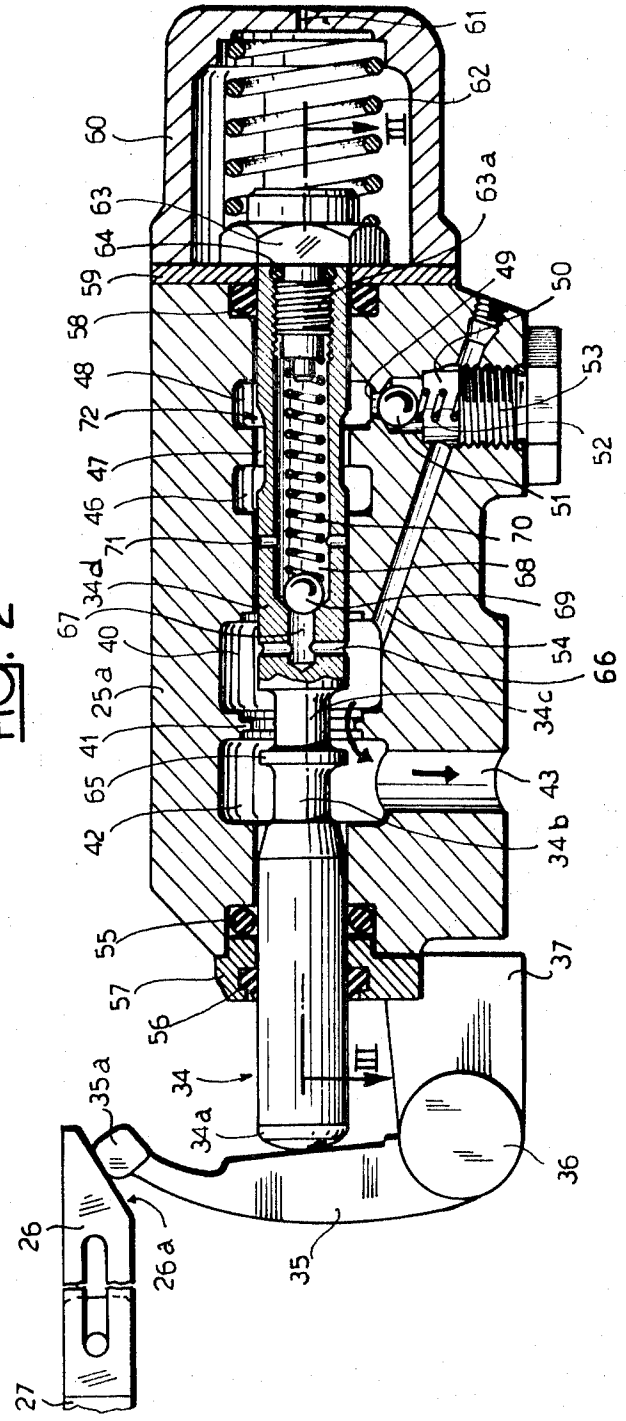

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FIG. 2

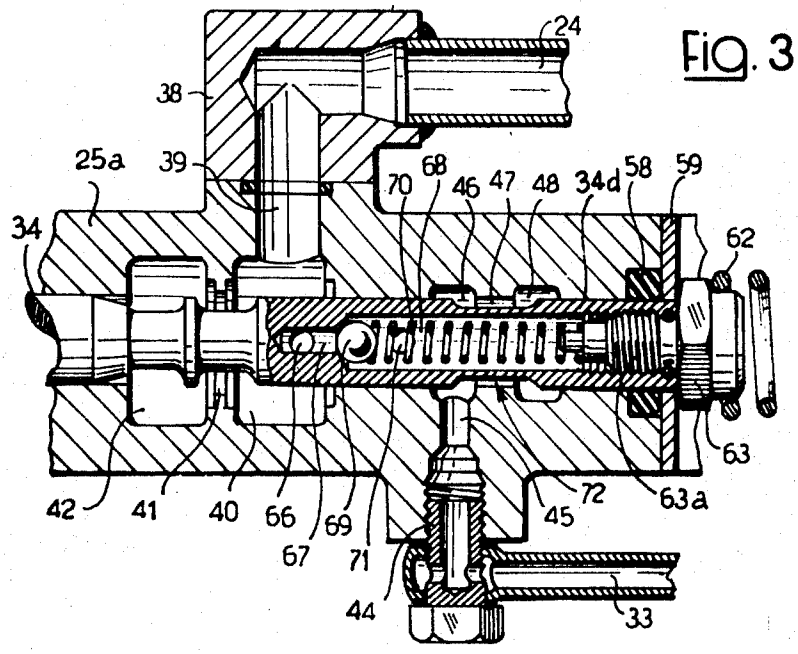

