United States Patent

[11] 3,538,985

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[33] **Germany**
[31] **1,557,705**

[54] **MACHINE FOR THINNING AND HOEING ROWS OF PLANTS**
14 Claims, 10 Drawing Figs.

[52] U.S. Cl. 172/6, 172/96
[51] Int. Cl. A01b 63/110
[50] Field of Search 172/5, 6, 56, 96

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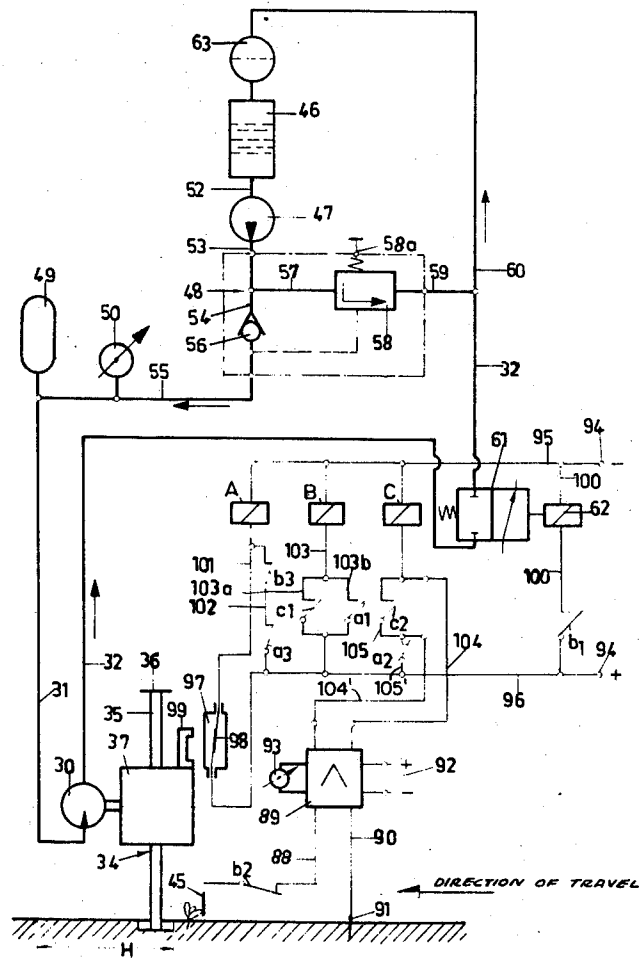
ABSTRACT: A plant thinning and hoeing device in which a rotary tool support having radially extending tools is mounted on a rotary hydraulic motor which is actuated by a feeler contacting a plant behind the tool support to actuate electrohydraulic circuitry to open a valve in the exhaust line of the motor to permit the motor to rotate to actuate the tool support member with automatic valving means controlling the fluid pressure to the drive motor.



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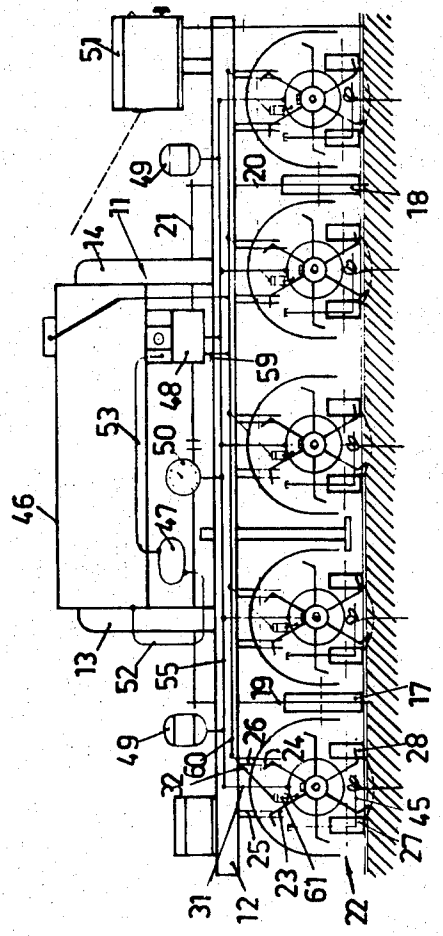

FIG. 2

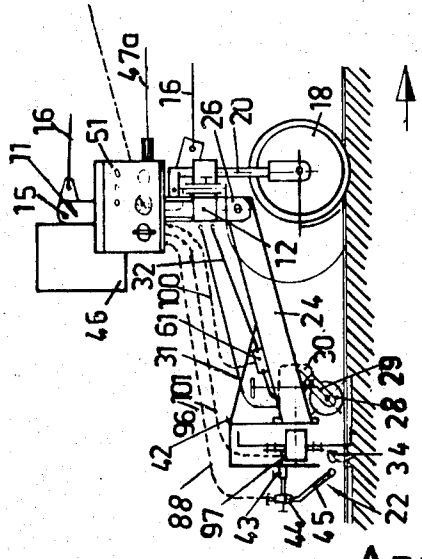

FIG. 1

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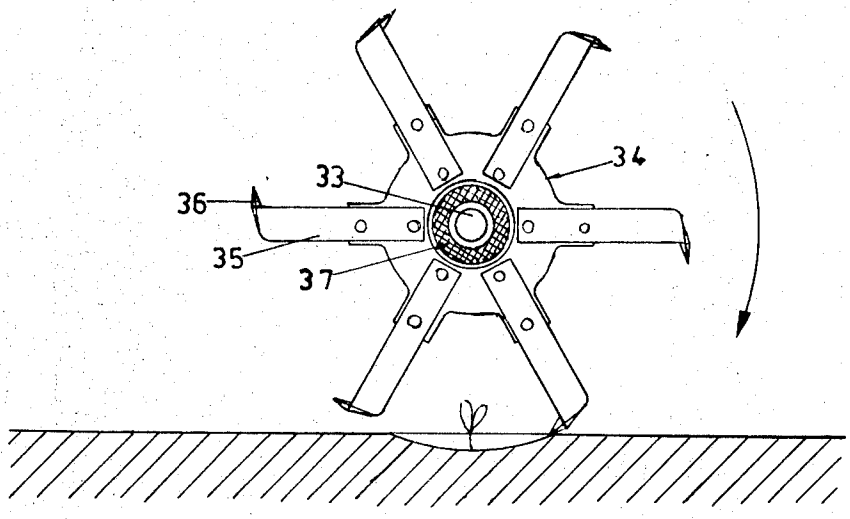

