

June 6, 1944.

M. A. MONIER

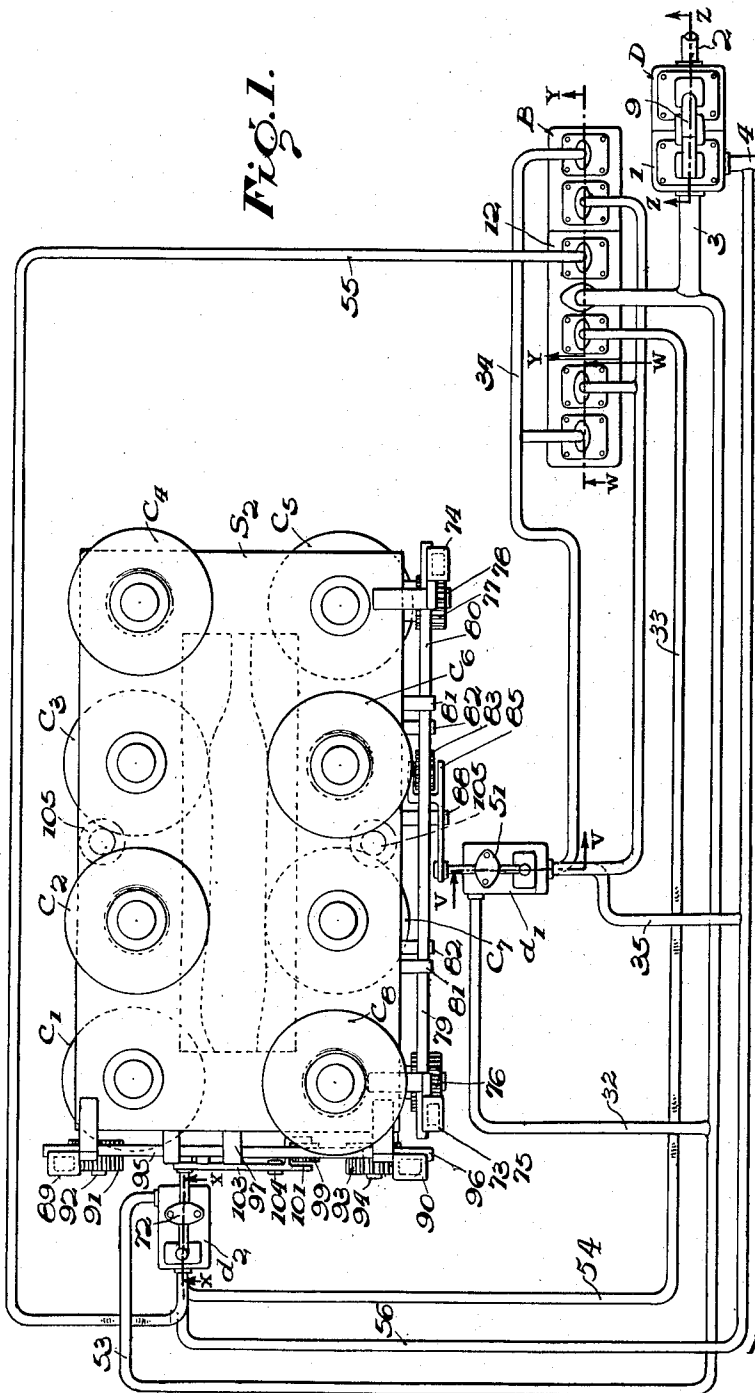
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3 Sheets-Sheet 1

FIG. 1.



Inventor.