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Fig. 3

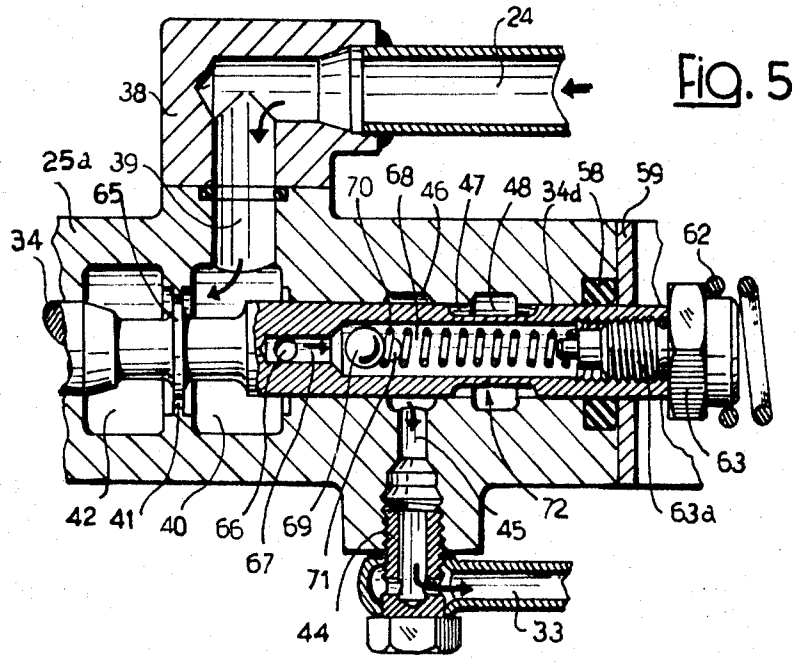
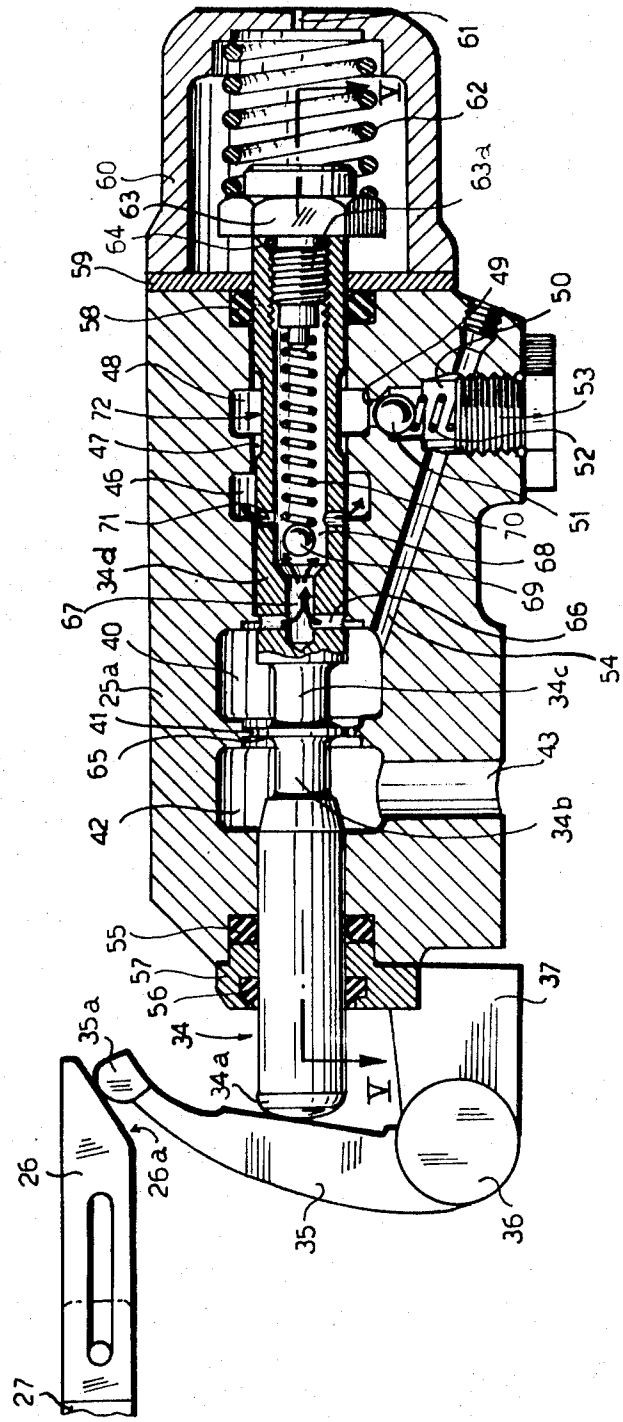

