United States Patent

[11] 3,589,240

[72] Inventor **Rodrigue Levesque**
28 rue Verbois, Rivere-Du-Loup, Quebec, Canada

[21] Appl. No. **837,761**
[22] Filed **June 30, 1969**
[45] Patented **June 29, 1971**

[54] **REMOTE CONTROL DIRECTION MECHANISM**
8 Claims, 3 Drawing Figs.

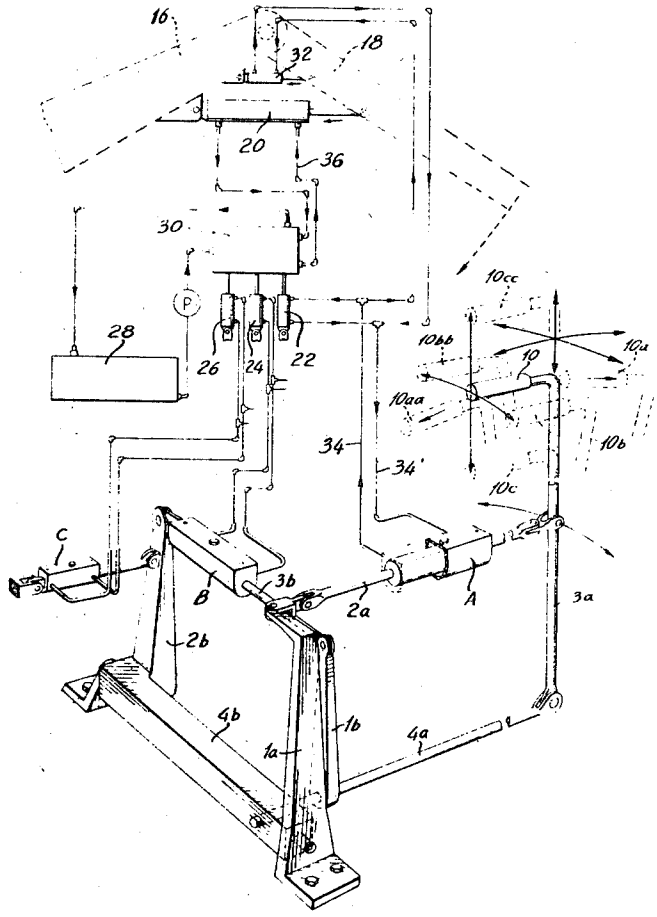
[52] **U.S. Cl.** **91/411,** 74/471
[51] **Int. Cl.** **F15b 13/00,** G05g 9/00
[50] **Field of Search** 91/411, 413, 460; 60/54.5; 74/471; 214/1

[56] **References Cited**
UNITED STATES PATENTS

2,396,309	3/1946	Coodal	74/471
2,497,127	2/1950	Lecarme	74/471
2,544,134	3/1951	Clark	60/54.5
2,877,660	3/1959	Rush	74/471
2,986,006	5/1961	Cox	91/413
2,988,928	6/1961	Dussumiel	74/471
3,011,739	12/1961	Boyce et al.	74/471
3,215,391	11/1965	Storm	74/471

Primary Examiner—William L. Freeh
Attorney—Raymond A. Robic

ABSTRACT: A remote control directional mechanism which enables to operate a knuckle boom-type loader along three orthogonal directions from a single operating handle. The boom of the loader will move along directions similar to the ones of the handle moved by an operator. The mechanism per se includes two interconnected angularly deformable quadrilateral arrangements of four arms, each arrangement having a hydraulic cylinder therein, the longitudinal variation of the cylinder permitting the corresponding actuation of the loader.



