Aug. 21, 1956 P. J. VAN BROEKHOVEN ET AL 2,759,330

HYDRAULIC COMPENSATING SYSTEM

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FIG. 1

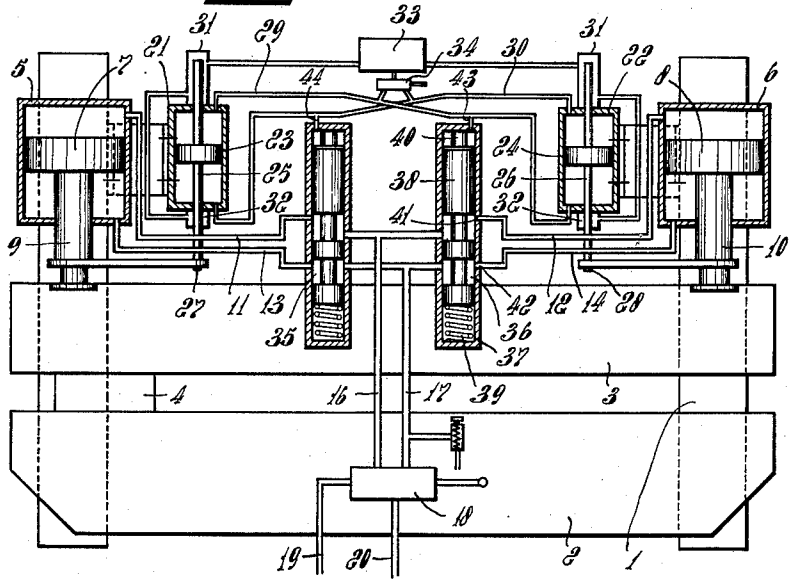
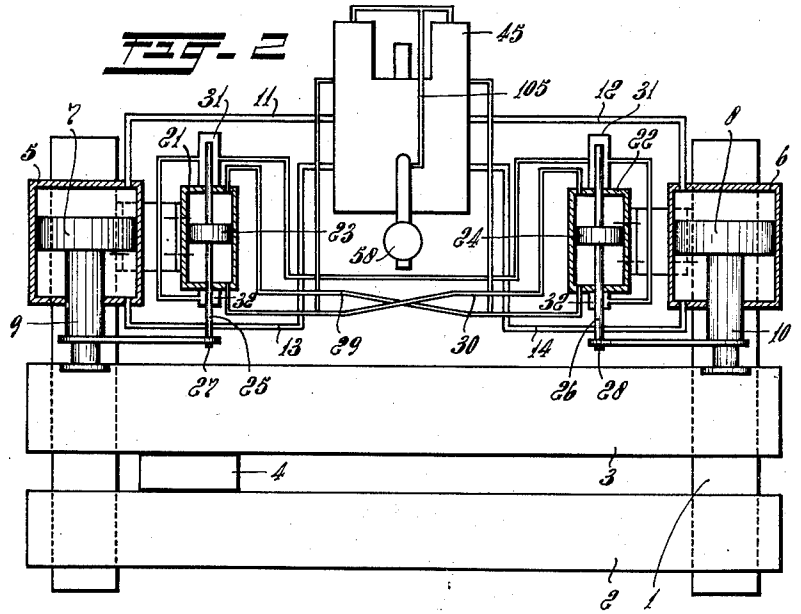