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Fig. 5

FIG. 4


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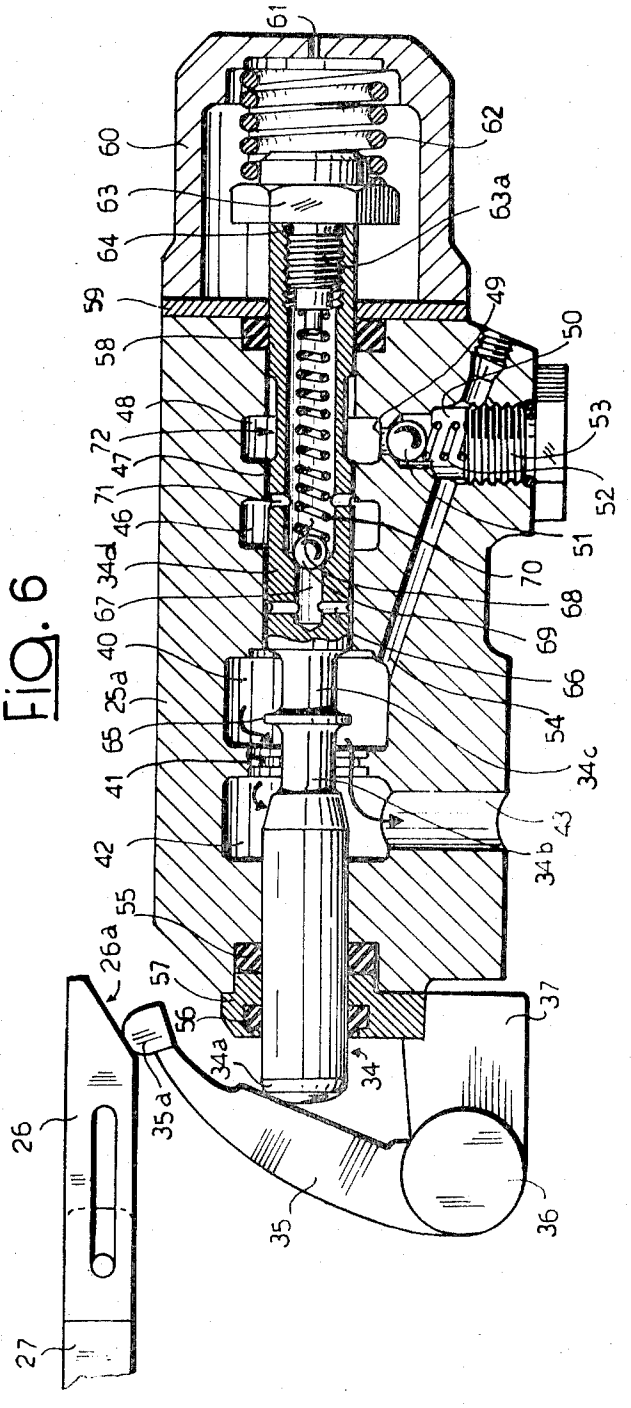