Marius Adrien Monier

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Cameron, Kerkam + Sutton
Attorneys

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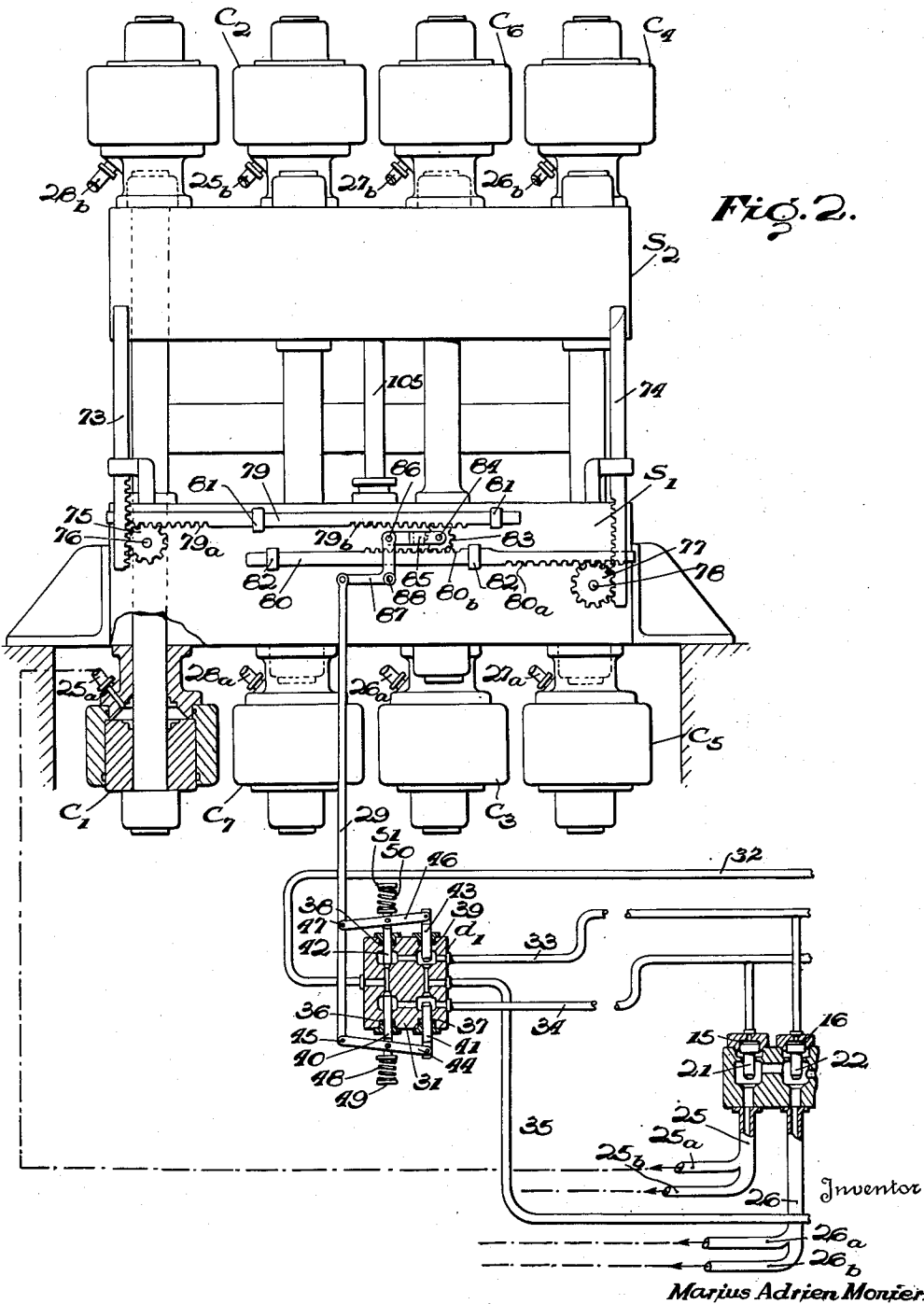