FIG. 2



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Fig. 3

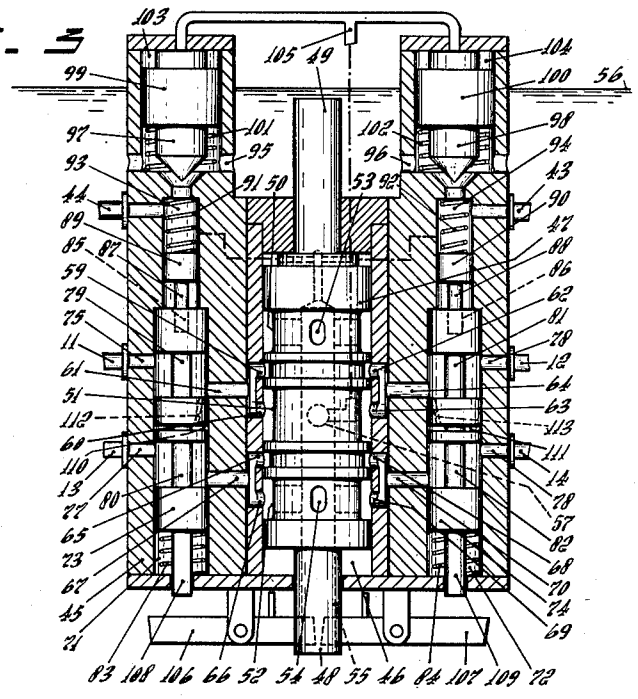


Fig. 4

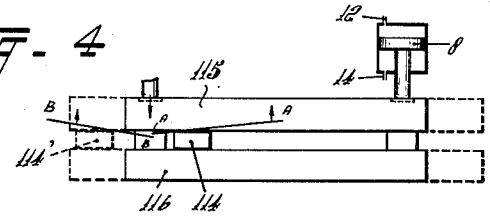
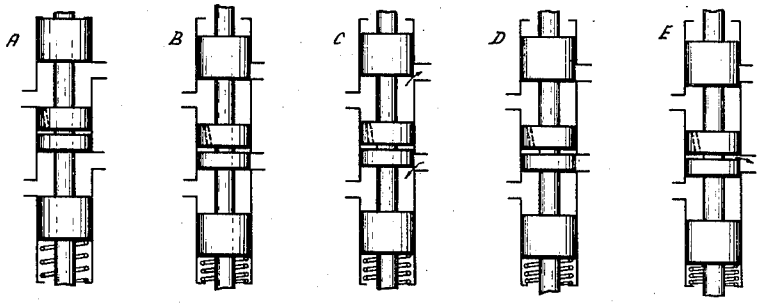


Fig. 5



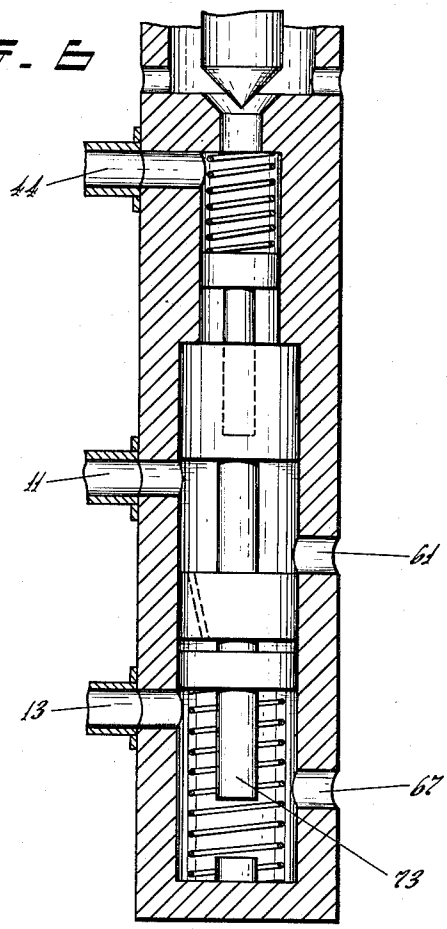
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Fig. 6



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HYDRAULIC COMPENSATING SYSTEM

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Application January 22, 1953, Serial No. 332,675

Claims priority, application Netherlands January 25, 1952

12 Claims. (Cl. 60—97)

The present invention relates to a hydraulic press and shearing device of the type comprising a frame having a table thereon and a pressing element, such as a stamp or platen, movably secured thereto, said pressing element being rigidly connected with two main pistons that are each movable in a substantially closed main cylinder secured to the frame, said main cylinder connected at its upper and at its lower ends by means of a supply line for lowering and a supply line for raising the main pistons with a source of fluid under pressure, more particularly a force pump or a reservoir which is adapted to be put into or out of communication with said supply lines by an operating member, for raising the pressure of a pressure fluid contained in the main cylinders and in the said supply lines.