FIG. 3

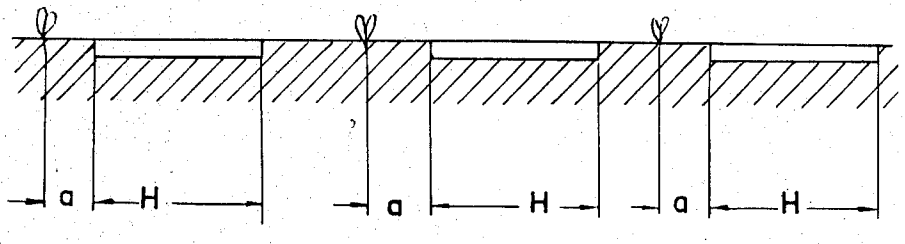

FIG. 10

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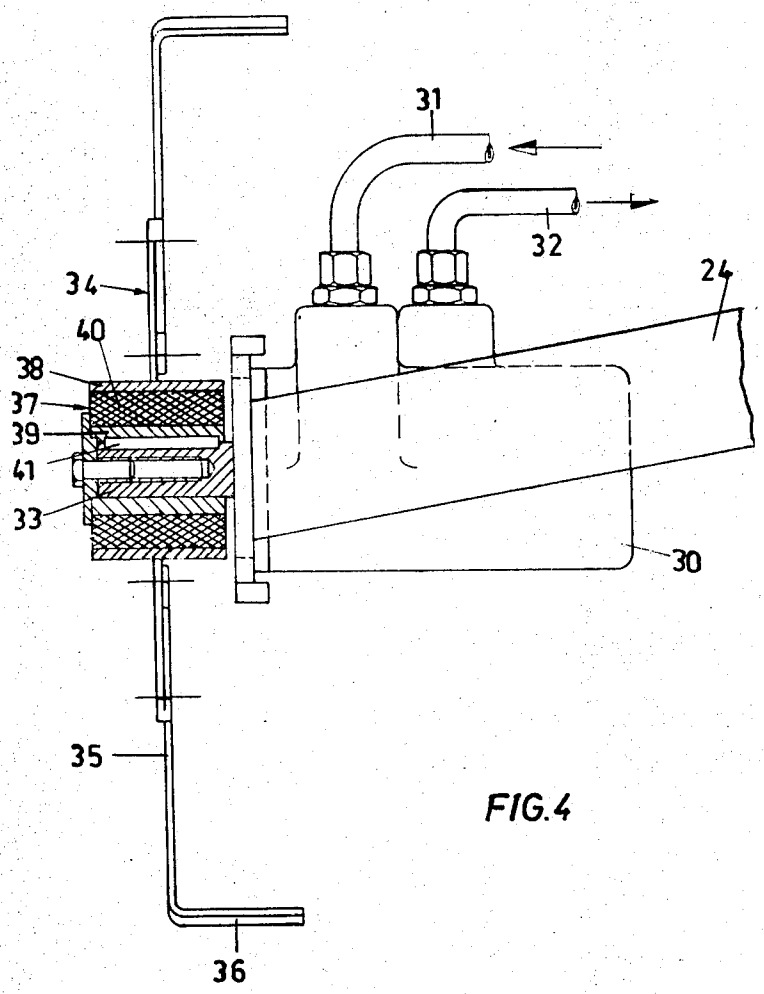