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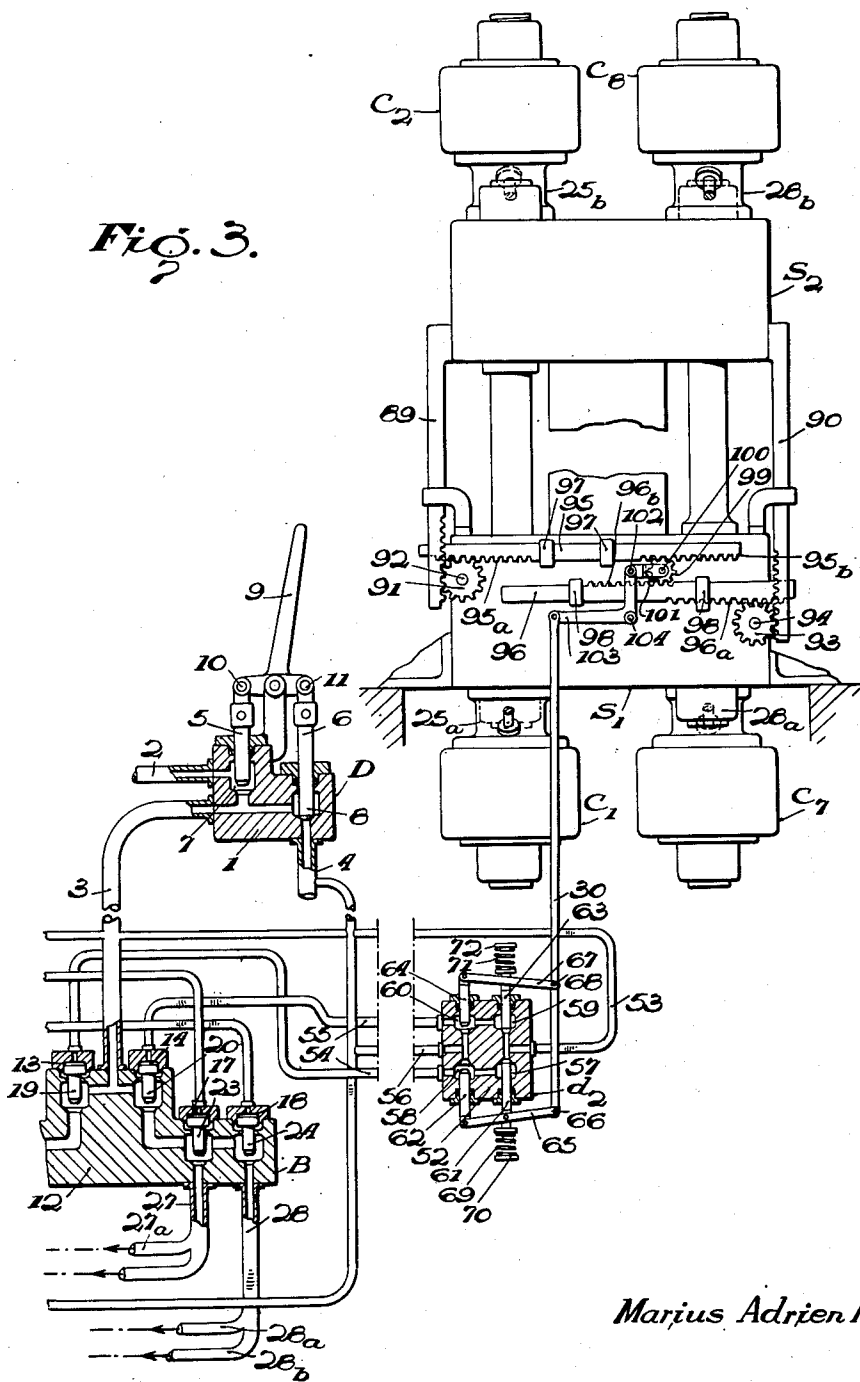
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Inventor