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FIG. 6

AUTOMATIC SCOOP POSITIONING DEVICE FOR MECHANICAL SHOVEL

BACKGROUND OF THE INVENTION

The present invention relates to mechanical shovels this name being given to those motor vehicles, with or without endless tracks, provided with a tipping scoop carried at the end of main lifting arms.

For satisfactory operation of a mechanical shovel the scoop must be positioned with the lower face parallel to the ground when the arms are in a fully lowered position in order to load materials collected in heaps, or must be positioned with the lower face an angle in the region of 7° 30' to the ground to carry out digging operations.

Therefore, each time a mechanical shovel completes a cycle of operation, the last operation of which is the tipping of the load on to a lorry or similar vehicle, the arms must be lowered to the fully lowered position and the scoop brought to one of the two above mentioned operational positions. This requires several operations on the hydraulic circuit which the operator must perform separately and which require a certain time.

OBJECTS OF THE INVENTION

One object of this invention is to provide a device which operates completely automatically to position the scoop of a mechanical shovel in a predetermined angular position with respect to the main lifting arms, without any manual intervention from the operator.

Another object of this invention is to provide a device of the above mentioned type which is capable of positioning the scoop during the lowering of the main lifting arms so as to reduce the time necessary for these two operations.

A further object of this invention is to provide a device of the above mentioned type, which is simple, strong and economical to manufacture, easy and convenient in adjustment and safe and precise in use.

SUMMARY OF THE INVENTION

According to the present invention there is provided an automatic scoop positioning device for a mechanical shovel of the type having a scoop supported at the ends of main supporting arms, comprising latching means operative to latch a valve plunger of a main distributor valve in position when moved to a position where the valve feeds an hydraulic scoop control ram to return the scoop from an emptying position, at least one auxiliary distributor hydraulically connected between the main distributor valve and the scoop control ram, the auxiliary distributor having a plunger which is biased to a first position where the auxiliary distributor allows fluid from the main distributor to flow to the ram and which is movable to a second position by means of an arm rigidly connected to the movable part of the scoop control ram where the auxiliary distributor diverts at least part of the fluid from the main distributor to lock the latching means in an open position and release the said main distributor valve plunger to return under the action of biasing means to a neutral position, the auxiliary distributor plunger returning to the first position and releasing the latching means when the scoop is next moved to the emptying position, thereby setting the latching means for a subsequent operating cycle.

Further characteristics and advantages of this invention will become apparent in the course of the following detailed description with reference to the accompanying drawings, given merely as an example without limitations.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view, partially in section, of a mechanical shovel provided with an automatic scoop positioning device constructed in accordance with the present invention;

FIG. 2 is a schematic axial section on an enlarged scale of an auxiliary distributor forming part of the scoop positioning device of FIG. 1, shown in a first position;

FIG. 3 is a partial axial section taken on the line III—III of FIG. 2;

FIG. 4 is a view similar to that of FIG. 2, illustrating the auxiliary distributor in a second position;

FIG. 5 is a partial axial section, taken on the line V—V of FIG. 4; and

FIG. 6 is a view similar to FIGS. 2 and 4, illustrating the auxiliary distributor in a third operational position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to FIG. 1, there is shown schematically the body 1 of a mechanical shovel to which two main lifting arms 3, are pivotally mounted by means of pivots 2. The position of the arms 3 is controlled by hydraulic rams comprising cylinders 7 having pistons 6, the piston rods 5 of which are connected by pivots 4 to the main lifting arms 3; the cylinders 7 are mounted on the body 1 of the mechanical shovel by means of pivots 8. The piston 6 divides the cylinder 7 into two chambers which are fed through conduits 9, 10 respectively from a main distributor 11.