FIG. 4

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FIG. 5

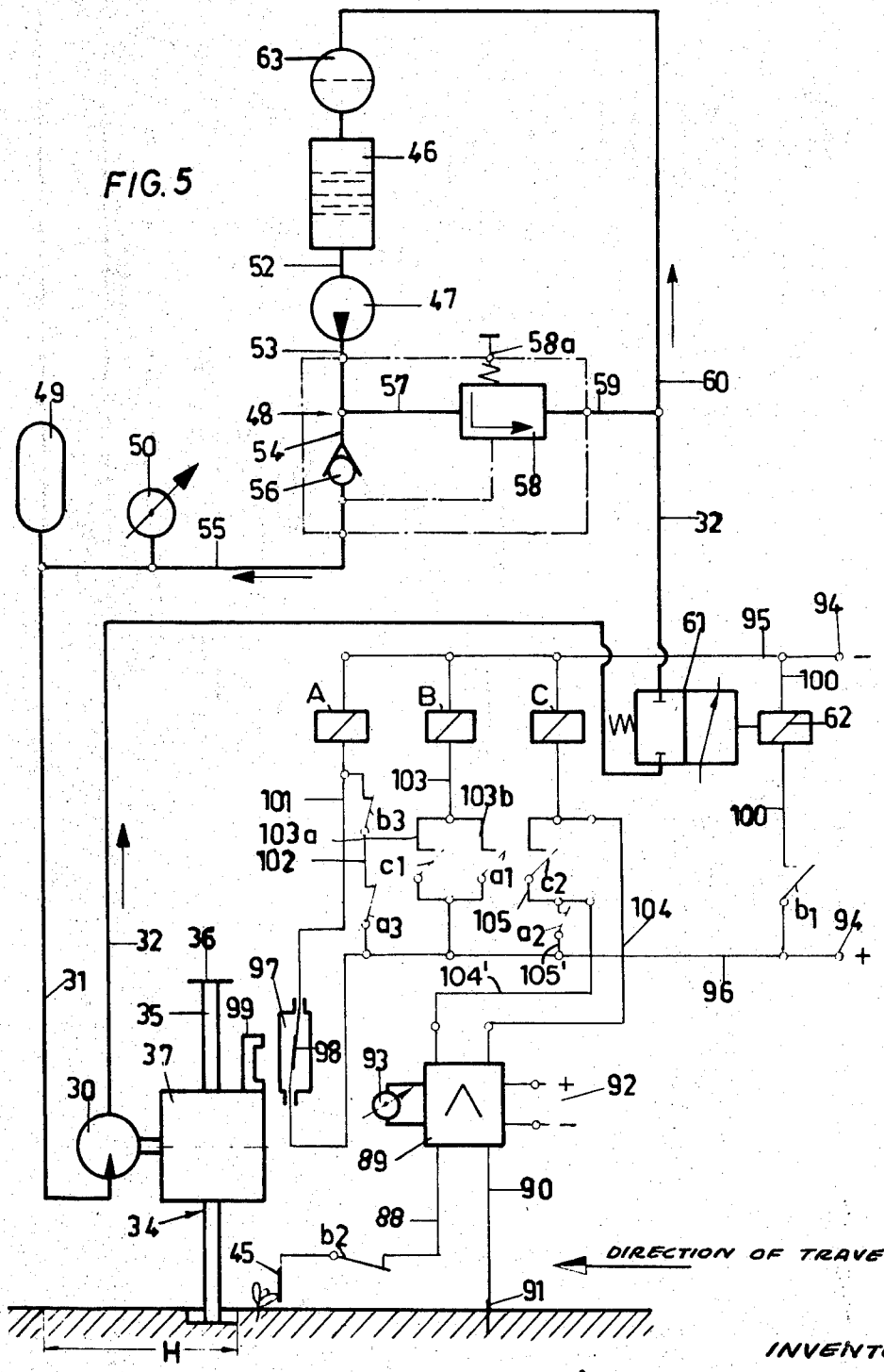

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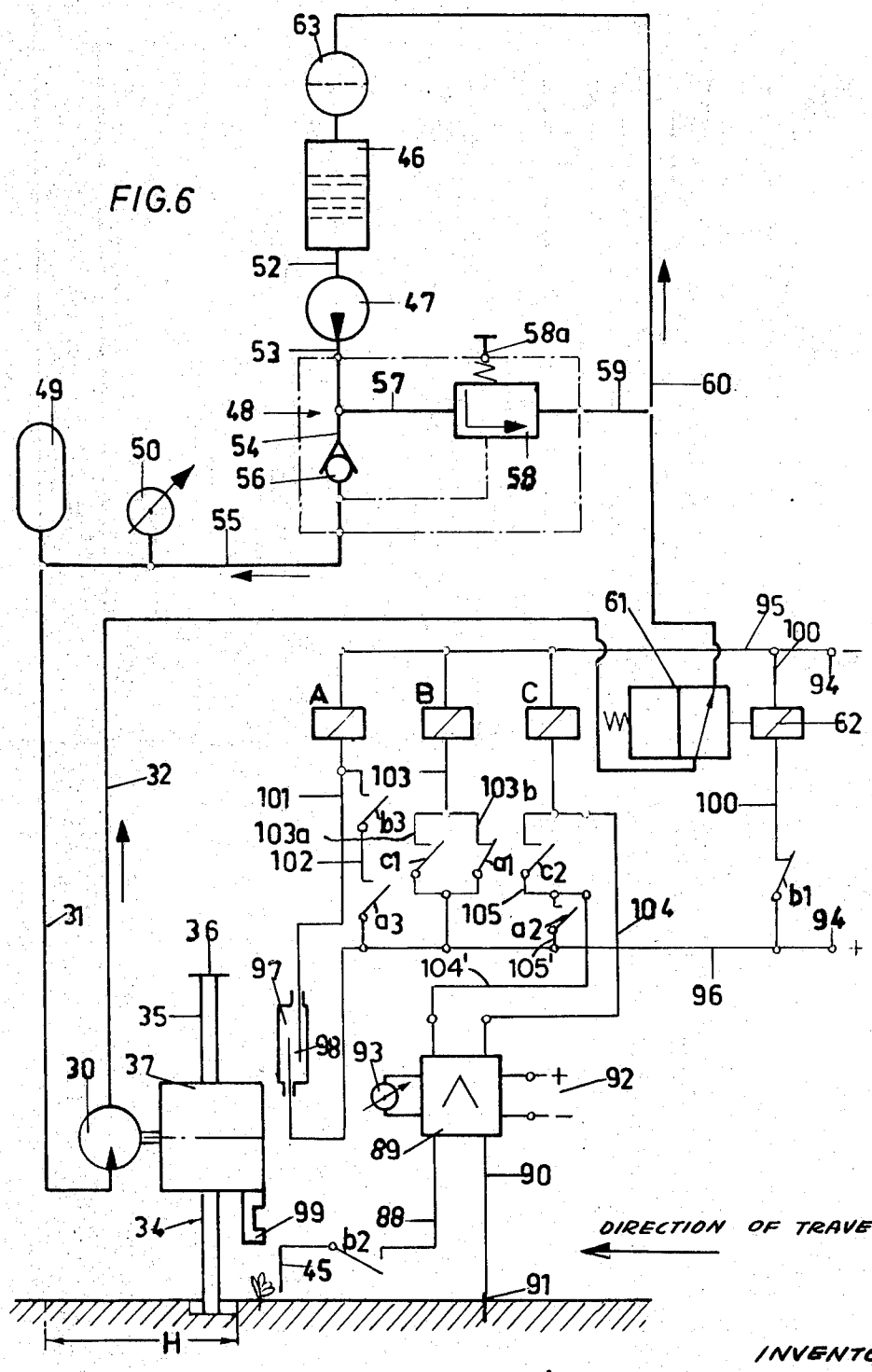
FIG.6



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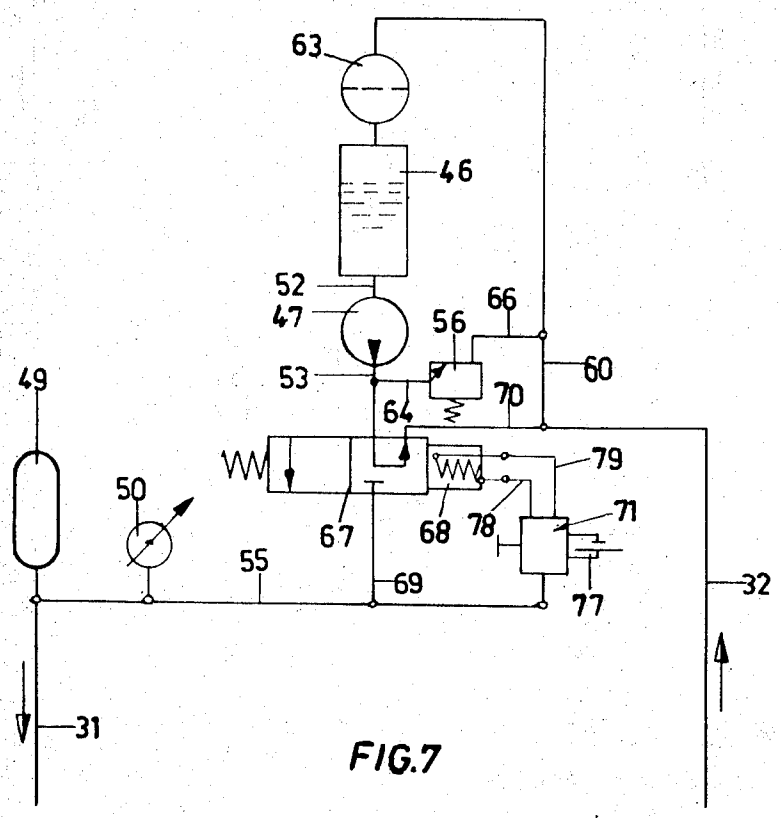