Marius Adrien Monzier.

Wm. Cameron, Kerkam & Sutton
Attorneys

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Marius Adrien Monier, Grillon, by Valreas,
France; vested in the Alien Property Custodian

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6 Claims. (Cl. 100—71)

Generally the correct operation of a press supposes that the resultant of the passive forces (resistance of the compressed article), the value of which is equal to that of the active forces (compression stresses), is directly opposed to this latter.

If, for any reason (abnormal distribution of the resistances or casual disappearance of certain ones of the same), this condition is no longer fulfilled, that is to say if a shifting occurs between the respective axes of application of both resultants in question, this shifting immediately gives rise to a reversing torque which in the case of presses of large dimensions can have serious consequences.

Without going so far as to cause in every case permanent deformations of the apparatus the above mentioned torque nevertheless imposes on the various organs of the press deflecting stresses which have as a visible consequence a lack of parallelism of the beds.

Without necessarily being dangerous these flexions give rise, in any case, to complementary frictions and even, on occasion, to jamming effects which are contrary to a satisfactory working of the press.

In ordinary presses one generally relies on the operator of the press for stopping the work as soon as the above mentioned lack of parallelism of the beds appears.

For presses of a great power, on the contrary, and especially for a press such as disclosed in Patent No. 2,197,441 granted to Perony, April 16, 1940, it has seemed necessary to provide a complementary safety device capable of automatically re-establishing the normal situation as soon as an abnormal shifting of the applied forces appears.

An object of the present invention is to provide a safety device which is characterized by the combination, with a distributor member controlling the admission and the outlet of the fluid under pressure which feeds the cylinders of the press, of an auxiliary control mechanism which, if necessary or advisable, automatically puts out of action one or more cylinders or cylinder groups, the said auxiliary mechanism comprising:

(1°) One or more auxiliary distributors adapted for permitting separately to regulate the supply of fluid to the various cylinders or cylinder groups under consideration;

(2°) When two auxiliary distributors are provided, a valve box adapted for co-ordinating the action of the said auxiliary distributors;

(3°) Lastly, one or two compensating controls

having a differential action, combined with the above mentioned auxiliary distributor or distributors and connected with the movable bed of the press in such a manner that at the moment when the lack of parallelism of the two beds reaches a given value the said control or controls act on the auxiliary distributor or distributors with which they are combined so as to stop the admission of the driving fluid for one or more cylinders or cylinder groups.

If the press comprises only one row of cylinders it is, of course, sufficient to have a single auxiliary distributor which is suitably arranged and a single compensating control, since one has to care only for the longitudinal parallelism of the beds.

On the contrary, when the press comprises two rows of cylinders two auxiliary distributors are necessary with one valve box and two compensating controls having a differential action, one of the said controls being assigned to the control of the longitudinal parallelism of the beds and the other to the control of their transversal parallelism.

A particular form of execution of a device suited for carrying out the invention is shown in the appended drawings and described by way of example, but, of course, the said form of execution could be modified in its details of construction without departing from the scope of the invention.

Figure 1 is a general diagrammatical plan view of the device.

Figure 2 comprises an elevation of the outside of the press in the longitudinal direction, with a partial tearing away showing the inner part of a cylinder, and also two sectional views of parts of associated control devices taken on the lines V—V and W—W of Figure 1.

Figure 3 is also an elevational view of the outside of the press in the lateral direction with three sectional views of parts of associated control devices which are taken on the lines X—X, Y—Y and Z—Z of Figure 1.

As shown in the drawings, the press which is described and shown by way of example comprises eight compression cylinders $C_1, C_2, C_3, C_4, C_5, C_6, C_7, C_8$ associated with the fixed bed S_1 and with the movable bed S_2 according to what is said in the aforesaid Perony patent, the said cylinders being, as shown hereinafter and as regards their supply with driving fluid, distributed in four groups G_1, G_2, G_3, G_4 , the group G_1 comprising the cylinders C_1 and C_2 , the group G_2 the cylinders C_3 and C_4 , the group G_3 the cylinders

C₃ and C₅ and the group G₄ the cylinders C₇ and C₈.

The control of the press is insured by means of a general distributor D and of two auxiliary distributors d₁ and d₂ which latter are respectively subjected to the action of the compensating control mechanisms the first of which corresponds to the longitudinal balance and the second to the lateral balance, the said auxiliary distributors being adapted for controlling the operation of a valve box B which regulates the supply of the driving fluid to the various cylinder groups.

The general distributor D, which could also be of another type than that which is shown in the drawings, is formed here of a three way cock comprising a block 1 to which leads the conduit 2 supplying the cylinders with fluid under pressure and from which extend on the one hand the conduit of distribution 3 and, on the other hand, the outlet conduit 4.

Two valve needles 5 and 6 respectively movable in the cavities 7 and 8 provided in the said block 1 insure, by reason of the movements imparted to them by a control lever 9 to which they are linked at 10 and 11 respectively, either the connection of the inlet conduit 2 for the fluid with the distributing conduit 3 or the interruption of the said communication and the connection of the said distributing conduit 3 with the outlet conduit 4.

