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(54) Control lever assembly.

(57) A control unit (28) for a tractor front loader includes a control lever assembly (44) mounted for pivotal movement about two perpendicular axes in the X and Y directions.

The control lever (44) can be moved to over-press positions at the extremes of its ranges of movement in order to activate further control functions.

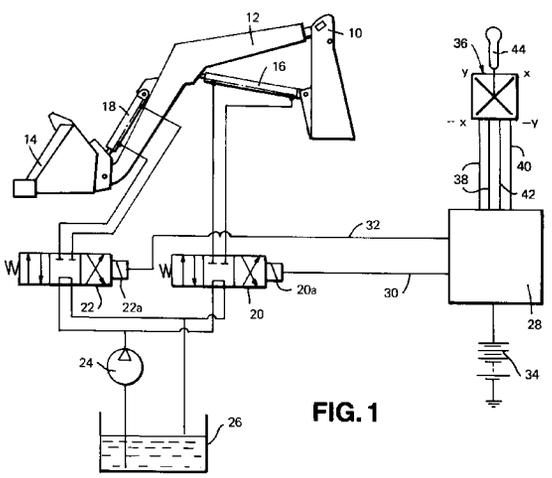

FIG. 1

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This invention relates to a pivotally mounted control lever assembly for controlling functions of a vehicle or machine. Such control lever assemblies mounted for pivotting about two perpendicular axes are currently used for example, to control different functions of the operation of tractor mounted front loaders or rear diggers.

It is an object of the invention to provide an improved form of control lever assembly capable of being used to control more functions of a vehicle or amchine than prior art control levers.

The invention therefore provides a control lever assembly including a control lever arranged for pivotal movement through a normal range of travel to control a first aspect of a vehicle or machine and for pivotal movement to an overpress position past the normal range of travel in at least one direction to control a second aspect of the vehicle or machine.

The invention provides the advantage that more functions can be controlled by manipulation of the control lever. Thus the need for separate buttons and switches on vehicle or machine consoles is reduced as is the number of occasions on which the vehicle or machine operator must release the control lever in order to operate other controls.

The control lever may be mounted for pivoting about two perpendicular axes through a normal range of movement in four perpendicular directions to control four different aspects of the vehicle or machine, and movable in compound directions to control two aspects simultaneously. Overpress positions may be provided in one or more of the four directions of movement, these being past the normal range of travel at either end of each direction of travel.

The lever assembly may be constructed to provide increasing resistance to pivoting as the pivot angle increases and a step increase in resistance to pivoting as an overpress position is reached.

The control lever may be mounted for pivotal movement forwards and back to control the lowering and raising of a loader beam and to right and left to control the pivotal movement of the loader bucket attached to the beam. Overpress positions may be provided at the extreme forward end of travel for activation of a beam float mode and at the extreme left hand end of travel for activation of a bucket return-to-dig mode.

Embodiments of the invention, as applied to a tractor front loader, will be described, by way of example only, with reference to the accompanying drawings in which:

Figure 1	schematically illustrates loader controls of a tractor loader;
Figure 2	diagrammatically illustrates the electrical components in the form of potentiometers operated by movement of the loader control lever;
Figure 3	diagrammatically illustrates the possible range of movement of the loader control lever and the regions corresponding to overpress positions;
Figure 4	graphically illustrates the lateral force required to move the loader control lever about its pivot point in the X or Y direction;
Figure 5	graphically illustrates the variation of wiper voltage as a percentage of applied volts with the pivot angle of the loader control lever in the X or Y direction;
Figures 6 & 7	illustrate the construction of one embodiment of a control lever assembly according to the invention, and
Figures 8 & 9	illustrate alternative embodiments of a control lever assembly according to the invention.

Referring to Figure 1, a tractor front loader has a loader tower 10 supported on the chassis (not shown). A loader beam 12 is pivotally connected to the upper end of the loader tower 10 at one end and has a bucket 14 pivotally connected to its other end. The beam 12 and bucket 14 are moved about their respective pivot points by means of beam and bucket double acting hydraulic actuators 16 and 18 respectively. The supply to and exhaust of hydraulic fluid from the beam and bucket actuators 16 and 18 is controlled by solenoid operated valves 20 and 22 respectively. The valves 20 and 22 receive pressurised fluid from pump 24 and exhaust fluid to reservoir 26. Valve operating solenoids 20a and 22a receive control signals from control unit 28 via lines 30 and 32.