FIG. 7

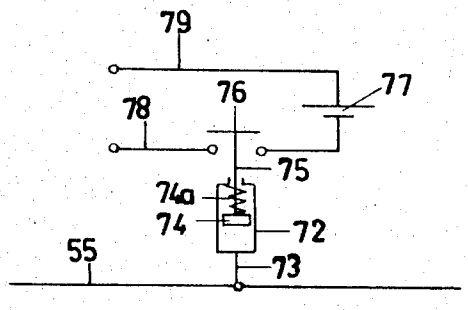

FIG. 8

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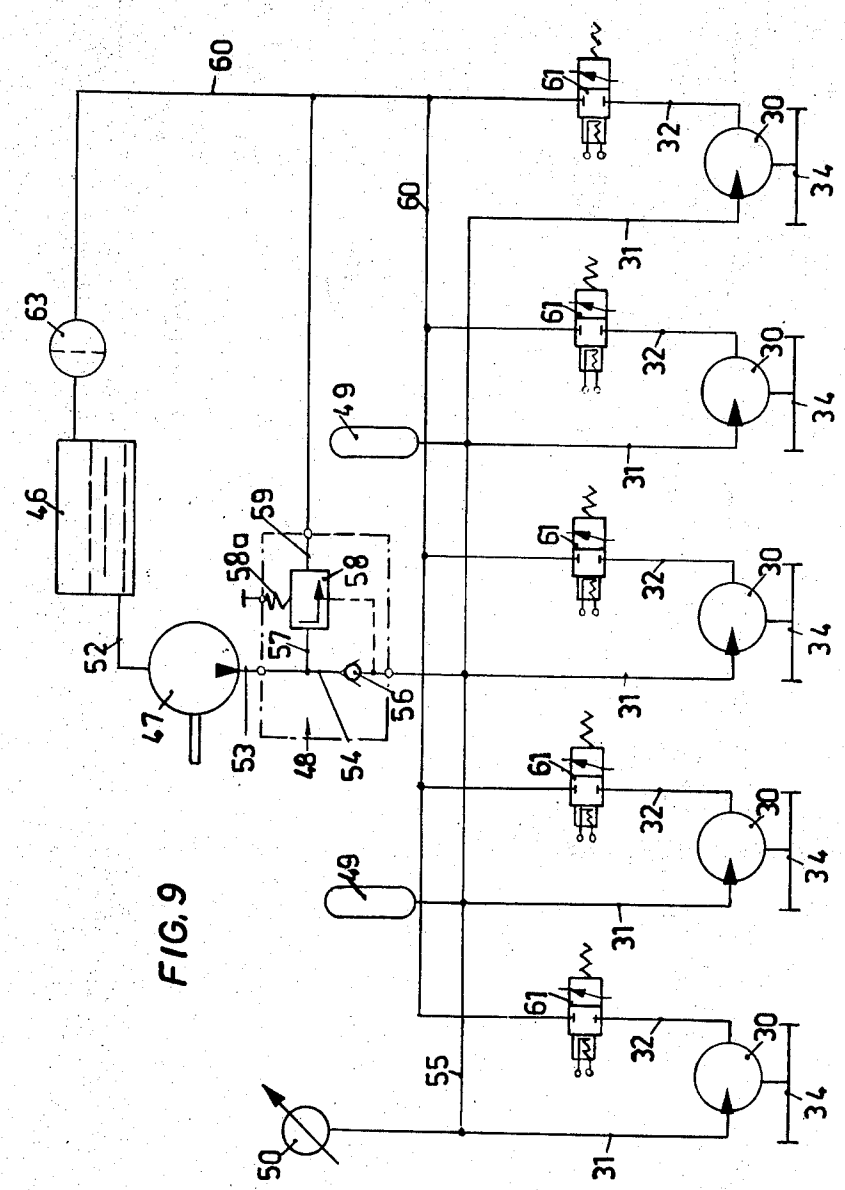

FIG. 9

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MACHINE FOR THINNING AND HOEING ROWS OF PLANTS

This invention relates to a machine for thinning and hoeing rows of plants, the machine being of the type having at least one rotatably mounted tool disc on which hoeing tools are mounted rigidly in generally radial arrangement, a plant feeler mounted behind each tool disc and a control device for operating and subsequently stopping the tool disc after a plant to be retained has been sensed by the feeler. Using a machine of this type it is possible to remove from a row of standing plants a certain number at certain distances apart, so that the remaining plants can grow without hindrance. It is also possible to hoe spaces between plants in spaced rows.

In known machines of this type each tool disc is driven mechanically. For this purpose the drive is derived from the crankshaft of a tractor drawing the machine, and is transmitted for example through a worm drive, a shaft, a conical gear drive, an articulated shaft and finally through a clutch to the tool disc. The control mechanism usually acts upon a clutch, with which the drive of each tool disc is equipped, with a view to operating the tool disc after the sensing of a plant to be retained and subsequently again stopping it.

Mechanical drive of the tool disc or discs is, however, complicated, unwieldy and expensive. It creates difficulties in adapting the tool discs to the distance apart of the rows where more rows than one are worked at the same time. Finally it is difficult to render the action of the control mechanism effective.

An object of the invention is to provide a machine of the type referred to, wherein each tool disc is hydraulically driven and control of the movement of each tool disc is electrohydraulic.

It has been proposed to provide a machine for thinning and hoeing rows of plants with a least one rotating tool disc, wherein each tool disc is driven hydraulically and is in movement-transmitting connection with the driving shaft of a hydraulic motor, see German Pat. Spec. No. 1,238,255. In this machine each tool disc is in constant rotation. Furthermore, in this machine the hoeing tools are not mounted rigidly on the tool disc, but are able to perform controlled pivotal movements perpendicularly to the plane of rotation of the tool disc between end positions radial and parallel to the axis of rotation for the purpose of leaving standing certain plants during rotation of the tool disc. Finally, in this machine a plant feeler is mounted in front of each tool disc and not behind it. Consequently, the machine in question belongs to another type of thinning and hoeing machines for rows of plants.

According to the present invention, in a machine of the type referred to, each tool disc is hydraulically driven and is mounted on the driving shaft of a hydraulic motor or is connected thereto in a motion-transmitting manner, the feed pipe of each hydraulic motor being in direct connection with same and always being subject to constant fluid pressure, a control valve being arranged in the return pipe of the or each hydraulic motor which valve, under the action of the control device, closes or opens the return pipe.