A scoop 13 is carried at the free ends of the lifting arms 3. The scoop 13 is pivotally mounted on the arms 3 by means of a pivot 12. The angular position of the scoop 13 is controlled by a pair of arms 15, pivoted at 14 to the scoop 13 and at 16 to a pair of control levers 17 which, in turn are pivoted at 17*a* to the main arms 3. The levers 17 are pivoted at 18 near their mid points to respective piston rods 19 of pistons 20 of two hydraulic control actuators or rams having cylinders 21. The cylinders 21 are pivoted at 22 to the body 1 of the mechanical shovel. The pistons 20 divide the cylinders 21 into two opposite chambers 21*a*, 21*b* and these chambers are connected by conduits 23, 24 respectively to the main distributor 11. The chamber 21*a* will be termed the "extend" chamber of the cylinder 21 and the chamber 21*b* will be termed the "return" chamber.

The return chamber 21*b* of at least one of the cylinders 21 communicates with a positioning device 25 which is connected to the main distributor 11 by a conduit 24, and is secured on the cylinder 21 itself. The device 25 is operated by means of a regulating arm 26 attached to an arm 27 which is rigidly attached to the piston rod 19 of the cylinder 21.

The main distributor 11 is provided with movable valves controlled by levers which are operated by the operator. The valve of the main distributor which controls the operation of the cylinders 21 to determine the angular position of the scoop 13 includes a valve plunger 28, the operating movement of the valve plunger is resisted by a spring 30 which tends to return the valve plunger, and thus the valve to a neutral or in-

operative position. The valve plunger **28** is manually operable by means of a lever **29.**

The valve plunger **28** cooperates with two small latching pistons **31,** biased by springs **32** towards a position where they locate in a groove in the valve plunger **28** to hold the valve in the operative position corresponding to rotation of the scoop in a return direction from an emptying position, that is, clockwise as shown in FIG. **1.**

The latching pistons **31** can be retracted so as to free the valve plunger **28** of the main distributor **11,** by means of fluid under pressure from the automatic positioning device **25,** via a conduit **33,** upon which the spring **30** returns the valve to the inoperative position and the scoop **13** stops in the angular position determined by the device **25.**

As illustrated in FIG. **2** the automatic positioning device **25** comprises an auxiliary distributor having a distributor body **25***a* in which slides a plunger **34** which projects out from the front of the body **25***a* and is engaged at its end **34***a*, by a lever **35** which is pivoted at one end to a pivot **36** carried by a lug **37** extending from the main body **25***a*. The upper end **35***a* of the pivoted lever **35** is engaged by the end **26***a* of an arm **26** which is rigidly attached to the arm **27** of the piston rod **19** of the cylinder **21.** The distributor plunger **34** has a solid portion adjacent the end **34***a* and a hollow portion **34***d* adjacent the other end.