The control unit 28 is connected to a power supply 34 and to control lever assembly 36 via power lines 38 and signal lines 40 and 42. The control lever assembly 36 includes a manually operable control lever 44 mounted for pivotal movement about two perpendicular axes in the X and Y directions shown in Figure 1, the control lever 44 being located appropriately for operation by the right hand. The control unit 28 generates the control signals in response to signals received from the control lever assembly 36 representing movement of control lever 44.

Pivotal movement of the control lever 44 to the left and right, i.e. in the X direction, commands pivotal movement of the bucket 14. Pivotal movement of the control lever 44 forwards and backwards, i.e. in the Y direction, commands pivotal movement of the beam 12. Movement of the contol lever 44 to an overpress position at the extreme left hand end of its range of movement, i.e. -X direction, activates a bucket return-to-dig mode. Similarly movement of the control lever 44 to an overpress position at its the extreme forward end of its range of

movement, i.e. +Y direction activates a beam float mode. The construction of the control lever assembly 36, in order that it may operate as described above, is as follows.

Referring to Figure 2 the control lever assembly 36 includes X and Y potentiometers 48 and 50 respectively. The potentiometers 48, 50 are connected to the power lines 38 and to the respective signal line 40, 42. Pivotal movement of the lever 44 in the X direction moves wiper 48a of potentiometer 48, whilst movement of the lever 44 in the Y direction moves wiper 50a of potentiometer 50. Movement of the control lever 44 in a direction being a compound of X and Y movement moves both wiper 48a and wiper 50a.

Referring now to Figure 5, the variation of wiper voltage, as a percentage of the voltage applied to the potentiometer, with control lever pivot angle is shown graphically. The wiper voltage varies linearly with lever pivot angle even into the overpress positions. However, the control unit 28 is programmed to interpret the signals it receives from the control lever assembly 36 appropriately. Thus signals corresponding to the normal range of pivot angle, -13.5 to 13.5 degrees, command movement of the beam or bucket in the normal manner. Signals corresponding to movement of the lever into one of the overpress positions, -13.5 to -17.5 degrees in the X direction or 13.5 to 17.5 degrees in the Y direction, command activation of the respective bucket return-to-dig and beam float modes.

Referring now to Figure 3, the range of movement of the control lever 44 is illustrated. The lever 44 is able to pivot 17.5 degrees from the vertical in each direction, X, -X, Y and -Y, with a tolerance of 0.5 degrees. The overpress positions in the -X and Y directions start at a pivot angle of 13.5 degrees with a tolerance of 1.5 degrees.

Referring also to Figure 4, the lateral force required to pivot the control lever 44 is shown graphically. The force increases as a linear function of the angle of pivot of the lever 44 over the range of movement corresponding to normal operation but when an overpress position is reached increases in a step function before again increasing as a linear function of the angle. This prevents accidental entry into the overpress positions and therefore accidental activation of the bucket float and return-to-dig modes.

Figures 6 and 7 show one embodiment of a control lever assembly 36 according to the invention. Figure 6 shows the assembly 36 when the control lever 44 is vertical and Figure 7 shows the assembly when the control lever 44 is pivotted to the overpress position in the -X direction to activate the bucket float mode. In both Figure 6 and Figure 7 (a) is a plan view and (b) a section through A-A in (a). The assembly includes a support structure 60 with a substantially square hole 61 formed in it and a slide plate 62 with a somewhat smaller substantially square hole 63 formed in it. A first set of four pegs 64 is located in the support structure 60 each peg 64 protruding upwards through a respective hole 66 formed in the plate 62. A second set of four pegs 68 is located in the plate 62, each peg of the second set 68 being located adjacent to a peg from the first set 64 to form a pair. A set of four pretensioned springs 70 is positioned, such that each spring 70 connects each first peg 64 to its adjacent second peg 68. The control lever 44 protrudes through the holes 61 and 63 and carries a substantially square block 72 within the holes.