Due to the hydraulic drive of each tool disc, the drive of the tool disc or discs is simple and adaptable. Further, due to the fact that the feed pipe of the or each hydraulic motor is subject to constant fluid pressure always the same hoeing length of the tool disc or discs results in unit time if the speed of the machine is constant. By the arrangement of a control valve in the return pipe of the or each hydraulic motor, which control valve closes or opens the return pipe under the action of the control device the desired operation and subsequent stopping of the tool disc in question can be effected in a simple and reliable manner.

For each tool disc, preferably, a hydraulic motor is provided which has an internal leak oil return flow. Such a hydraulic motor has the advantage that, even in the case of high counter pressure of about 70 atmospheres in its return pipe, it does not require an external leak oil pipe, which would have an adverse effect.

Preferably each tool disc is mounted on the driving shaft of its hydraulic motor with interposition of an annular elastic coupling connected to the driving shaft. This arrangement works well both for the hoeing tools and for the hydraulic motor when, during rotation of the tool discs, their hoeing tools encounter resistance, for example stones, because in this manner the hoeing tools and hydraulic motors are protected to some extent from shock.

To maintain constant fluid pressure in the feed pipe of each hydraulic motor, in one embodiment of the invention there is arranged in each feed pipe at least one hydraulic pressure storage device and a hydraulic pressure storage feed device between a hydraulic pump and the pressure storage device, the said feed device having a nonreturn valve and a pressure regulating valve connected with the return pipe. In this embodiment the pressure regulating valve may be adjusted to a desired pressure. Since the number of revolutions of the hydraulic motor depends upon the fluid pressure obtaining in its feed pipe the possibility arises of altering the length hoed by the hoeing tools when the speed of travel of the machine remains constant.

In a further embodiment of the invention, for obtaining constant fluid pressure in each feed pipe, there may be arranged in each feed pipe at least one hydraulic pressure storage device and between the hydraulic pump and this pressure storage device an excess pressure valve connected to the return pipe, and further a hydraulic valve disposed behind the excess pressure valve and being electromagnetically operated in accordance with the pressure in the feed pipe, the said further hydraulic valve allowing pressure fluid to pass into the return pipe when a set fluid pressure is exceeded. In addition, in this embodiment an electrohydraulic pressure control means is disposed in the feed pipe of the hydraulic motor which control means acts upon an electromagnetic switch which operates the hydraulic valve.

Preferably the electrohydraulic pressure control means can be set for various pressures. This, if required, makes it possible by the alternation of the fluid pressure prevailing in the feed pipe of the hydraulic motor or motors to alter the length hoed by the hoeing tools at constant speed of travel of the machine.

In both embodiments, in view of the fact that the length hoed by the hoeing tools depends on the pressure in the feed pipe, pressure gauge, calibrated to units of length of the hoeing length, may be inserted in the feed pipe. This pressure gauge indicates the length hoed by the hoeing tools in unit time at the pressure in the feed pipe.

Further, for operating the control valve in each return pipe an electromagnetic switching device may be provided, which is switched on when a plant to be retained is sensed and thereby moves the control valve into its open position, and, after a certain rotary movement of the relevant tools disc, is switched off, thereby moving the control valve to the closed position.

To switch on each electromagnetic switching device an electric feeler circuit may be provided, which circuit includes an electric contact feeler, an amplifier and a potentiometer for setting the feeler sensitivity.

Further, for switching off each electromagnetic switching device there may be provided a switch and on the relevant tool disc an operating member for the switch. The switch and the operating member are preferably so disposed in relation to one another that they shut off the control valve of the return pipe when the corresponding tool disc with its hoeing tools is outside the range of the plants.

Further, as the switch preferably a contactless terminal switch with a reed contact is provided, while the operating element therefor is preferably a permanent magnet.

Finally, for the electromagnetic switching device, there may be provided a control device, which on the one hand is connected to the feeler circuit initiating switching on of the electromagnetic switching device and on the other hand is connected with the switch for initiating switching off of the electromagnetic switching device, and has three high-resistance

relays connected in parallel to the electromagnetic switching device and operating a series of contacts for switching the switching device on and off as necessary.

Embodiments of the invention will now be described in more detail by way of example, with reference to the accompanying diagrammatic drawings, in which:

FIG. 1 is a side elevation of a machine;

FIG. 2 is a rear elevation;

FIG. 3 is a rear elevation of a tool disc;

FIG. 4 illustrates a tool disc and a hydraulic motor, partly in longitudinal section and partly in side elevation;

FIG. 5 is an electrohydraulic circuit diagram, including a tool disc and a hydraulic motor, all parts being shown in the position they occupy when the tool disc is stationary;

FIG. 6 is the same as FIG. 5, but with all parts in the position they occupy when the tool disc rotates;

FIG. 7 is a circuit diagram of another embodiment of the hydraulic devices for conducting pressure fluid at constant pressure to each hydraulic motor;

FIG. 8 is a circuit diagram of an electrohydraulic pressure control means shown in FIG. 7;

FIG. 9 is a diagram showing five tool discs and their hydraulic motors, and hydraulic devices for conducting pressure fluid to the hydraulic motors and a control slide valve disposed in the return pipe of each hydraulic motor; and

FIG. 10 is a diagram of a row of plants to be treated.

FIG. 10 shows the conditions in a row of plants when singling out plants in this row by means of the machine of the invention, wherein plants remain only at certain minimum distance apart, while the other plants are removed. This FIG. shows that, after sensing a plant which is to be retained, at a distance *a* in the direction of movement of the machine beyond that plant the ground is hoed for a length H. The plants in this length H are removed. The next plant adjacent the length H is not hoed out, irrespective of whether it is at a greater or less distance beyond the hoed length H. When this plant has been sensed further hoeing takes place beyond it.

The machine illustrated has, referring to FIGS. 1 and 2, a basic frame 11 which consists of a lower horizontal beam 12, two spaced uprights 13, 14 and an upper horizontal beam 15 which connects the upper ends of the uprights. The basic frame 11 is connected to the rear end of a three-point linkage 16 with the aid of which the machine can be connected to a tractor (not shown).

The machine is supported on the ground by wheels 17, 18. These are mounted in forks 19, 20 the upper parts of which are rotatably mounted in parts of the lower beam 12 and are connected by a horizontal link 21 for steering the wheels.