PATENTED JUN 29 1971

3,589,240

SHEET 1 OF 2

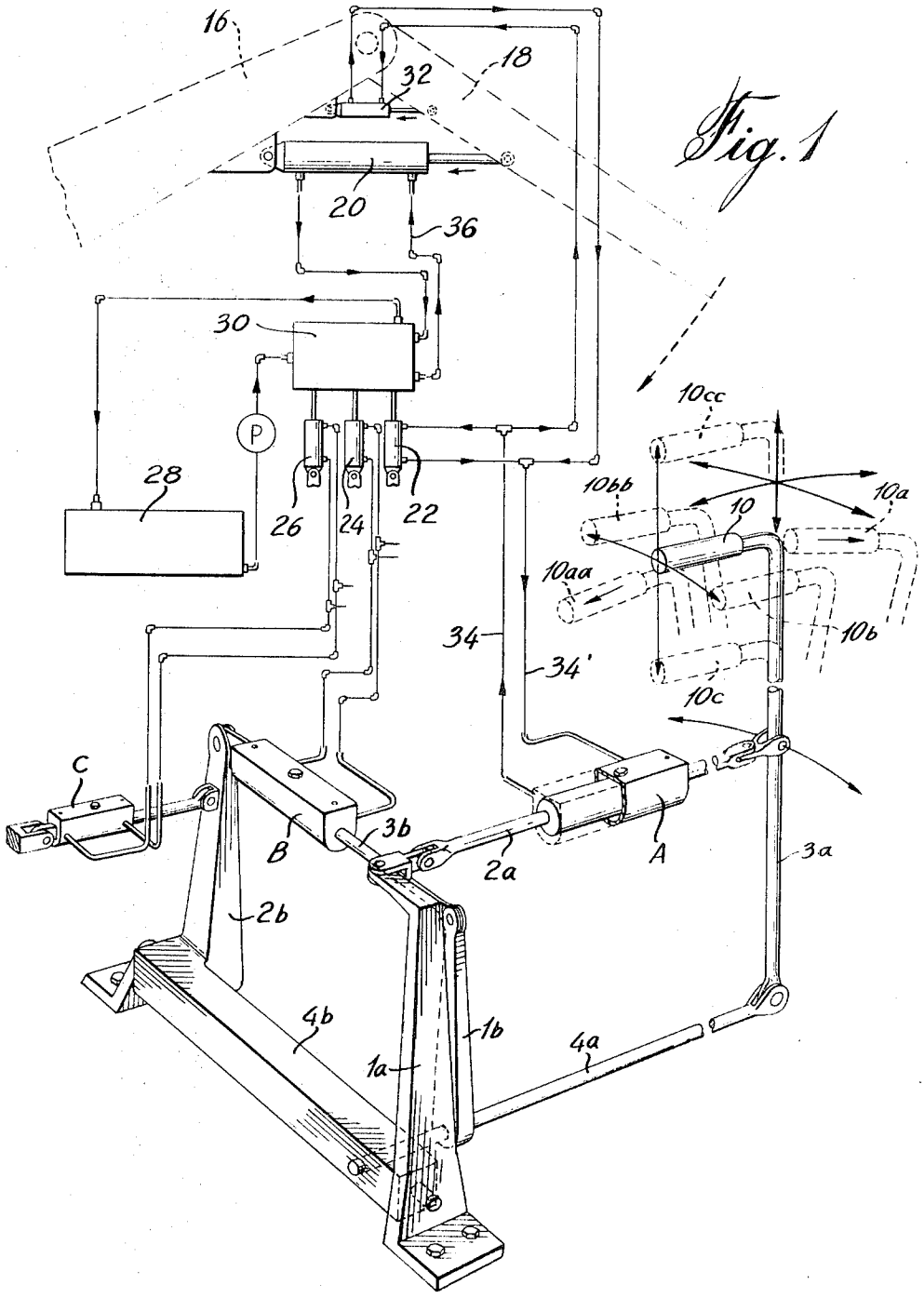


Fig. 1

INVENTOR
Rodrigue LÉVESQUE
BY
Raymond A. Robic
ATTORNEY

PATENTED JUN 29 1971

3,589,240

SHEET 2 OF 2

Fig. 2

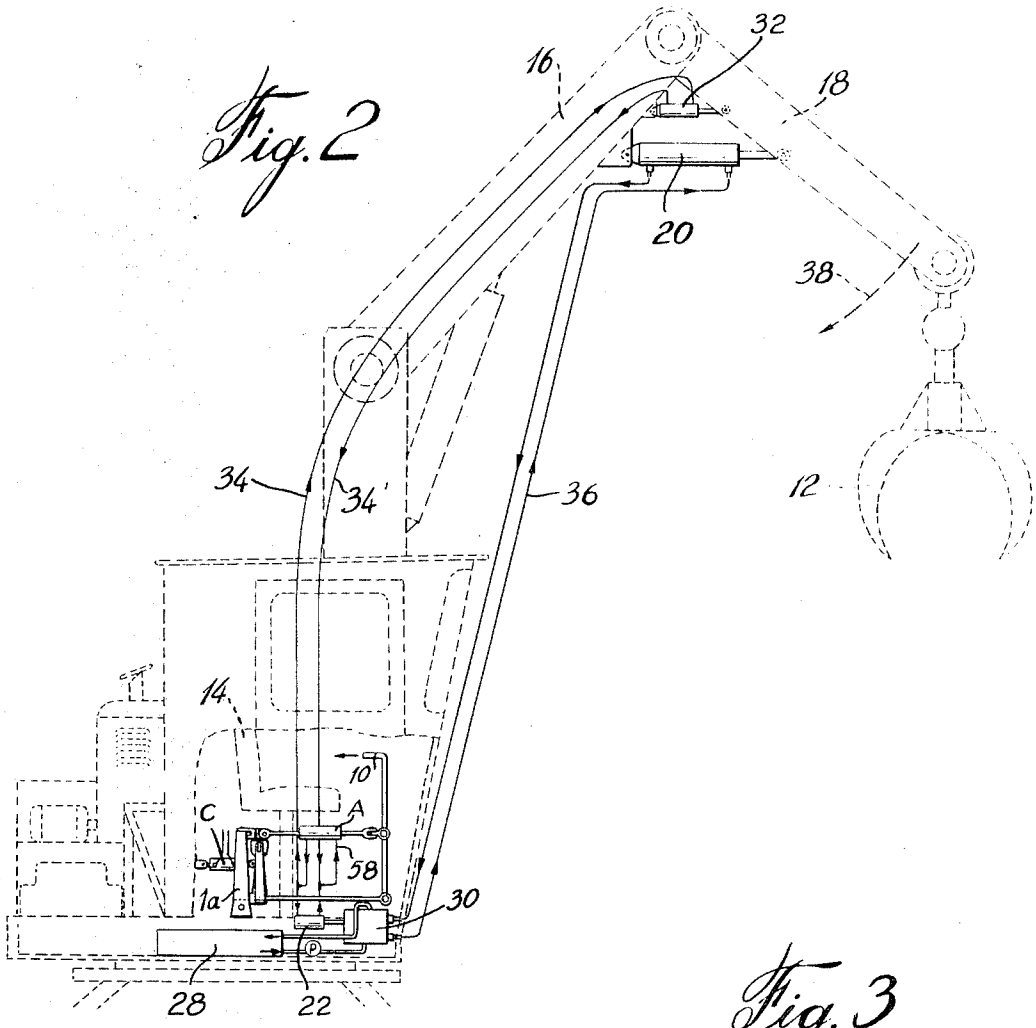
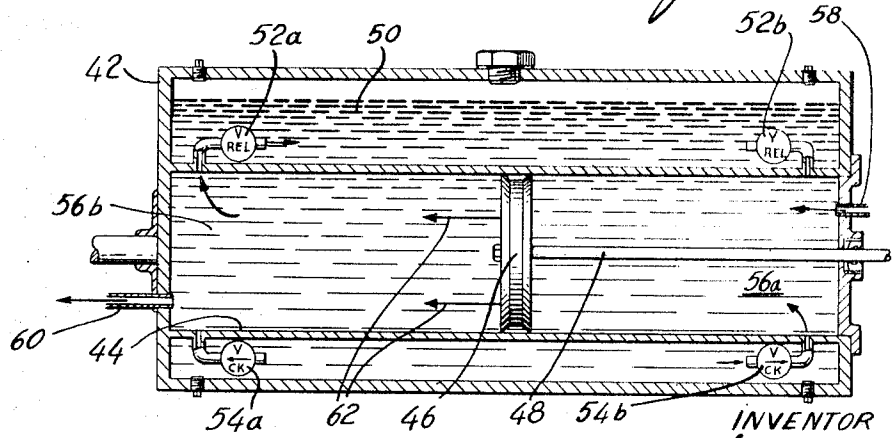


Fig. 3



INVENTOR
Rodrigue LÉVESQUE
BY
Raymond & Robic
ATTORNEY

REMOTE CONTROL DIRECTION MECHANISM

This invention relates to a remote control mechanism and more particularly to a mechanism which controls the operation of a working system along directions corresponding to a manual lever.