The valve box B which is supplied with driving fluid by the conduit 3 when the valve needle 5 of the general distributor is open is formed of a block 12 in which are arranged six differential valve casings 13, 14, 15, 16, 17 and 18 respectively in which the movable differential valves 19, 20, 21, 22, 23 and 24 can be moved.

From the lower seat of the valve 21 extends the conduit 25 with two branches 25a and 25b through which both cylinders C₁ and C₂ of the group G₁ are supplied with fluid respectively.

From the lower seat of the valve 22 extends the conduit 26 which has two branches and supplies both cylinders C₃ and C₄ of the group G₂ with fluid.

From the lower seat of the valve 23 extends the conduit 27 which has also two branches and supplies with fluid both cylinders C₅ and C₆ of the group G₃.

From the lower seat of the valve 24 extends the conduit 28 with two branches supplying with fluid both cylinders C₇ and C₈ of the group G₄.

Owing to this arrangement the advantage of which will be shown hereinafter the various cylinder groups are supplied with fluid independently from one another.

Furthermore, the casings of the valves 21 and 22, which insure the control of the feeding of all the cylinders of one row, are supplied with driving fluid only when the valve 19 is open, and the casings of the valves 23 and 24, which insure the control of the cylinders of the other row, are supplied with driving fluid only when the valve 20 itself is open, owing to which the play of both valves 19 and 20 permits of neutralizing each one of the cylinder rows independently from the other according to the needs.

The control of the opening and closing of the six differential valves of the valve box B it itself insured through the medium of both auxiliary distributors d₁ and d₂ which are identical, but the first of which is subjected to the action of the longitudinal compensating mechanism, as for instance by means of a driving rod 29 or the like, whilst the second is subjected to the action of the

transversal compensating mechanism, which acts by means of the rod 30.

The distributor d₁, which has the duty of insuring the longitudinal control by putting out of action either both groups G₁ and G₂ or both groups G₃ and G₄ according to the requirements, is formed itself of a block 31. A conduit 32 supplying the fluid under pressure and connected with the conduit 3 of the general distributor D leads to the block 31 from which extend:

(1°) a conduit 33 which leads to the upper part of the casings of the differential valves 22 and 23 which control the feeding of both cylinder groups G₂ and G₃;

(2°) a conduit 34, which leads to the upper part of the casings of the differential valves 21 and 24 which control the feeding of both cylinder groups G₁ and G₄, and

(3°) lastly a discharge conduit 35 which joins the outlet conduit 4 of the general distributor D.

In the said block 31 are arranged four valve needle casings 36, 37, 38 and 39 respectively, adapted for receiving four valve needles 40, 41, 42 and 43 the first two of which are mounted and linked on a control link 44, which is itself linked at 45 on the master rod 29, whilst the other two are linked on a control link 46 itself linked at 47 on the master rod 29.

Moreover, the valve needle 40 and the link 44 are subjected to the action of a compression spring 48 which rests on a fixed point 49 and constantly tends to maintain the valve needle applied against its seat in order to prevent the driving fluid arriving through the conduit 32 from flowing into the casing of the valve needle 41, and in a like manner the valve needle 42 and the link 46 are subjected to the action of a compression spring 50 which rests against a fixed stop 51 and constantly tends to apply the said valve needle onto its seat in order to prevent the driving fluid arriving through the conduit 32 from flowing into the casing of the valve needle 43.

The casing of the valve needle 41 permanently communicates with the conduit 34 and the casing of the valve needle 43 permanently communicates with the conduit 33, but since these two casings also communicate with the discharge conduit 35 so long as their respective valve needles remain in the opened position, the fluid under pressure can exert its action on the valves 21, 22, 23 and 24 of the valve box only if the rod 29 is moved sufficiently for first closing one or the other of the said valve needles 41 or 43 and for opening then either the valve needle 40 or the valve needle 42 while overcoming the force of the corresponding compression spring.