The pretensioned springs 70 bias the plate 62 into its neutral position illustrated in Figure 6. The two springs aligned in the X direction are designated 70a whilst the two aligned in the Y direction are designated 70b. When the control lever 44 is pivotted in the -X direction at a pivot angle of 13.5 degrees the block 72 contacts the plate 62. In order for the lever 44 to be pivotted further and to enter the bucket float overpress position the bias of the X direction springs 70a must be overcome and the plate 62 moved in the -X direction. Similarly, when the lever 44 is pivotted in the Y direction the bias of the Y springs 70b must be overcome before the lever can enter the bucket return-to-dig overpress position. Thus the springs 70 provide the step increase in lateral force shown in Figure 4.

Figure 8 shows an alternative embodiment of a control lever assembly according to the invention. The increase in lateral force required to move the lever 44 into the overpress positions is provided by a piano wire spring 80. The spring 80 is fixed to the support structure by two screws 82 and is tensioned against a post 84 located in the support structure. The spring 80 overlays the hole 61 in the support structure 60 so that it must be pushed aside before the lever 44 can be pivotted into the overpress positions.

A further alternative embodiment of a control lever assembly 36 according to the invention is shown in Figure 9. The increase in lateral force is provided by a flat plastic or stainless steel spring 86. The spring 86 is fixed to the support structure 60 by two screws 88 and is tensioned against two posts 90 located in the support structure 60. The spring 86 is shaped such that it overlays the hole 61 in such a way that it must be pushed aside before the lever 44 can be pivotted into the overpress positions.

There are many other forms of control lever assembly which may be constructed to perform in the manner of the invention. The three embodiments described above are described by way of example only.

Control lever assemblies according to the invention may be used in many other applications in addition to that of a tractor loader described above. For instance, in a backhoe machine a control lever assembly positioned for left hand operation may operate backhoe slew in the X direction and beam raise/lower in the Y di-

rection. Overpress positions may be provided in both the +X and -X directions arranged for activation of a backhoe return-to-trench/dump mode in either direction. A right hand operable control lever assembly would be provided for operation of the dipper in the X direction and the bucket in the Y direction. Again overpress positions could be provided for activation of special modes.

Control lever assemblies according to the invention are not limited to the inclusion of two overpress positions. The assemblies may incorporate one, two three or four overpress positions as necessary for the application.

The use of overpress positions is not limited to activation of a mode which results in a single operation being performed before the system reverts to normal operation. Overpress positions could be used to switch between two modes which remain in operation until the lever is returned to the overpress position to switch again.

Claims

1. A control lever assembly including a control lever arranged for pivotal movement through a normal range of travel to control a first aspect of a vehicle or machine and for pivotal movement to an overpress position past the normal range of travel in at least one direction to control a second aspect of the vehicle or machine.

2. A control lever assembly as claimed in claim 1 in which the control lever is mounted for pivoting about two perpendicular axes through a normal range of movement in four perpendicular directions to control four different aspects of the vehicle or machine and moveable in compound directions to control two aspects simultaneously.

3. A control lever assembly as claimed in claim 1 in which the overpress positions are provided in one or more of four directions of movement, these positions being past the normal range of travel at either end of each direction of travel.

4. A control lever assembly as claimed in claim 1 in which the assembly is arranged to provide increasing resistance to pivoting as the pivot angle increases and a step increase in resistance to pivoting as an overpress position is reached.

5. A control lever assembly as claimed in claim 1 in which the control lever is mounted for pivotal movement forwards and back to control the lowering and raising of a loader beam and to right and left to control the pivotal movement of a loader bucket attached to the beam.

6. A control lever assembly as claimed in claim 1 in which overpress positions are provided at the extreme forward end of travel for activation of a beam float mode and at the extreme left hand end of travel for activation of a bucket return-to-dig mode.

7. A control lever assembly as claimed in claim 1 for a backhoe machine the assembly being positioned for left hand operation operates the backhoe slew in the X direction and beam raise or lower in the Y direction.

8. A control lever assembly as claimed in claim 1 in which overpress positions are provided in both the +X and -X directions arranged for activation of the backhoe return to trench or dump mode in either direction.

9. A control assembly as claimed in claim 1 in which a right hand operable control lever assembly is provided to operate a dipper in the X direction and a bucket in the Y direction.