With devices of this type difficulties are encountered when a workpiece to be treated is not located symmetrically with respect to the points of application of the forces exerted by the main pistons on the pressing element. In that case a force will result which urges the pressing element to a cocked position, which not only leads to an inaccurately formed workpiece but which may also cause damage to the press.

In order to obviate the above-mentioned difficulty, various constructions have already been proposed. Thus it is known to make use of an auxiliary shaft located beside the pressing element and supported in bearings in the frame, which auxiliary shaft is connected with the pressing element by hinged arms. If the pressing element should tend to assume a cocked position, the unequal displacement of said element is transferred to said auxiliary shaft which is then subjected to torsion. For this solution to be effective the said auxiliary shaft must be very thick, which naturally entails great drawbacks.

According to another solution each of the main cylinders has an auxiliary cylinder secured thereto, within which an auxiliary piston which is rigidly connected with the main piston of the associated main cylinder, is movable, the upper and lower portions of said auxiliary cylinders being interconnected by cross conduits in such a manner that at all times an upper portion of one auxiliary cylinder is connected with a lower portion of the other auxiliary cylinder. The object of this last-named arrangement is that each auxiliary cylinder can only move if and in so far as the other auxiliary cylinder is moved simultaneously.

Yet the operation of this device is not perfect either, in the first place because the fluid conduits are susceptible to a certain expansion and secondly because every pressure fluid is somewhat compressible. In addition there will always be a certain amount of leakage of the pressure fluid past the packings in every type of sealing means, which also gives rise to inaccuracies.

The present invention relates to a device of the last-named type which is provided with auxiliary appliances in order to eliminate the drawbacks just discussed. To that end the device of the type described is so arranged according to the invention that the supply line for lowering and the supply line for raising each main piston contain a double regulating valve adapted to be moved in opposition to a spring means, which valve permits the fluid in both lines to pass therethrough when it is in its inoperative position and which is adapted to be moved out of said inoperative position by means of an actuating plunger located in a plunger cylinder, the interior of which cylinder is connected by a fluid conduit with the lower part of the auxiliary cylinder associated with the respective main cylinder. According to the invention each regulating valve and the associated actuating plunger may be formed as one piece, the plunger cylinder being extended and forming the housing for said regulating valve.

According to another feature of the invention each actuating plunger may be urged against the regulating valve by spring means, but may be adapted to be moved away from said regulating valve in opposition to said spring means. Another feature of the invention is that each cross conduit may be connected by a conduit and an equalization valve comprising a housing and a plunger with a pressure fluid reservoir, the interior of said equalization valve housing communicating with the source of pressure and said plunger being kept in or urged towards its opened position by spring means. According to the invention it is also possible for the passage in each equalization valve to be in direct communication with the interior of the cylnder of the associated actuating plunger. Moreover it is possible according to the invention that a common casing is arranged in the fluid reservoir so as to be submerged, the operating member, the regulating valves, the actuating plungers and the equalization valves being housed in said casing.

Still another feature of the invention is that the operating member may comprise a cylindrical bore in the said common casing and a cylindrical operating plunger slidable in said bore, said operating plunger being provided with three annular grooves that are interspaced in an axial direction, each of said grooves forming a displaceable annular chamber, the middle chamber of which is in communication with the source of pressure, admitting of being aligned with either a set of single or multiple inlet ports of the regulating valves leading to the supply lines for lowering the main pistons, or with a second set of single or multiple inlet ports leading to the supply lines of raising the main pistons, the arrangement being such that in each position one of the outer chambers which are each in permanent communication with the fluid reservoir, is aligned with the other set of inlet ports.

According to the invention the operating plunger may be provided with a longitudinal bore which is in open communication with the fluid reservoir and which in addition is connected with each of the outer chambers via transverse bores.

It is also possible according to the invention to construct a device in which each regulating valve is equipped with a plunger consisting of two axially spaced parts, said plunger being adapted to slide in a bore for said regulating plunger, in which bore the inlet ports for the supply lines for respectively lowering and raising the main pistons as well as the outlet ports for said lines end, each outlet port being so spaced relatively to the associated inlet port that upon a displacement of the double plunger, each of the two outlet ports are first simultaneously closed by a part of the plunger in such a manner that the bores for the regulating plungers are located at equal distances from the bore for the operating plunger in the common casing, the axes of the three bores being parallel. Furthermore it is possible according to the invention to provide each regulating valve with a blocking member that is movable under the influence of the operating plunger, while when the operating plunger is in the position in which the supply lines for

raising the main pistons communicate with the source of pressure, each regulating plunger is blocked by its associated blocking member in the position in which said regulating plunger permits fluid to pass.