In a like manner, the auxiliary distributor d₂ which has for its duty to insure the lateral control by putting out of action either one or the other of both cylinder rows, according to the requirements, comprises a block 52. A conduit 53 for the driving fluid coming from the conduit 3 of the general distributor D leads to block 52 from which extend:

(1°) a conduit 54 which leads to the upper part of the casing of the valve 19 in order to control the feeding of both cylinder groups G₁ and G₂ of one and the same row;

(2°) a conduit 55 which leads to the upper part of the casing of the valve 20 in order to control the feeding of both cylinder groups G₃ and G₄ of the other row, and

(3°) lastly, a discharge conduit 56, which joins the outlet conduit 4 of the general distributor D.

In the said block 52 are arranged four valve needle casings 57, 58, 59 and 60 which receive

four valve needles 61, 62, 63 and 64: the first two are linked on a link 65, which is itself linked at 66 on the master rod 30, and the other two on a link 67, which is itself linked at 68 on the rod 30, the valve needle 61 and the link 65 being acted upon by a spring 69 which rests against a fixed stop 70, while the valve needle 63 and the link 67 are acted upon by a spring 71 resting against a fixed stop 72.

The casing of the valve needle 62 permanently communicates with the conduit 54 and the casing of the valve needle 64 permanently communicates with a conduit 55, but since each of these two casings also communicates with the discharge conduit 56 as long as its valve needle remains in the opened position, the fluid under pressure can exert its action on both valves 19 and 20 of the valve box only when the rod 30 is moved sufficiently for causing first the closure of one or the other of the said valve needles 62 or 64 and then the opening either of the valve needle 61 or of the valve needle 63 while overcoming the force of the corresponding compression spring.

The auxiliary mechanism adapted for insuring the longitudinal compensation comprises two vertical racks 73 and 74 integral with the bed S_2 and movable with it, one of the said racks engaging a pinion 75 capable of freely rotating about a fixed axis 76 integral with the bed S_1 , and the other of said racks engaging a pinion 77 also capable of freely rotating about a fixed axis 78 integral with the bed S_1 .

It comprises, furthermore, two horizontal double racks 79 and 80 which can slide in guides 81 and 82, respectively, on the fixed bed S_1 .

The teeth 79a of the rack 79 engage the pinion 75, and the teeth 80a of the rack 80 engage the pinion 77. Between the teeth 79b of the rack 79 and the teeth 80b of the rack 80 is arranged a pinion 83 which can freely rotate about an axis 84 mounted at one end of a yoke 85, the other end of which yoke is linked at 86 on one of the arms of a bell-crank lever 87, which lever can rock about an axis 88 integral with the bed S_1 .

At the end of the other arm of the bell-crank lever is connected the upper end of the above mentioned rod 29.

In a like manner, the auxiliary mechanism adapted for insuring the lateral compensation carries two vertical racks 89 and 90 integral with the bed S_2 and moving with it, one of the said racks engaging a pinion 91 capable of freely rotating about a fixed axis 92 integral with the fixed bed S_1 , and the other of said racks engaging a pinion 93 also capable of freely rotating about a fixed axis 94 integral with the bed S_1 .

Also, it comprises two double horizontal racks 95 and 96 which can slide in guides 97 and 98, respectively, on the fixed bed S_1 .

The teeth 95a of the rack 95 engage the pinion 91, and the teeth 96a of the rack 96 engage the pinion 93.

Between the teeth 95b of the rack 95 and the teeth 96b of the rack 96 is arranged a pinion 99 which can freely rotate about an axis 100 mounted at one of the ends of a yoke 101, the other end of which yoke is linked at 102 on one of the arms of a bell-crank lever 103, which lever can rock about an axis 104 integral with the bed S_1 .

At the end of the other arm of the said bell-crank lever is connected the end of the above mentioned rod 30.

The operation of the device is as follows:

When all the parts are in the position in which they are shown in the appended drawings, the

driving fluid arriving through the conduit 2 can pass under the valve needle 5 and from here through the conduit 3 into the valve box B.

In the latter, the driving fluid can also pass under the valves 19 and 20 and then into the space under the valves 21, 22, 23 and 24, and finally reach the eight cylinders of the press through the conduits 25, 26, 27 and 28.