Mounted on the rear side of the frame 11 at distances apart corresponding to the distances apart of rows of plants to be worked are five hoeing assemblies 22. For connecting each hoeing assembly 22 to the frame 11 there are two parallel lever arms 23, 24 which are only partly shown in FIG. 2. The forward ends of the lever arms 23, 24 are pivotally connected to flanges 25, 26 formed on the underside of the beam 12 and at their rear ends wheels 27, 28 are mounted to support the corresponding hoeing assembly 22. The wheels 27, 28 are mounted in supports 29 attached to the rear ends of the lever arms 23, 24.

A hydraulic motor 30 is secure between the rear ends of the lever arms 23, 24 of each assembly 22. The hydraulic motor 30 is of the type which has an inner leak oil return flow, with a feed pipe 31 and a return pipe 32 for the pressure fluid.

Each hydraulic motor 30 has a rearwardly extending driving shaft 33 on which is mounted a tool disc 34 to which in radial, equidistant arrangement six hoeing tools 35 are rigidly attached. Each hoeing tool 35 has a hoeing blade 36 at its outer end. The disc 34 is mounted on the shaft 33 by a hub 37, which consists of an outer ring portion 38 of metal, an inner ring portion 39 of metal, and a rubber ring 40 between these two metal ring portions. Transmission of rotation from the driving shaft 33 to the tool disc 34 is by a key 41 (FIG. 4) in keyways formed both in the inner ring portion 39 and in the driving shaft 33.

A casing 42 is provided for each hydraulic motor 30 and tool disc 34, which partly surrounds them. The casing is also fixed to the lever arms 23, 24.

At the rear end of each casing 42 is a cross bar 43 which carries a holder 44 for a plant feeler 45 the rear side of which is electrically insulated. The plant feeler 45 is stirrup-shaped and is mounted on the holder 44 so as to be adjustable in height. The holder 44 is mounted on the cross bar 43 so that its distance can be varied.

On the uprights 13, 14 and on the upper beam 15 an oil tank 46 is mounted, and below it is an oil pump 47 driven from the crankshaft of the tractor and for this purpose provided with a drive connection 47*a*. Also below the oil tank 46 is a hydraulic pressure storage loading device 48. Also, on the upper side of the beam 12 two hydraulic pressure storage devices 49, a pressure gauge 50 and a control box 51 for the reception of parts of the control device, are disposed.

As shown in FIGS. 5 and 6, in the hydraulic circuit, the oil pump 47 and the oil tank 46 are connected by a pipe 52. The oil for driving the hydraulic motors 30 is fed from the pump 47 through a pipe 53 to the pressure storage loading device 48.

In the pressure storage loading device 48 there is connected to the pipe 53 a pipe 54 which leads to a common feed pipe 55. In the pipe 54 of the pressure storage loading device 48 is a nonreturn valve 56 which prevents return flow of oil from the common feed pipe 55. Before the nonreturn valve 56 a pipe 57 branches off from the pipe 53 to a pressure regulating valve 58, from which a pipe 59 leads to a common return pipe 60. Should the oil pressure in the pipes 53, 54, 57 exceed a given value, oil flows through the regulating valve 58 and is fed back to the common return pipe 60 via the pipe 59 until the pressure falls to the intended value.

By means of a setting screw 58*a* on the regulating valve 58 a pressure may be set at which the regulating valve 58 will allow oil to pass. The oil pressure in the common feed pipe 55 will therefore be constantly held at a desired value by the pressure storage loading device.

Connected to the common feed pipe 55 are the hydraulic pressure storage devices 49, of which only one is seen in FIGS. 5 and 6. In these pressure storage devices 49 is stored oil under pressure, and their purpose is to supply oil to the hydraulic motors 30 in emergency. In order to avoid loss of oil pressure in this event, the devices are gas-pressurized.

Connected to the common feed pipe 55 is a pressure gauge 50, with a scale calibrated in units of length of the hoeing length.

Connected to the common feed pipe 55 are the feed pipes 31 to the hydraulic motors 30; only one is shown in FIGS. 5 and 6.

In the return pipe 32 is a hydraulic control slide valve 61 operated by a valve solenoid 62 by which the control slide valve 61 can be moved to either of two positions. In one position (FIG. 5) it closes the return pipe 32 of the hydraulic motor 30 in question, while in the other (FIG. 6) it opens the return pipe 32. The return pipe 32 leads from the control slide valve 61 to the common return pipe 60, which in turn leads to an oil filter 63 connected to the tank 46.

The embodiment shown in FIG. 7 corresponds to that shown in FIGS. 5 and 6, except that the pressure storage loading device 48 is omitted and instead other devices are provided. Thus, from the pipe 53 from the oil pump 47, a pipe 64 branches off and leads to an excess pressure valve 65 which in turn is connected through a pipe 66 to the common return pipe 60. Further, the pipe 53 leads to a hydraulic valve 67 which can be moved into either of two positions by a solenoid 68. In one position the hydraulic valve 67 connects the pipe 53 to a pipe 69 which leads to the common feed pipe 55. In its other position (FIG. 7) the hydraulic valve 67 connects the pipe 53 to a pipe 70 which leads to the common return pipe 60.

The solenoid 68 is operated by an electrohydraulic pressure control means 71. This pressure control means (FIG. 8) has a casing 72 connected by a pipe 73 to the common feed pipe 55. Within the casing 72 is a piston 74 subject to the pressure of a

spring 74a. The oil pressure in the common feed pipe 55 acts on the piston 74. The piston 74 has a piston rod 75 which carries a contact member 76 at its outer end. By means (not shown) the pressure exerted by the spring 74a upon the piston 74 can be adjusted.

The pressure control means 71 is also connected to a source of current 77 and has wires 78, 79 which lead to the solenoid 68 of the hydraulic valve 67. The connection 78 can be opened or closed by the contact member 76 of the piston rod 75.

If the desired fluid pressure prevails in the common feed pipe 55, this will keep the piston 74 and therewith the contact member 76, against the action of the spring 74a, in the position shown in FIG. 8, wherein the connection 78 to the solenoid 68 is broken and therefore the hydraulic valve 67 is in the position shown in FIG. 7, in which oil under pressure from the oil pump 47 is fed to the common return pipe 60 through the pipe 70. However, if the oil pressure in the common feed pipe 55 falls below the desired level, the piston 74 and the contact member 76 move downwards under the action of the spring 74a, and the contact member 76 closes the circuit. This causes excitation of the solenoid 68 which will move the hydraulic valve 67 into the position in which it connects the pipe 69, leading to the common feed pipe 55, to the pipe 53 from the oil pump 47. By this means the oil pump 47 will feed oil into the common feed pipe 55 until such time as the oil pressure therein reaches the given value; the connection 78 is then broken and the solenoid 68 returns the hydraulic valve 67 to its other position.