10. A control lever assembly as claimed in claim 1 having a plurality of overpress positions at least one of said positions arranged to activate two modes which remain in operation until the control lever is returned to the overpress position to switch again.

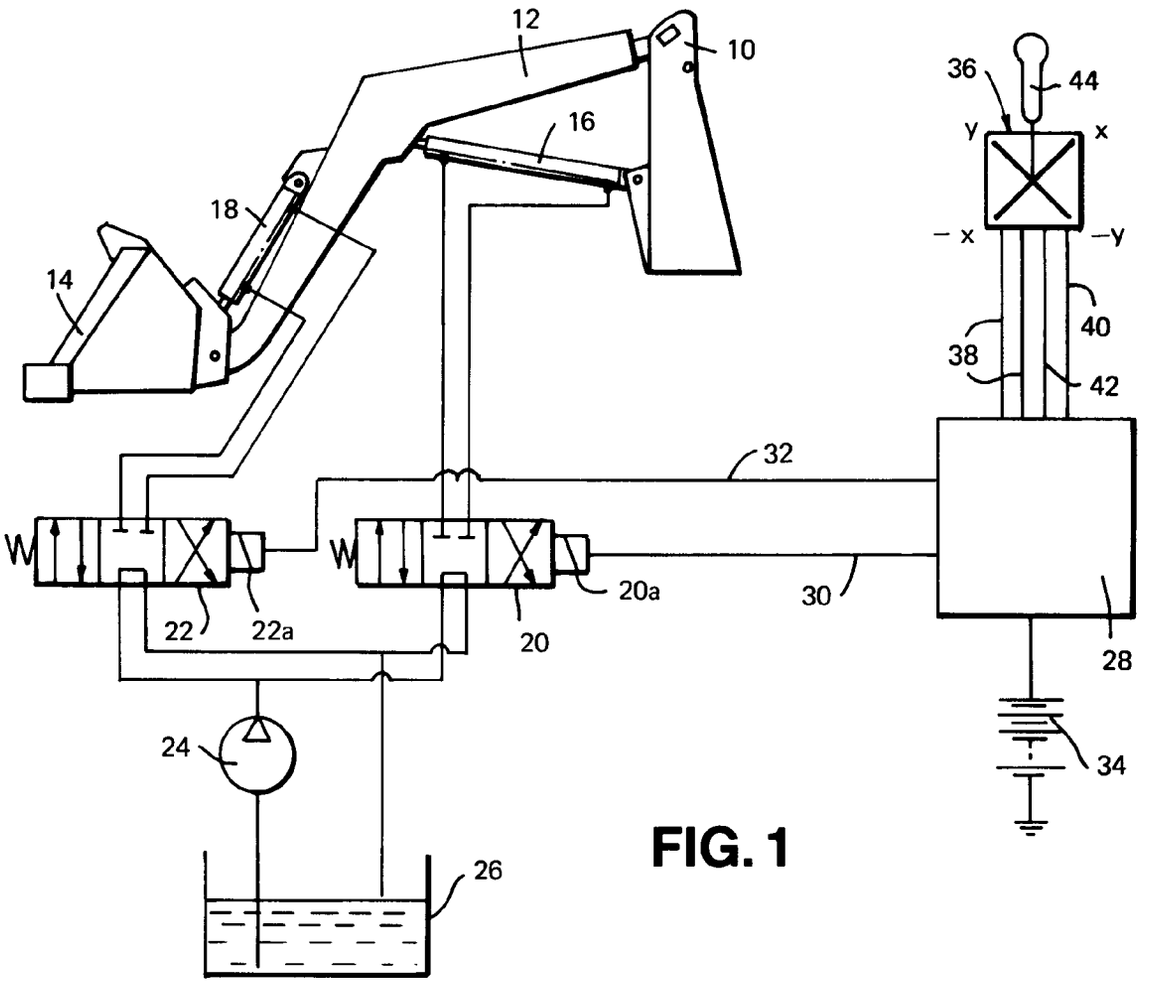
12
10
16
18
14
36
44
y
x
– x
–y
40
38
42
32
20a
30
22
22a
20
28
24
34
26