Under the action of the driving fluid the movable bed S_2 is lowered and comes nearer to the fixed bed S_1 .

As long as there is no abnormal shifting between the axes of application of the resultant of the active forces and that of the passive resistances, the four racks 73, 74, 89 and 90, which follow the bed S_2 in its downward movement, are moved by exactly the same amount. The same is true for the horizontal racks 79, 80, 95 and 96 and, consequently, both pinions 83 and 99 rotate each about its own axis, without undergoing any linear displacement. The bell-crank levers 87 and 103 remain unmoved as well as the rods 29 and 30. The valve needles 40 and 42 of the auxiliary distributor d_1 and the valve needles 61 and 63 of the auxiliary distributor d_2 remain closed. The conduits 32 and 53 which lead to the said auxiliary distributors supply no driving fluid.

If, for any reason, an abnormal shifting occurs between the axes of application of the active forces and of the passive resistances acting between the beds, and if this shifting is sufficient for preventing the movable bed S_2 from moving further parallelly to itself and parallelly to the fixed bed S_1 , a certain difference appears between the respective displacements of the various racks 73, 74, 89 and 90.

In order to simplify the explanation it will be supposed first that the shifting in question is such that the movable bed S_2 of the press undergoes a certain tilting movement in the longitudinal direction as, for instance, counterclockwise, with respect to an observer looking at Figure 2, without undergoing any tilting movement in the lateral direction.

In this case, the rack 73 moves downward faster than the rack 74, and the displacement of the rack 79 from the right to the left is larger than that of the rack 80 from the left to the right.

Accordingly, the axis 84 of the pinion 83 is compelled to move from the right to the left for compensating this difference, while carrying with it the yoke 85, which obliges the bell-crank lever 87 to rock about its axis, thus causing a downward movement of the rod 29.

This downward movement leaves the valve needle 42 of the auxiliary distributor d_1 in the closed position, but it causes, first, the closure of the valve needle 41, and then, when it has reached a sufficient value, the opening of the valve needle 40.

At this moment the driving fluid which arrives through the conduit 32 can pass under the valve needle 40 and round about the valve needle 41, and then through the conduit 34 above the valves 21 and 24.

Since the section of the upper end of both these valves is larger than that of their lower end, the action of the fluid which acts on their upper face is greater than that of the fluid which acts on their lower face. Consequently, the said valves are moved against their seats and they cut off the communication between the conduit 3 supplying the driving fluid and the conduits 25 and 28 which feed both cylinder groups of the

left hand G_1 and G_4 , that is to say the cylinders C_1 , C_2 , C_7 , C_8 .

Since the latter are no longer supplied with driving fluid the axis of application of the resultant of the active pressures immediately tends to move from the left to the right in order to re-establish the desired balance.

As this movement proceeds the pinion 83 tends to return to its middle position, as well as the bell-crank lever 87 and the rod 29.

The valve needle 40 rises to its closing position again and then the valve needle 41 opens, thus putting the conduit 34 and, accordingly, the space above the valves 21 and 24 in communication with the discharge conduit 35. The valves 21 and 24 can open again in order to supply fluid to the cylinders C_1 , C_2 , C_7 and C_8 .

A tilting movement of the movable bed S_2 in the other direction would cause the rod 29 to rise and the valves 22 and 23 to close.

If it is the lateral balance which is disturbed, without the longitudinal balance being affected, it is the axis 100 of the pinion 99 which moves and causes, according to the requirements, an upward or a downward movement of the rod 30. According to the direction of the movement of the latter, an operation similar to that which has just been described causes the closure of one or the other of the two valves 19 and 20 of the valve box B. If it is the valve 19 which closes, the flow of the fluid towards the cylinders C_1 , C_2 , C_3 and C_4 of one of the cylinder rows is cut off. On the contrary, if it is the valve 20 which closes, it is the supply of fluid to the cylinders of the other cylinder row which is cut off.

Of course, two tilting movements, i. e. a longitudinal and a lateral movement, can be combined and cause then the stopping of three cylinder groups.