To the body **25***a* is rigidly attached a connecting block to which the conduit **24** which leads from the main distributor **11** is connected. The connecting block communicates with a transverse passageway **39** in the body **25***a* which leads into a chamber **40** which communicates through a narrow passage **41** with a second chamber **42** to one side of the chamber **40.** The chamber **42** communicates through a transverse passageway **43,** with the return chamber **21***b* of the cylinder **21.**

The conduit **33** which leads to the latching pistons **31,** is connected to the auxiliary distributor body **24***a* through a connection union **44,** communicating with a transverse passageway **45,** which leads into an annular chamber **46** which surrounds the plunger **34;** the chamber **46** can communicate with a second annular chamber **48,** through an axial passageway **47** in which the plunger slides **34.**

The chamber **48** has a side opening **49** which communicates with a chamber **50,** controlled by a ball valve **51** biased by a spring **52** the other end of which presses against a threaded plug **53;** the chamber **50** communicates with the chamber **40** through an oblique passageway **54.**

The solid front part of the plunger **34** cooperates with an oil seal **55** in the body **25***a* and with a dust excluding seal **56** located in a cover **57** attached to the distributor body **25***a*. The hollow end **34***d* of the plunger **34** cooperates with an oil seal **58** located at the rear end of the body **25***a* and held in place by a plate **59** held tightly between the body **25***a* and a protecting cover **60** having a small breather hole **61.**

Inside the cover **60** there is a biasing spring **62** which acts between the cover **60** and a threaded plug **63** which is screwed into the end of the hollow portion **34***d* of the plunger **34;** an oil seal **64** between the plug **63** and the plunger **34** seals the inside of the hollow portion from the atmosphere.

Near the center of the plunger **34** there are two reduced portions **34***b*, **34***c*, separated by a portion **65** of the same diameter as the rest of the plunger. Where the hollow portion **34***d* of the plunger **34** joins the solid portion there is formed a transverse passageway **66** which communicates with an axial passageway **67** which leads to a chamber **68** inside the hollow portion **34***d*. A ball valve **69,** biased by a spring **70** the other end of which acts on the threaded part **63***a* of the plug **63** controls fluid flow into the chamber **68.**

The hollow portion **34***d* of the plunger **34** has a portion **72** of reduced diameter the function of which will be described below.

The chamber **68** within the plunger **34** has a radial aperture **71** which communicates between the chamber **68** and the chamber **47** of the distributor body **25***a*.

The main distributor valve **11** is so arranged that, although the valve plungers are biased to a neutral inoperative position where the associated hydraulic actuators are isolated from the source of fluid pressure, each valve plunger has a groove and an associated pair of pistons such as the pistons **31** illustrated as associated with the valve plunger **28** which controls the operation of the scoop control ram. The pistons **31** latch into the groove in the plunger **28** so that when the lever **29** has been moved to an operating position it may be released and the pistons **31** will hold the valve plunger **28** in the operating position without further attention from the operator.

The automatic scoop positioning device operates as follows:

When any material in the scoop has been emptied by tipping forward the previously raised scoop the operator moves the lever **29** to control the return of the scoop thus latching the main distributor valve plunger **28** in position by the small pistons **31.** The operator can then operate the lever which controls the lowering of the main arms **3** which will descend solely under gravity because the scoop control circuit has been already operated and the distributor does not allow the simultaneous operation of two hydraulic circuits.

As this takes place the arm **27** rigidly attached to the piston rod **19** of the scoop control cylinder **21** approaches the auxiliary distributor **25** which forms part of the automatic positioning device. Up to this point the auxiliary distributor **25** is in the position illustrated in the FIGS. **2** and **3;** the hydraulic fluid under pressure which arrives from the main distributor **11** through the conduit **24** passes through the passageway **39,** the chamber **40,** the narrow passage **41,** the chamber **42** and the transverse passageway **43** to the return chamber **21***b* of the cylinder **21,** the piston **20** of which therefore moves so as to return the scoop in a clockwise direction as seen in FIG. **1** from the emptying position.