The hydraulic arrangement shown in FIG. 9 for feeding oil under pressure to the five hydraulic motors 30 correspond to the hydraulic arrangements shown in FIGS. 5 and 6 and, for controlling the oil pressure, also include a pressure storage loading device 48. In FIG. 9 will be seen the connection of each hydraulic motor 30 by its feed pipe 31 to the common feed pipe 55 and by its return pipe 32 to the common return pipe 60, and the arrangement of a control slide valve 61 in each return pipe 32.

Each hoeing assembly 22 has a control device. The parts of these control devices are particularly shown in FIGS. 5 and 6.

Each control device incorporates a plant feeler 45, which is an electric touch feeler connected by a input signal conductor 88, which has a contact b_2, to an amplifier 89. Also connected to the amplifier 89 by a conductor 90 is an earthing contact 91. When a plant is touched by the feeler 45 and the contact b_2 is closed, a circuit is closed through the conductor 88, contact b_2, feeler 45, the plant, the soil, the earthing contact 91, and the conductor 90, through which the feeler current can flow. The feeler circuit is supplied with current from a source 92. From this source 92 the amplifier 89 is also supplied with current. This amplifier amplifies the current flowing in the feeler circuit and provides output power signals via first and second output signal lines 104 and 104' respectively. A potentiometer 93 is connected to the feeler circuit and the amplifier 89. By means of this potentiometer 93 the sensitivity of the feeler circuit and of the feeler 45 can be set.

The control device also has current connections 94 to which first and second power wires 95 and 96 are attached. The wire 96 leads to a contactless terminal switch 97 which has a protective gas filling and a reed contact 98.

The contactless terminal switch 97 is disposed within the casing 42 surrounding the tool disc 34 of the corresponding hoeing assembly 22. Mounted on the hub 37 of the tool disc 34 is a permanent magnet 99. The terminal switch 97 and the permanent magnet 99 are so disposed that the magnet can act upon the reed contact 98. When the magnet 99 acts on the contact 98, the latter is closed, but when the effect of the magnet 99 ceases, the contact 98 opens. Apart from this the terminal switch 97 and the magnet 99 are so arranged that the tool disc 34 with its hoeing tool 35 is outside the range of the plants when the permanent magnet 99 acts upon the contact 98 of the terminal switch 97.

The solenoid 62 of the control device of each hoeing assembly 22 is connected by means of a wire 100, in which is a contact b_1, to the wires 95, 96. In addition the control device includes three high resistance relays A, B and C connected to the wires 95, 96 in parallel with the solenoid 62.

The first relay A is connected in series with the contactless terminal switch 97 by a wire 101 and has a wire 102 shutting the terminal switch 97, contacts a_3 and b_3 being disposed in the wire 102. The second relay B has a wire 103 with two parallel branches 103a and 103b. In the branch 103a is a contact c_1, the branch 103b having a contact a_1. The third relay C is connected to the feeler circuit by a wire 105' in the first part of which adjoining the wire 96 is a contact a_2. The relay C, behind the part of the wire 105' having the contact a_2, has a wire 105 with which the wire 105' can be shunted.

When the relay A operates the contact a_1 is opened, the contact a_2 is closed, and the contact a_3 is also closed. Operation of the relay B closes the contact b_1 and opens the contacts b_2 and b_3. Finally, operation of the relay C closes contacts c_1 and c_2.

When the tool disc 34 is at a standstill the various parts of the control device are in the position shown in FIG. 5. Thus, the contact 98 of the terminal switch 97 is closed, due to the effect of the permanent magnet 99, and the relay A is attracted. The relay B is, on the other hand, released, which causes the contact b_1 to be open, so that the solenoid 62 is not excited and the control slide valve 61 is in a position in which the return pipe 32 of the hydraulic motor 30 is closed; thus the hydraulic motor 30 cannot rotate. Since the relay B is released the contact b_2 is also closed and the feeler 45 is ready for sensing a plant. Finally, the relay C is also in its released state and the contacts c_1 and c_2 are also open. However, the relay C is connected to the feeler circuit through the wire 105' since contact a_2 in the wire 104 is closed due to the relay A being attracted.

If now the feeler 45 senses a plant, the feeler circuit is closed. This causes through an output signal wire 104 operation of the relay C so that contact c_2 closes and the relay C is connected to the wire 96 through the wire 105 and remains pulled in even if the feeler circuit should be again opened. Voltage is also applied to output signal 104' from amplifier 89. By operation of the relay C contact c_1 is also closed, so that the relay B is connected to the wire 96 through the branch 103a and is pulled in. Operation of the relay B results in closing of the contact b_1. Consequently, through the wire 100, the solenoid 62 is connected to the wire 96 and is excited, so that it moves the control slide valve 61 into the position to open the return pipe 32 of the hydraulic motor 30. This sets the hydraulic motor 30 and the tool disc 34 in motion, and the hoeing tools 35 will hoe the ground behind the plant sensed, along the hoeing length H.

Pulling in of the relay B further results in the contact b_2 opening, thus depriving the feeler 45 of current. Further contact of the feeler with a plant or with the soil will therefore have no effect on the control device. By pulling in of the relay B the contact b_3 in the wire 102 of the relay A is also opened.

When the tool disc 34 rotates the permanent magnet 99 is moved away from the terminal switch 97 and the contact 98 is opened. As a result of this, and of the opening of the contact b_3 due to the operation of the relay B, the relay A is deprived of current and opens. Opening of the relay A results in closing of the contact a_1 in the branch 103b, opening of the contact a_2 in the wire 105' and closing of the contact a_3 in the wire 102. Opening of the contact a_2 interrupts the connection of the relay C and consequently this again opens. Opening of the relay C not only has the effect that the contact c_2 in wire 105 opens, but the contact c_1 in the branch 103a of the wire 103 of the relay B also opens.

When this happens the parts of the control device assume the position shown in FIG. 6 corresponding to state of motion of the tool disc 34, wherein the return pipe 32 of the hydraulic motor 30 is opened by the control slide valve 61.

As the tool disc **34** approaches the completion of one revolution, the magnet **99** moves into position adjacent the switch **97** and consequently closes the contacts **98**. Closure of the contacts **98** immediately reactivates relay A.