When the operator of the press desires to stop his machine, he needs only to move the lever 9 from the right to the left. Thus he causes the closure of the valve needle 5 and the opening of the valve needle 6. Consequently, he cuts off the supply of driving fluid and permits the fluid in the cylinders to flow back through the valve box B and the conduit 3 and to escape through the conduit 4 at the moment when the usual control device 105 for the raising of the movable bed begins to work.

Although the form of execution which has been described and shown by way of example is applicable to a press with eight compression cylinders of the type which has been described in the aforesaid Perony patent, it is obvious that a man skilled in the art would be able, without any difficulty, to make such a device applicable either to a press with another number of cylinders or to a press using cylinders of another type for the control of the beds, or finally to a press in which the flow of driving fluid to certain of the cylinders would not be controlled by the compensating mechanism.

It is also obvious that the above described compensating rack mechanisms and auxiliary distributors could be replaced by any other equivalent system without departing from the scope and spirit of the invention.

I claim:

1. In a hydraulic press having one press element movable toward another and a plurality of actuating cylinders for said movable element arranged in a plurality of series with the cylinders of each series divided into groups, means for preventing tilting of said movable element about one

axis extending between said series and about a second axis extending between said groups comprising a common source of pressure fluid for said cylinders, valve means for distributing said pressure fluid between said series, means responsive to tilting of said movable element about said one axis for actuating said valve means to cut off the supply of pressure fluid to one or the other series, additional valve means between said first valve means and each series for distributing said pressure fluid between the groups of each series, and means responsive to tilting of said movable element about said second axis for actuating said additional valve means to cut off the supply of pressure fluid to groups on one or the other side of said second axis.

2. In a hydraulic press having one press element movable toward another and a plurality of actuating cylinders for said movable element arranged in a plurality of series with the cylinders of each series divided into groups, means for preventing tilting of said movable element about one axis extending between said series and about a second axis extending between said groups comprising a common source of pressure fluid for said cylinders, conduits for conducting said pressure fluid separately to each series, a control valve in each conduit, said conduits being branched to conduct said fluid separately to each group, a supplemental control valve in each branch, means responsive to tilting of said movable element about said one axis for closing one or the other of said series control valves, and means responsive to tilting of said movable element about said second axis for closing the supplemental control valves of the groups on one or the other side of said second axis.

3. In a hydraulic press having one press element movable toward another and a plurality of actuating cylinders for said movable element arranged in a plurality of series with the cylinders of each series divided into groups, means for preventing tilting of said movable element about one axis extending between said series and about a second axis extending between said groups comprising a common source of pressure fluid for said cylinders, conduits for conducting said pressure fluid separately to each series, a control valve in each conduit, said conduits being branched to conduct said fluid separately to each group, a supplemental control valve in each branch, fluid pressure control means for selectively operating said series control valves, means responsive to tilting of said movable element about said one axis for actuating said fluid pressure control means, a second fluid pressure control means for selectively operating said supplemental control valves, and means responsive to tilting of said movable element about said second axis for actuating said second fluid pressure control means.

4. Apparatus as defined in claim 1, wherein said valve means and additional valve means are combined in a valve box having an inlet passage connected to said source and divided into two branches, said valve means controlling the distribution of pressure fluid between said branches, each of said branches leading to one of said additional valve means with separate outlets to said groups, said additional valve means each controlling the distribution of pressure fluid between its separate outlets.

5. Apparatus as defined in claim 1 wherein said valve means and additional valve means are combined in a valve box having an inlet

passage connected to said source and divided into branches one for each series, said valve means comprising a control valve in each branch, each of said branches leading to separate outlets for the groups of its series, and said additional valve means comprising a control valve for each outlet.

6. Apparatus as defined in claim 1 wherein said valve means and additional valve means are combined in a valve box having an inlet passage connected to said source and divided into branches one for each series, said valve

means comprising a control valve in each branch, each of said branches leading to separate outlets for the groups of its series, and said additional valve means comprising a control valve for each outlet, said valves being of the differential type normally maintained open by pressure fluid flowing to said cylinders, and said means responsive to tilting of the movable press element comprising means for subjecting said valves to differential fluid pressure for closing the same.

MARIUS ADRIEN MONIER.