It is also possible according to the invention to construct a device in which the plunger part of each regulating valve adapted to close the outlet port of the supply line for raising the main piston is in its inoperative position located in the bore for the regulating plunger between the inlet port of the supply line for lowering the main piston on the one hand and the outlet port of the supply line for raising the main piston on the other hand in such a manner that said plunger part is provided with an annular groove which by means of a passage is connected with the one side of the said plunger part and which is located at a distance in the axial direction from the other side of said plunger part, said distance being at least equal to the axial dimension of the outlet port of the supply line for raising the main piston.

Finally a change-over device may be provided according to the invention in order to enable the regulating valves to be functionally interchanged.

In order to elucidate the invention two embodiments of the press and shearing device will be described with reference to the accompanying drawings.

In these drawings:

Fig. 1 is a schematic showing of a first embodiment of the press and shearing device;

Fig. 2 is a diagrammatic showing of a second embodiment of the device;

Fig. 3 shows on a larger scale a part of Figure 2;

Fig. 4 diagrammatically shows a table and platen having a workpiece arranged between them;

Fig. 5 shows a plurality of positions of a regulating valve;

Fig. 6 shows a modified embodiment of the regulating valves.

To a frame **1** a table **2** is stationarily secured, while a pressing element **3** is movable relatively to the table **2** in order to enable a workpiece **4** to be deformed by exerting pressure thereon. Furthermore, main cylinders **5** and **6** are secured to the frame **1**, within which cylinders main pistons **7** and **8** are provided. Said main pistons **7** and **8** are rigidly connected with the pressing element **3** by means of main piston rods **9** and **10**. To the upper portions of the cylinders **5** and **6**, supply lines **11** and **12** for lowering the main pistons are connected, while to the lower portions of said cylinders supply lines **13** and **14** for raising the main pistons are connected. The cylinders **5** and **6** as well as the lines **11–14** are filled with a pressure fluid, such, for example, as oil. The pressing element **3** can be lowered and raised, respectively, by putting the oil under pressure in the lines **11** and **12** and **13** and **14**, respectively. For that purpose the supply lines **11**, **12** and **13**, **14**, respectively, can be brought into communication with main conduits **19** and **20** by collecting conduits **16** and **17**, respectively, as well as via an operating member **18**, which main conduits **19** and **20** lead, for example, to a force pump or a pressure reservoir not shown.

When the workpiece, such as the workpiece **4** shown, is located asymmetrically relative to the main piston rods **9** and **10**, the pressing element **3** will tend to assume a cocked position, in which case, according to the drawing, the right hand portion of the pressing element **3** will be lower than the left hand portion which is arrested.

In order to counteract this tendency, auxiliary cylinders **21** and **22** with appurtenances are provided, which auxiliary cylinders are rigidly secured to the main cylinders **5** and **6**. In the auxiliary cylinders **21** and **22** auxiliary pistons **23** and **24** are located, to which auxiliary piston rods **25** and **26** are secured. These auxiliary piston rods **25** and **26** pass through the ends of the cylinders **21** and **22** and are rigidly connected at **27** and **28** to the main piston rods **9** and **10**. The upper portion of the cylinder **21** is connected with the lower portion of the cylinder **22** by a cross conduit **29**, the lower portion of the cylinder **23** being connected with the upper portion of the cylinder **22** by another cross conduit **30**. The cylinders **21** and **22** are identical to each other. If, for example, the pressing element **3** moves downwardly, the auxiliary piston rods **25** and **26** and consequently the auxiliary pistons **23** and **24** will also move downwardly.