Earth handling devices, power lift machines, knuckle boom type loaders or similar devices are usually controlled by a plurality of handles or levers, each one having its own function. Generally, each of these handles has no directional relationship with the direction of the working machine which makes it difficult for the operator of the machine to learn its operation and to constantly perform its operation accurately.

The above-mentioned difficulty may be overcome by a mechanism which may remotely control an actuating machine in a plurality of directions by operating a handle in directions substantially identical to the desired directions of the machine. This arrangement enables an operator to work faster and more skillfully, and it also helps to train an apprentice faster.

The new remote control mechanism comprises, for a three-dimensional operation, three control devices having a variable length and connected to a three-dimensional motion actuating system, the said control devices being oriented and interconnected in such a way so that a handle connected to such an interconnection and operated along specified coordinates will produce movements of the actuating system along corresponding coordinates.

The three control devices may be disposed along three orthogonal directions and interconnected by straight links connected at one end to fixed supports so that a movement of the handle will produce a corresponding directional movement of the actuating system.

A preferred embodiment for interconnecting two control devices consists of two deformable quadrilateral arrangements of four arms, the control device being located in one of the arms of each arrangement. The two arrangements respectively disposed at 90° are pivotally interconnected so as to respond to orthogonal movements of the handle and to provide corresponding orthogonal movements of the actuating system.

The control devices are essentially of variable length, that is, are actuated by a longitudinal variation. These control devices may be linear electrical resistors or hydraulic pressure devices such as a combined cylinder and piston.

In the drawings which illustrate embodiments of the invention,

FIG. 1 is a schematic view of a hydraulic system including a remote control mechanism;

FIG. 2 is a schematic view of a knuckle boom type loader incorporating the mechanism illustrated in FIG. 1;

FIG. 3 is a cross-sectional view of a hydraulic pressure device.

It is the intent of the invention to move the digging claws **12** in the same direction as the operating handle **10** moved by an operator sitting in the chair **14**. For example, a forward movement of the handle **10** will result into a forward movement of the digging claws **12** by the relative movement of the arms **16** and **18** of the boom due to the actuation of the hydraulic power cylinder **20**. This power cylinder **20** is hydraulically actuated by the hydraulic pressure device A which is longitudinally actuated by the handle **10**.

FIGS. 1 and 2 show the actuation of the digging claws **12** in one direction but it would become obvious to a person skilled in the art to move the said claws in orthogonal directions by the use of suitably placed power cylinders responding to other hydraulic control devices such as B and C shown in FIG. 1.

The remote directional control device per se comprises the hydraulic pressure devices A, B and C, respectively operated by lever **10**. Obviously, each of these pressure devices may be any control device which has a variable length.

A simple arrangement of the control devices A, B and C consists in that each control device is disposed in orthogonal directions from one another and each one is connected to one arm, one end of each arm is fixed to a solid support while the other ends of each arm is directly interconnected, one of said other end being connected to the controlling lever.

However, the preferred embodiment for connecting the hydraulic pressure devices A, B and C consists of a set of four arms *1a*, *2a*, *3a* and *4a* forming a quadrilateral arrangement and into which the pressure device A is disposed through the arm *2a*. The arm *1a* is solidly fixed to a rigid base while the other arms *2a*, *3a* and *4a* are pivotally connected to each other to form a quadrilateral arrangement. The forward and rearward movements of the handle **10** in the direction **10***a* and **10***aa* varies the length of the pressure device A. The longitudinal variation of the device A produces a hydraulic displacement through the cylinder **22** which actuates the valve assembly **30** and in turn hydraulically varies the length of the power cylinder **20**. The valve assembly **30** is continuously fed by the reservoir or oil tank **28** through the pump P.

Therefore, it may be seen that a displacement of the handle **10** in a predetermined direction will cause the power cylinder **20** to move the arms **16** and **18** in a parallel direction so that the gripping claws **12** will move in a direction parallel to the movement of the handle **10**.

Similarly, the hydraulic pressure device B is supported by a set of four arms *1b*, *2b*, *3b* and *4b*. The hydraulic pressure device B varies in length by the actuation of the handle **10** from the position **10***b* to **10***bb*. This movement of the handle rotates the arm *4a* about its own axis and the arm *1b* about the same axis of the arm *4a* to which it is solidly secured. The arms *2b* and *4b* are practically fixed for the extension of the device B.