The lowering of the arms **3** continues under gravity and the rotation of the scoop **13** eventually causes contact between the extension **26** of the arm **27** and the end of the pivoted lever **35** which therefore moves the plunger **34** of the auxiliary distributor **25,** to the right as shown in FIG. **2.** After the plunger has moved a distance of about **6** mm the auxiliary distributor takes up the position illustrated in FIGS. **4** and **5.**

The plunger **35** is now in a position where the annular portion **65** which separates the two portions of reduced diameter **34***b*, **34***c*, partially blocks the narrow passage **41** and prevents the free flow of the oil from the chamber **40** to the chamber **42.** As the fluid continues to be fed under pressure to the chamber **40** there is an increase of pressure in this chamber and the pressure

moves back the ball **69** of the ball valve and flows through the apertures **66** of the plunger along the axial passageway **67** and into the chamber **68**, against the resistance of the spring **70**.

Through the radial aperture **71** the oil under pressure flows into the chamber **46** which communicates through the passageway **45** and the union **44** with the conduit **33** which leads to the latching pistons **31**. Because of the increase of the pressure in the chamber **40** the fluid can now move apart the latching pistons **31** which were holding the control plunger **28** of the main distributor valve in the operating position. When the latching pistons are moved out of the latching position the plunger **28** returns to neutral position under the action of the spring **30** thereby closing off the flow of fluid to the ram **21** and stopping the returning movement of the scoop, the arms **3** continue to descend under gravity until they stop. When the arms **3** have reached the end of their travel the scoop is located in the predetermined position, that is with the front face parallel to the ground or in the desired angular position suitable for digging, according to the presetting of the automatic positioning device.

Thus the automatic positioning device allows the scoop to be moved by means of hydraulic control actuators until it reaches a predetermined angle with respect to the main lifting arms at which point the rotation control is terminated. Once the automatic positioning has been achieved the scoop can be moved in any direction to load the material; the operator moving the control lever **29** from the neutral position to a control position and holding it in position for the duration of the operation. During such operations the arms **26, 27** cause a further axial shifting of the plunger **34** of the auxiliary distributor **25** causing it to move, for example, a further distance of up to about **8** mm to the position illustrated in FIG. **6**.

In this position the latching pistons cannot move to hold the plunger **28** in position because the oil under pressure enclosed in the conduits **33, 45** and in the chamber **46** keeps the latching pistons apart and away from the plunger **28**; therefore it is necessary for the operator to hold the operating lever **29** in any control position during this stage of the operating cycle.

The oil, which arrives under pressure through the conduit **24** reaches the return chamber **21***b* of the cylinder **21** through the conduit **39**, the chambers **40, 42** and the passageway **43**. When the scoop is laden and moved to the desired position the operator allows the control lever to return to the neutral position and the movement of the scoop stops. The operator then causes the arms **3** to raise and stops them at the desired point, after which he can proceed to empty the scoop by moving the lever **29** forward and holding it in position for the duration of the emptying operation, while the scoop rotates anticlockwise.

During the emptying of the scoop the hydraulic cylinder **2** which controls the rotation of the scoop is extended by oil entering under pressure into the chamber **21***a*. The arms **26, 27** move away from the auxiliary distributor **25** allowing the plunger **34** to return to the first position under the action of its return spring **62**.

When the auxiliary distributor **25** returns to the position illustrated in FIGS. **2** and **3**, the chamber **46** communicates with the chamber **48** by means of the annular region **72** of reduced diameter of the plunger **34**, and the oil which was enclosed in the chamber **46** and which held the latching pistons away from the plunger **28** can now flow towards the chamber **48**. Urged by the springs **32** which act on the latching pistons **31**, the oil in the chamber **46** passes into the chamber **48** forces open the valve **51**, penetrates into the chamber **50** and reaches, via the oblique passageway **54**, the chamber **40**. The oil then passes through the auxiliary distributor and out into the conduit **24** towards the main distributor **11**. At this stage the oil in the return chamber **21***b* of the control cylinder **21** runs in the opposite direction through the passageway **43**, the chambers **42, 40**, the passageway **39** and the conduit **24**.

In this way the latching pistons are released and can thus once again latch the plunger **28** of the main distributor **11** in the next return operation.