If, for example, the auxiliary piston **23** is to be moved downwardly over a certain distance, the pressure fluid which is then forced out of the lower portion of the cylinder **21** should be received in the upper portion of the cylinder **22**. This is only possible if the auxiliary piston **24** moves over the same distance as the auxiliary piston **23**. It stands to reason that there is a similar relation between the pressure fluid in the lower portion of the cylinder **22** and the upper portion of the cylinder **21**. It should be noted that in connection with the fact that pressures above and below normal may occur in the cylinders **21** and **22**, the passages of the auxiliary piston rods **25** and **26** through the covers of the cylinders **21** and **22** are sealed and are in addition surrounded by oil chambers **31** and **32**. These oil chambers are interconnected and communicate with an oil reservoir **33**. This reservoir **33**, moreover, can be brought into communication with the cross conduits **29** and **30** via a valve **34**, and via said cross conduits this reservoir can be brought into communication with the interior of the cylinders **21** and **22**.

The valve **34** is opened only when the pressing element **3** is in its highest position and in that position the pressing element **3** itself actuates the valve in a manner not shown. The purpose of this last-named arrangement is to prevent the oil in the cylinders **21** and **22** from having a value which differs from the normal value. If, for example, this oil would get heated and expand under the influence of friction, the excess of oil will flow from the auxiliary cylinders **21** and **22** towards the reservoir **33** as soon as the pressing element **3** again comes to its highest position.

Though the arrangement described hereinbefore generally causes the pressing element to move up and down in a perfectly vertical direction, small inaccuracies may nevertheless occur, which may result from the fact that the pressure fluid is not completely incompressible, as well as from the fact that the cross conduits **29** and **30** may show a certain amount of expansion when the internal pressure is increased. According to the invention, therefore, a correcting arrangement is provided which will now be described.

In the lines **11**, **13** and **12**, **14**, respectively, of the cylinders **5** and **6**, respectively, double valves are provided, which are generally designated by **35** and **36**. Each of these valves comprises a cylinder **37** within which a plunger **38** is located. Each said plunger **38** is urged upwardly by a spring **39**, the plunger bearing against the upper cover of the cylinder **37** through an abutment **40**. Each plunger **38** is reduced in diameter in two places, the reduced portions forming a passage for the fluid in the supply lines **11** and **13** or **12** and **14** when the plunger is in its highest position. If, however, the right-hand plunger **38** should be moved downwardly out of the position shown, the ports **41** and **42** communicating with the lines **12** and **14**, respectively, are closed by the normal diameter portions of the plunger **38**. In this connection it should be noted that the ports **41** and **42** have their large dimension circumferentially of the cylinder and their small dimension along the cylinder, so that they will be closed even when the plunger **38** is displaced downwardly over a small distance. The portion of the cylinder **37** located above the plunger **38** communicates via a conduit **43** with the cross conduit **29** and thus with the upper portion and the

lower portion, respectively of the cylinders **21** and **22**, respectively.

It should also be noted that the internal diameter of the cylinders **21** and **22** is large as compared with the diameter of the cylinders **37**. If for any reason the regulating action of the cylinders **21** and **22** should not be able to prevent the pressing element **3** from assuming a slightly cocked position, e. g., a position in which the right hand part of said element is downwardly inclined, this will increase the pressure in the cross conduit **29** because of an increase in pressure in the portions of the cylinders **21** and **22** connected therewith. This increased pressure will then likewise act in the upper portion of the right-hand cylinder **37** (Fig. 1) and as a result the right-hand plunger **38** will be forced downwardly, a small amount of oil flowing to the cylinder **37** then. The lines **12** and **14** are closed then, so that the main piston **8** is no longer subject to increased pressure. On the pressing element **3** an increasing force is then temporarily exerted by the main piston **7** only, so that the pressing element **3** will again move toward a straight position. The over-pressure in the cross conduit **29** will disappear then, so that the right-hand plunger **38** will return in its inoperative position. The lines **12** and **14** are then open again, so that a simultaneous further movement of the pistons **7** and **8** will result. It stands to reason that there is a perfectly identical relation between the operation of the cylinder **5** and the valve **35**. Seeing that even a small displacement of the pistons **23** and **24** will result in a large displacement of the plunger **38**, while in addition the ports **41** and **42** are closed even when the displacement of the plunger **38** is small, it will be clear that the correcting action of the valves **35** and **36** is very accurate and sensitive.