FIG. 1

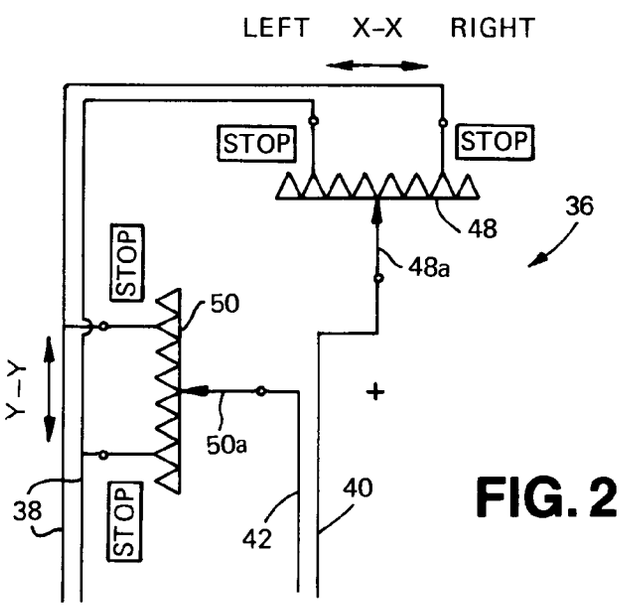
LEFT
X–X
RIGHT
STOP
STOP
36
48
48a
STOP
50
Y–Y
+
50a
38
STOP
40
42