Naturally still keeping to the principle of this invention, the forms of realization and the manufacturing details can be amply varied, in respect to what has been described and illustrated, without departing from the scope of this invention.

What is claimed is:

1. In a mechanical shovel of the type having a scoop, main support arms on which said scoop is pivotally mounted, scoop control means on said main support arms, at least one scoop control actuator cylinder operating said scoop control means and controlling the angular position of said scoop with respect to said main support arms, said scoop control cylinder having a piston dividing said cylinder into first and second chambers,

a main hydraulic fluid distributor, said main distributor including a scoop control valve the operation of which determines the angular position of said scoop by controlling the flow of hydraulic fluid to said scoop control cylinder,

said scoop control valve, having a valve member moving between a first position controlling said valve to direct fluid to said first chamber of said scoop control cylinder to move said scoop toward an emptying position, and a return position controlling said valve to direct fluid to said second chamber of said scoop control cylinder to return said scoop to operating position,

biasing means biasing said valve member to an intermediate neutral position where said scoop control cylinder is hydraulically isolated,

the improvement comprising an automatic scoop positioning device having latching means, biasing means urging said latching means to latch said valve member in said return position when said valve member is moved to said return position,

at least one auxiliary distributor mounted on said scoop control cylinder, said auxiliary distributor being hydraulically connected between said main distributor and said second chamber of said scoop control cylinder, and having a movable distributor member,

biasing means biasing said distributor member towards a first position where said distributor directs said fluid to said second chamber of said scoop control cylinder, and

an arm rigidly attached to the piston rod of said scoop control cylinder,

said arm in operation of said shovel moving said distributor member against the action of said biasing means as said scoop control cylinder moves said scoop in said return direction, said auxiliary distrib-

utor diverting said fluid to lock open said latching means when said scoop reaches a predetermined operating position thereby releasing said valve member, stopping said returning movement of said scoop and locking said scoop in said predetermined operating position, said auxiliary distributor member returning to said first position and releasing said latching means when said scoop is next moved to said emptying position, thereby setting said latching means for a subsequent operating cycle, said distributor member of said auxiliary distributor having a hollow portion adjacent one end, said hollow portion being closed by a threaded stopper, a return spring biasing said distributor member to said first position acting on said stopper, said spring reacting against and enclosed by a cap on the end of said auxiliary distributor, said distributor member having two adjacent regions of reduced diameter, said distributor having two cooperating chambers, a first chamber communicating with said main distributor and a second chamber communicating with said second chamber of said scoop control cylinder, said two adjacent regions of reduced diameter forming communicating passageways between said first and second chambers when said auxiliary distributor member is in said first position and interrupting said communication when said auxiliary distributor member is in said predetermined position corresponding to said predetermined operating position of said scoop, a third chamber in said auxiliary distributor, said third chamber communicating with said latching means, radial apertures in said hollow portion of said auxiliary distributor member, said radial apertures forming, together with said hollow portion of said auxiliary distributor member, a passageway communicating with said first chamber and said third chamber, a ball valve in said hollow portion allowing fluid flow only from said first chamber to said second chamber.

2. The automatic scoop positioning device of claim **1** wherein there is a pivoted lever on said auxiliary distributor, said arm rigidly attached to said piston rod of said scoop control cylinder moving said distributor member by means of said pivoted lever.

3. The automatic scoop positioning device of claim **1,** a fourth chamber in said auxiliary distributor, a passageway allowing said fourth chamber to communicate with said first chamber, a ball valve allowing fluid flow only from said fourth chamber to said first chamber, said auxiliary distributor member having a third region of reduced diameter allowing communication between said third chamber and said fourth chamber when said auxiliary distributor member is in said first position whereby a passageway is completed between said latching means and said main distributor allowing said latching means to release under the action of said biasing means to reset for a subsequent cycle of operation.

4. The automatic scoop positioning device of claim **1** wherein both ends of said auxiliary distributor member are in contact with the atmosphere.

* * * * *