Similarly, the hydraulic pressure device B hydraulically influences the cylinder **24** which in turn actuates the valve assembly **30** which will operate the digging claws **12** in a movement parallel to the hydraulic pressure device B and more particularly in the direction parallel to the arrow extended between the dotted handles **10***bb* and **10***b*.

The downward and upward movements of the digging claws **12** will result when a similar movement of the handle **10** will move between the dotted handles **10***cc* and **10***c*. This latter movement of the handle **10** will pivot the arm *2b* by rotating the arm *4b* about its own axis. This is obtained by pivoting the arm *4a* about the arm *4b*, this action being the result of a vertical movement of the arm *3a*. One end of the hydraulic pressure device C is connected to a fixed structure at one end and to the arm *2b* at the other end. In a similar manner as for the devices A and B, the device C will perform its function upon the gripping claws **12** through the cylinder **26** and the valve assembly **30**, the latter being adapted to move a power cylinder which will move the gripping claws in a corresponding vertical movement as the handle **10**.

Obviously, the location of the hydraulic pressure device C may constitute a lower extension of the arm *3a* without departing from the spirit of the preferred embodiment described above.

The correspondence of the relative positions of the handle **10** and the boom **18** is defined by the positioning cylinder **32**. The operation is as follows: When the handle **10** moves in a rearward direction relative to the operator (see FIG. 2), the hydraulic cylinder A creates a pressure in the pipes **34**. This pressure actuates the cylinder **22** connected to the valve assembly **30**. In an appropriate movement, the oil in the pipe **36** circulates under pressure to actuate the power cylinder **20** in a retracting movement identified by the arrow **38** which results in the movement of the arm **18** in a rearward direction and this movement actuates the positioning cylinder **32** which determined the position of the handle **10**. Consequently, if the handle **10** is in a forward position, the arm **18** of the boom will be in a forward position, and if the handle is in a rearward position, the arm **18** will be in a rearward position and similarly with any intermediate positions. The same principle is applied to the two other orthogonal movements of the gripping claws **12**.

If other movements of the gripping claws **12** are desired, such as the rotation thereof or the opening and closing of the claws by an appropriate attachment may be fixed on the handle **10**.

Each of the hydraulic pressure devices A, B and C are particularly illustrated in FIG. **3** which shows an outer tubular container **42** and an inner tubular container **44** located inside the outer container **42**. A piston **46** is mounted inside the inner container and is adapted to slide by the rod **48**. A liquid **50** fills the inner container and also substantially fills the outer container **42**. The liquid **50** moves from one container to the other by at least a pair of release valves **52***a* and **52***b* and at least a pair of check valves **54***a* and **54***b*.

When the handle **10** is actuated, the rod **48** actuates the piston **46** in the direction of the arrows **62** and the liquid in the chamber **56***b* moves into the outlet pipe **60** which leads to one of the valves **22**, **24** or **26** and to the positioning cylinder **32** or a corresponding one for the two other orthogonal displacements. Simultaneously, the liquid returning through pipe **34'** enters the inlet **58** to fill the entrance chamber **56***a* of the inner container. A movement of the handle **10** in a direction opposite to the one described above moves the piston **46** to the right (see FIG. **3**) and produces a reverse cycle of the fluid **50**.

A pair of release valves **52***a* and **52***b* are provided between the inner container **44** and the outer container **42** in order to absorb the excess pressure in the inner container **44**. These release valves are also used when the handle **10** moves away from its initial corresponding position relative to the gripping claws. In this case, a strong and quick pressure applied to the handle **10** in the desired direction will relocate it relative to the position of the claws.

The check valves **54***a* and **54***b* are used to let the liquid move in only one direction as indicated by the arrows within each of the said check valves so as to permit the passage of a certain quantity of liquid from the outer container **42** into one of the entrance or exit chamber **56***a* and **56***b*. These check valves are also useful when the handle **10** must be relocated as described above.