Figure 2 shows another embodiment which presents further advantages over the embodiment according to Figure 1 as described hereinbefore. In the first place this second embodiment differs in that in a body **45** a plurality of means are united. This body **45** is shown in detail in Figure 3. In a central bore **46** an operating plunger **47** is located. On the one side said plunger **47** ends in stud **48** projecting beyond the body **45**, while the other end of said plunger consists of a projecting operating rod **49**, by means of which rod the entire device is operated. The operating plunger **47** is reduced in diameter at **50**, **51** and **52** over a certain length, so that between the plunger **47** and the central bore **46** three annular chambers are formed. The reduced portions **50** and **52** communicate via openings **53** and **54** with a longitudinal bore **55** in the operating plunger **47**. This longitudinal bore **55** is in open communication with the space around the body **45**. In this connection it should be observed that the entire body **45** is accommodated in an oil reservoir (not shown), the level of which is shown by the line **56**. The two annular chambers surrounding the portions **50** and **52**, therefore, are always in open communication with the oil reservoir. In the casing **45** a passage **57** is provided which outside the casing **45** is connected to a conduit leading to a force pump **58**. The middle annular chamber, therefore, is always in direct communication with the condiut of the force pump.

In the wall of the bore **46** a plurality of openings are provided, which lead to regulating valves likewise housed in the casing **45**; the openings **59** and **60** lead to an inlet port **61** which is in communication with the supply line **11** for lowering the main piston **7**, openings **62** and **63** lead to an inlet port **64** which is in communication with the supply line **12** for lowering the main piston **8**; openings **65** and **66** lead to an inlet port **67** which is in communication with the supply line **13** for raising the main piston **7**; openings **68** and **69** lead to an inlet port **70** which is in communication with the supply line **14** for raising the main piston **8**.

If the operating plunger **47** is in its highest position,

as shown in Figure 3, the inlet ports **61** and **64** are in communication with the force pump **58**, while the inlet ports **67** and **70** are in communication with the oil reservoir. If, on the other hand, the operating plunger **47** is in its lowest position the situation with regard to the inlet ports is exactly the reverse.

The inlet ports **61**, **64**, **67** and **70**, which are of multiple design, lead to regulating plunger bores **71** and **72**, in which regulating plungers **73** and **74** are located. Outlet ports **75** and **76** are connected with the supply lines **11** and **12**, respectively, for lowering the main pistons, while outlet ports **77** and **78** are connected with the supply lines **13** and **14**, respectively, for raising the main piston.

Each of the regulating plungers **73** and **74** is reduced in diameter in two places, the plunger **73** at **79** and **80** and the plunger **74** at **81** and **82**. Each plunger, therefore, comprises three plunger portions, the uppermost portions of which are adapted to close the passages to the supply lines for lowering the main pistons, while the middle portions are adapted to close the passages to the supply lines for raising the main pistons.

In the position of the regulating plungers as shown all the passages are open, the regulating plungers being kept in said position under the influence of springs **83** and **84**. In the top portions of the regulating plungers recesses **85** and **86** are provided. In said recesses the stems **87** and **88**, respectively, of actuating plungers **89** and **90**, respectively, are accommodated. Said actuating plungers have their stems **87** and **88** urged into the recesses **85** and **86** by springs **91** and **92**. Above each actuating plunger there are spaces **93** and **94**, respectively, which spaces communicate with the conduits **44** and **43**, respectively, which lead to the cross conduits **30** and **29**, respectively. The spaces **93** and **94** respectively are, in addition, connected with openings **95** and **96**, respectively, which are in open communication with the oil reservoir. The passages to said openings **95** and **96** can be closed by equalization valves **97** and **98**, which valves are adapted to be actuated by plungers **99** and **100**. The plungers **99** and **100** are kept in the open position by springs **101** and **102**. Above the plungers **99** and **100** spaces **103** and **104** are located, which spaces communicate with a conduit **105** leading to the force pump **58**.