Operation of the relay A opens the contact a_1 in the branch **103***b* of the wire **103** of the relay B. Due to the opening of the contact a_1 the relay B is deprived of current and opens. Opening of the relay B in turn opens the contact b_1 in the wire **100** of the solenoid **62** and closing of the contact b_2 in the feeler circuit **88**. Due to opening of the contact b_1 the solenoid is deprived of current and the control slide valve **61** resumes the position in which it closes the return pipe **32** from the hydraulic motor **30** to immediately stop the motor. Additionally, the closure of contacts b_2 serves to reactivate feeler **45** in order that the cycle can be repeated upon feeler **45** contacting the next plant.

Moreover, due to closing of the relay A the contact a_2 in the wire **105'** of the relay C is closed and the relay C is again connected to the feeler circuit. Finally operation of the relay A results in the contact a_3 in wire **102** being closed. Beyond this, due to the opening of the relay B, the contact b_3 in the wire **102** of the relay A is closed.

Thus, all parts of the control device have again resumed the position corresponding to the tool disc **34** being at a standstill, as shown in FIG. **5**.

When the feeler **45** of the same hoeing assembly again senses a plant during further movement of the machine along the row of plants, the cycle of operations will be repeated.

I claim:

1. A machine for movement along rows of plants for thinning and hoeing the plants, said machine comprising a frame, at least one tool support member mounted on said frame for unlimited rotation, hoeing tools mounted rigidly on said tool support member in a radial array, a rotary hydraulic motor having an output shaft drivingly connected to said tool support member for rotating said tool support member upon actuation of said rotary hydraulic motor, a source of hydraulic fluid, a feed pipe connecting said rotary hydraulic motor and said source of hydraulic fluid, pressure means in said feed pipe to constantly provide substantially constant pressure fluid to said motor, an exhaust pipe extending from said rotary hydraulic motor for returning exhaust fluid to said source of hydraulic fluid, control valve means in said return pipe operable for opening and closing said return pipe to permit said motor to rotate said tool support or to stop said tool support in fixed position, a plant feeler mounted on said frame behind each rotatable mounted tool support member for detecting plants and control means connected to said feeler and said control valve, said control means being responsive to the detection of a plant by said plant feeler for opening said valve to cause said motor to rotate and consequently rotate said tool support member for thinning said row of plants for a given distance.

2. Machine according to claim **1**, wherein each tool support member is mounted on the driving shaft of its associated hydraulic motor on an annular elastic coupling connected to the output shaft of said motor.

3. Machine according to claim **1** wherein a pressure gauge, calibrated in units of length of the hoeing length, is provided in the feed pipe of the hydraulic motor.

4. Machine accordingly to claim **1** wherein said control means includes an electromagnetic switching device which is switched on by the control device when a plant to be retained is sensed and thereby moves the control valve to the open position, and is switched off after a given rotary movement of the tool support member, thereby moving the control valve to the closed position to stop rotation of said tool support member.

5. The invention of claim **1** wherein said pressure means comprises a hydraulic pump and additionally including at least one hydraulic pressure storage device in said feed pipe, a nonreturn valve in said feed pipe between said hydraulic pressure storage device and said hydraulic pump and a pressure regulating control valve connected to said feed pipe between said nonreturn valve and said hydraulic pump for directing pressurized fluid from said pump to said exhaust line when the pressure of said fluid from said pump exceeds a given value and for bypassing said fluid around said nonreturn valve when the pressure of said fluid from said pump is below said given value.

6. The invention of claim **5** wherein said pressure regulating valve includes adjustment means to vary the given pressure to consequently vary the pressure of hydraulic fluid provided to said hydraulic motor.

7. The invention of claim **1** wherein said pressure means comprises a hydraulic pump and additionally including at least one hydraulic pressure storage device in said feed pipe between said pump and said hydraulic motor, an excess pressure release valve connected in said feed pipe between said hydraulic pressure storage device and said pump responsive when subjected to pressure exceeding a critical value to provide communication between said feed pipe and said exhaust pipe, an electromagnetically operated valve located in said feed line between said hydraulic pressure storage device and said connection to said excess pressure release valve operable for either directing pressurized fluid from said pump to said exhaust pipe or to said hydraulic motor and control means for actuating said electromagnetically operated valve to direct fluid from the pump to the motor in response to the detection of pressure below a set low-pressure value in the portion of said feed line downstream from said electromagnetically operable valve.

8. The invention of claim **7** wherein said control means for actuating said electromagnetically operated valve includes a contact member connected to a piston rod of a piston and cylinder having one end of said cylinder connected to said feed line downstream of said electromagnetically operated valve and spring means biassing said piston in a direction opposite the direction of force on said piston created by pressure in said feed line.

9. The invention of claim **8** wherein said spring means is adjustable for varying said set low-pressure value.

10. The invention of claim **4** wherein said control means additionally includes circuit means connected to said feeler, an amplifier and a potentiometer for adjusting the sensitivity of said feeler.

11. The invention of claim **10** wherein said control means includes switch means mounted adjacent said tool support member and an operating member on said tool support member operable for closing said switch means when said tool support member is in a given position of rotation.

12. The invention of claim **11** wherein said control means includes valve solenoid means actuated by said switch means for closing said electromagnetically operable control.

13. The invention of claim **12** wherein said switch means is a reed switch and said operating means member is a permanent magnet.

14. The invention of claim **13** wherein said control means additionally includes first and second power wires, first, second and third relays each of said relays having one terminal connected to said first power wire, said first relay including a first contact that is normally closed, a second contact that is normally open and a third contact that is normally closed, said second relay having a first contact that is normally open, a second contact that is normally closed, and a third contact that is normally closed, said third relay having a first contact that is normally open and a second contact that is normally open, a signal source amplifier having an input signal source conductor connected to said feeler with said second contact of said first relay being interposed in said input signal source conductor between said feeler and said relay, first and second output signal lines extending from said signal source amplifier, said valve solenoid for operating said valve being connected across said first and second power wires in series with said first contact of said second relay, a first wire from said first relay connecting said first relay in series through said reed switch to said second power wire, conductor means connecting said

third contact of said second relay and said third contact of said first relay in parallel to said magnetically operable switch between said first relay and said second power wire, conductor means connecting said first contact of said third relay and said first contact of said first relay in parallel between said second relay and said second power wire, and conductor means connecting said second contact of said third relay and said second contact of said first relay in series between said third relay and said second power wire with said second output signal line being connected to a point in said conductor between said second contact of said first relay and said second contact of said third relay and said first output signal line being connected to a point in said conductor between said second contact of said third relay and said third relay.