FIG. 2

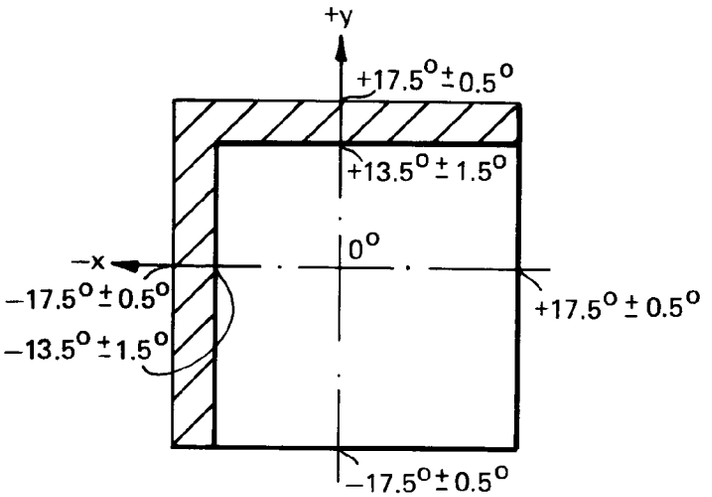

FIG. 3

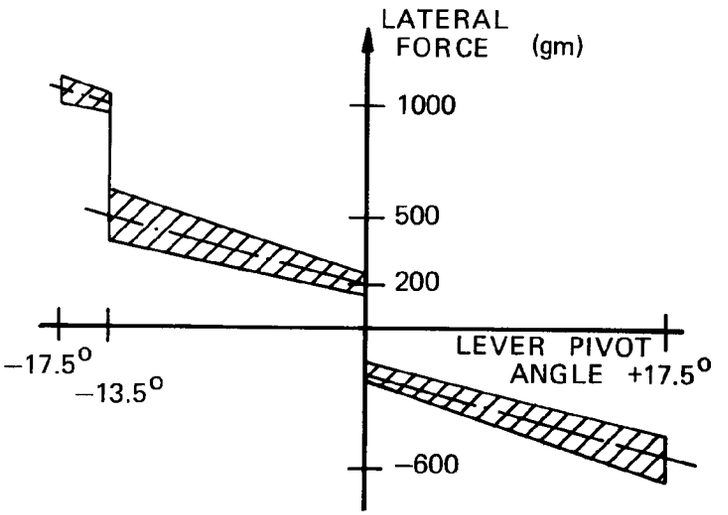

FIG. 4

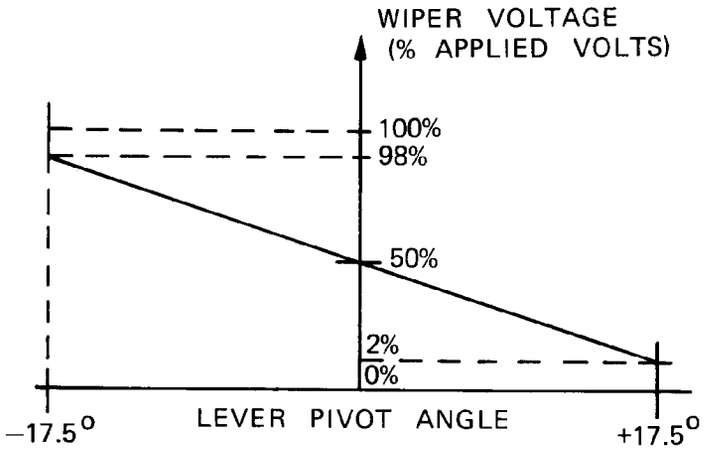

FIG. 5

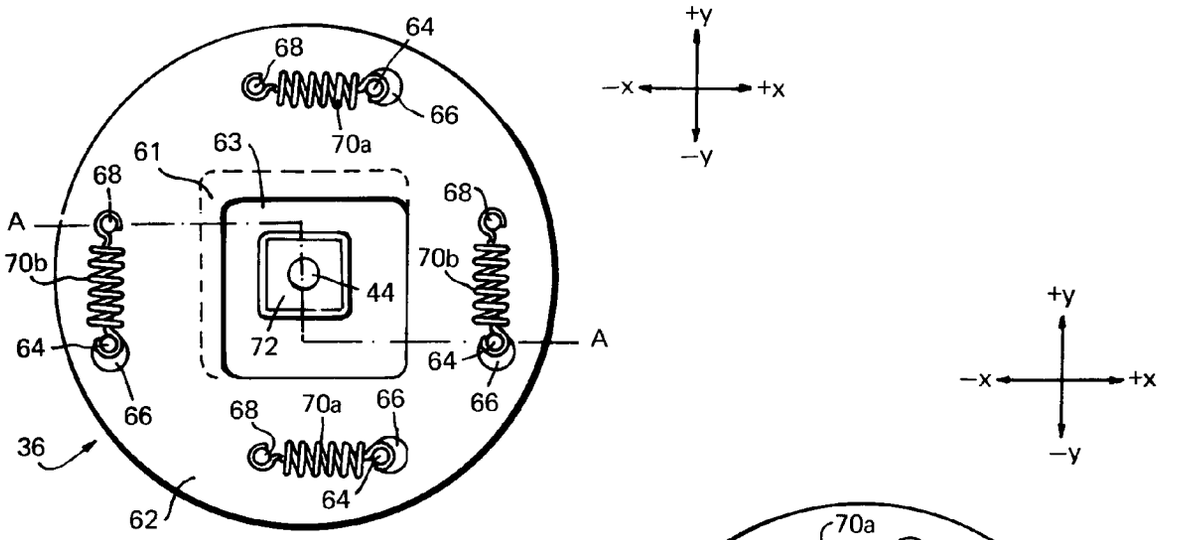

FIG. 6

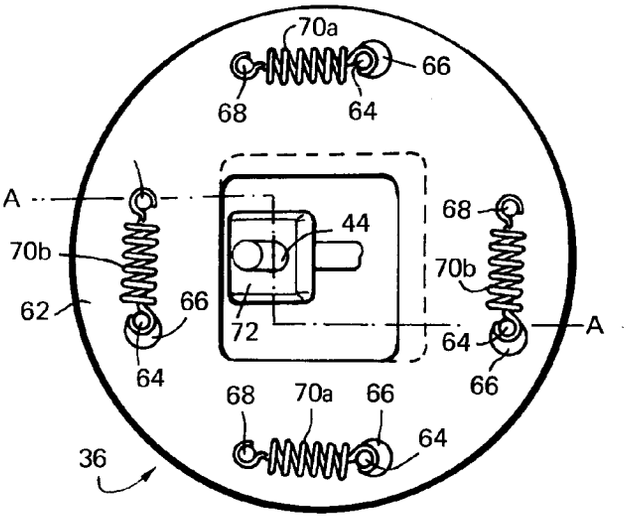

FIG. 7

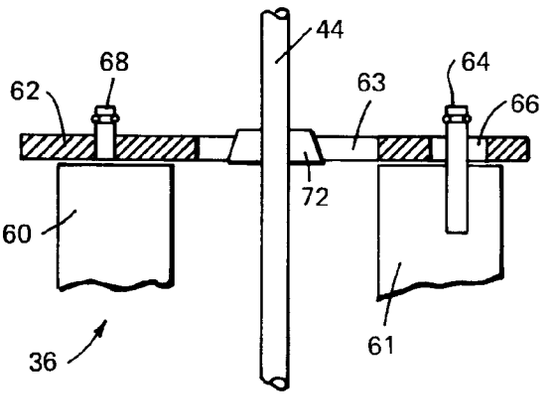

FIG. 6a

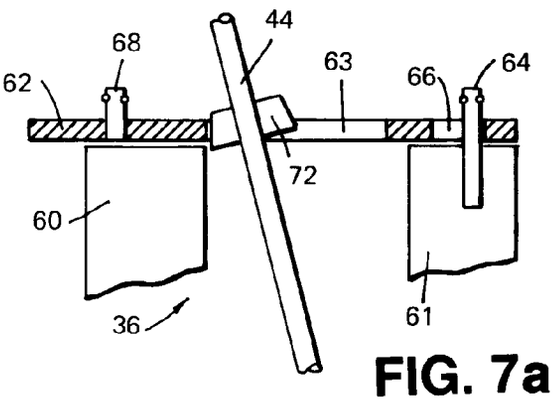

FIG. 7a

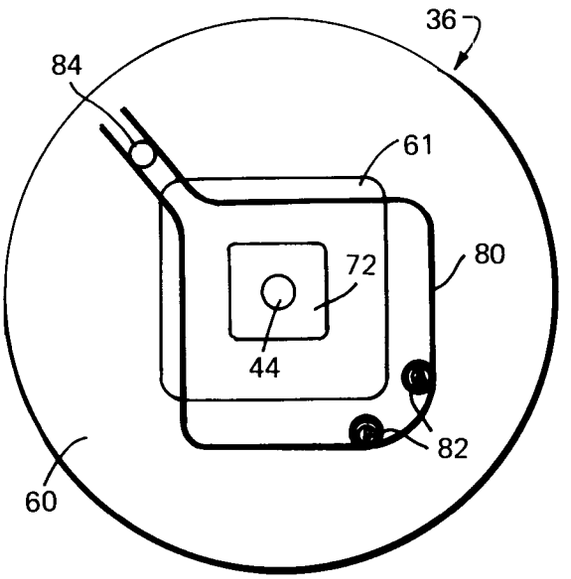

FIG. 8

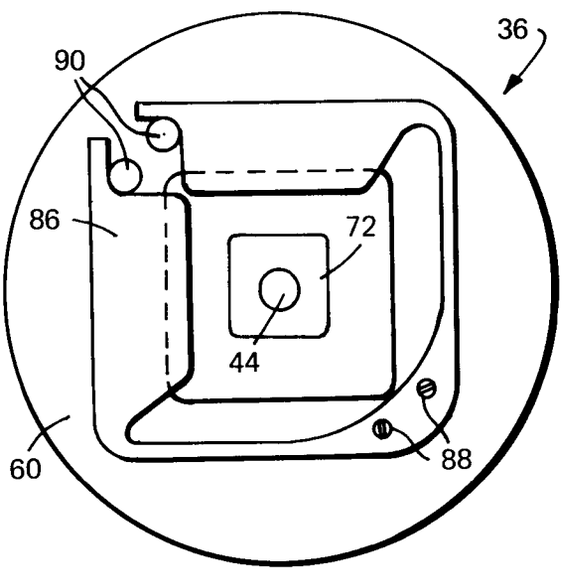

FIG. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 0317

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X Y	US-A-4 026 048 (HILL ET AL.) * column 3, line 19 - line 49 * * figures 2,5 *	1,3,4,10 2,5,9	E02F9/20 E02F9/24 G05G9/08
Y A	GB-A-1 558 604 (I.C.P.U.C.) * page 1, line 41 - page 2, line 17 * * figure *	2,5,9 7	
A	GB-A-2 186 999 (KUBOTA LTD.) * page 2, line 117 - page 3, line 19 * * figures 1-6,10 *	2,5	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)
E02F G05G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 April 1994	Estrela y Calpe, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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