From the above description, it should be clear that the desired results are obtained, that is, a movement of the handle **10** by the operator sitting in the chair **14** will result in a similar movement of the gripping claws **12**. Obviously, the handle **10** moves about a slightly curved path having a radius corresponding to the length of the arm **3***a* plus the length of the handle **10** extending from the arm **3***a* when the handle **10** moves in the two substantially horizontal directions while the radius is substantially equal to the length of the arm **4***a* when the handle moves up and down. These slightly curved paths of the handle **10** are not reproduced by the movement of the gripping claws **12**, the latter being dependent upon the displacement of the power cylinder **20** and the length of the arm **18**. However, the curved paths produced by the movement of the handle **10** are particularly appreciated by the operator which may be located adjacent the center of curvature of these curved paths.

While only a preferred embodiment has been disclosed, it is obvious that electrical, mechanical or hydraulic equivalents can be substituted for obtaining the same desired results.

I claim:

1. A remote control mechanism for transmitting motions in at least two orthogonal directions, said mechanism comprising:

a first control device having a variable length,

a first elongating means for said first control device to allow a variation of the length of the first control device, the said first means defining a first deformable quadrilateral arrangement of four arms,

a movable operating lever connected to the first elongating means for varying the length of the first control device, the direction of movement of the lever being parallel to the length of the first control device,

a second control device having a variable length and disposed at 90° with the first control device,

second elongating means for said second control device so as to allow a variation in length of the second control device, the said second means defining a second deformable quadrilateral arrangement of four arms, means for interconnecting the two elongating means so that a movement of the said operating lever in a direction parallel to the length of the second control device varies the length of the said latter device,

means for operatively connecting the said control devices to an orthogonal motion actuating system so that a movement of of the same operating lever serves to produce corresponding orthogonal movements of the actuating system, wherein the first quadrilateral arrangement comprises

a first arm rigidly immovable;

a second arm pivotally connected to said first arm through which is mounted the first hydraulic pressure device;

a third arm opposed to the first arm and pivotally connected to the second arm, the operating lever being connected about the intersection of the second and third arms for longitudinally varying the length of the first hydraulic pressure device;

a fourth arm opposed to the said second arm and pivotally connected to the third arm.

2. A mechanism as recited in claim **1**, wherein the first and second control devices are hydraulically pressure devices mounted respectively in one of the arms of the first and second quadrilateral arrangements.

3. A mechanism as recited in claim **2**, wherein the operating lever is fixed to one arm of the first quadrilateral arrangement adjacent the first control device.

4. A mechanism as recited in claim **1**, wherein the second quadrilateral arrangement comprises,

a first arm solidly fixed to the fourth arm of the first arrangement which is rotatably mounted about its longitudinal axis;

a second arm opposite the first arm of the second arrangement and invariably spaced relative to the first arm of the first arrangement;

a third arm extending between the first and second arms of the second arrangement and including the second hydraulic pressure device;

whereby a transverse pivoting movement of the controllable lever longitudinally varies the second hydraulic pressure device.

5. A mechanism as recited in claim **4**, wherein the second arrangement is mounted so as to rotate about its fourth arm, and a third hydraulic pressure device is mounted between a stationary member and one arm of the second arrangement so that the rotation of the latter arm longitudinally varies the length of the third hydraulic pressure device, means for hydraulically connecting the said third hydraulic pressure device to a third motion actuating system perpendicular to the said orthogonal movement actuating system, whereby a vertical movement of the controllable lever varies the length of the third hydraulic pressure device.

6. A mechanism as recited in claim **1**, wherein the means for connecting the hydraulic pressure devices to the orthogonal movement actuating system comprise a valve assembly and fluid conduit means for hydraulically connecting the said assembly to the hydraulic pressure devices, and the orthogonal movement actuating system comprises power hydraulic cylinders, each power cylinder being actuated by the valve assembly.

7. A mechanism as recited in claim **6**, wherein a lever-positioning hydraulic cylinder is mechanically actuated by each power cylinder and hydraulically connected to the said conduit means for controlling the position of the operating lever.

8. A mechanism as recited in claim **2**, wherein each hydraulic pressure device comprises two tubular containers mounted one inside the other and having a liquid therein, a piston axially movable in the inner container for dividing the said inner container into two chambers, one chamber having a liquid inlet and the other chamber having a liquid outlet, the said inlet and outlet being hydraulically connected to the said actuating system, and each chamber has a release valve and a check valve communicating the same with the outer container.