To the lower side of the casing **45** two levers **106** and **107** are pivoted, which are adapted to be moved by the stud **48**. Said stud has its lower side provided with a notch in which the levers **106** and **107** are located. If the stud **48** moves downwardly the free ends of the levers **106** and **107** move upwardly, and these free ends will then bear against the ends **108** and **109** of the regulating plungers **73** and **74**. Said regulating plungers cannot be moved downwardly then, so that said regulating plungers are blocked in the position in which they permit the pressure fluid to pass.

In conclusion it should be stated concerning the regulating valves that the central portions of the regulating plungers **73** and **74** are provided with grooves **110** and **111**, with which passages **112** and **113** communicate.

As regards the operation of the device of Figs. 2 and 3 the following should be mentioned:

If during a downward movement of the pressing element **3** e. g. the right hand side (Figure 2) of the pressing element assumes a position in which it is lower than the left hand side, the right hand regulating plunger **74** will be moved downwardly in the same manner as was described hereinbefore, so that the supply line **12** for lowering the main piston **8** and the supply line **14** for raising the main piston **8** will be closed as a result of an increased pressure in the space **94**, which pressure will make itself felt on the actuating plunger **90**.

In this connection the function of the equalization valves **97** and **98** should be noted. So long as the force pump **58** supplies a pressure which is smaller than a certain minimum pressure determined by the springs **101**

and 102, the plungers 99 and 100 will be in the highest position as shown in Figure 3. The interior of the auxiliary cylinders 21 and 22 then communicate with the oil reservoir via the cross conduits 29 and 30, the conduits 43 and 44, the spaces 94 and 93 and the openings 96 and 95. A possible shortage or excess of oil of the auxiliary cylinders 21 and 22, therefore, is equalized each time.

If, however, the pressure of the pump becomes larger than the said minimum pressure, the valves 97 and 98 will be closed. Thereupon the auxiliary cylinders communicate only with the spaces 93 and 94, so that the regulating plungers 73 and 74 can then become operative. Supposing that this is indeed the case with the right hand regulating plunger 74, this means that the oil in the auxiliary cylinder 22 below the auxiliary piston 24 has reached a certain pressure which is above normal (as a result of the fact that the main piston 8 is in a lower position than the main piston 7). This, however, also means that the oil above the auxiliary piston 24 at the same time has a pressure below normal. Seeing that such pressure below normal would prevent the auxiliary piston 24 from moving downwardly and this move regulating plunger 74, this should be obviated. Now this is possible because the actuating plungers 89 and 90 are adapted to be moved away from the regulating plungers 73 and 74 respectively in opposition to the springs 91 and 92.

In the last-named case the low pressure above the auxiliary piston 24 would result in the actuating plunger 89 moving upwardly, whereby the said low pressure is removed. The high pressure below the auxiliary piston 24 can then make itself felt in the space 94, so that the regulating plunger 74 will move downwardly with the result, as desired, that the supply line 12 for lowering and the supply line 14 for raising the main piston 8 will be closed.

During the lifting of the pressing element 3 there will generally be no occasion for said element to tip up to one side. In this connection it should be pointed out that the regulating valves, as described and shown, should not come into operation during the lifting of the pressing element, because their effect would then be exactly the reverse of what is intended. If nevertheless very slight deviations should occur during the lifting of the pressing element the bias of the springs 83 and 84 is sufficiently large to prevent the regulating valves from coming into operation.

In order to be on the safe side it is possible according to another more drastic solution to block the regulating valves during the lifting. This can be effected by the levers 106 and 107 in the manner already described, which levers keep the regulating plungers 73 and 74 in their upward position when the operating plunger 47 is in its lowest position.

This blocking may also be effected by closing the bottom of the regulating plunger bores 71 and 72 and by shortening the regulating plungers 73 and 74, as shown in Fig. 6 as an alternative, so that the oil pressure required for lifting the pressing element 3 will also press the regulating plungers 73 and 74 upwardly during the lifting of said pressing element.

Instead of shortening the regulating plungers it is also possible to provide the lowermost full regulating plunger portions with axial fluid passages.

If such large deviations from the horizontal position of the pressing element are to be feared that a correction is necessary, other embodiments, not shown, come into consideration, according to which embodiments the regulating valves have their functions interchanged under the influence of a change-over device, so that their effect is then correct again.

There will now be described in greater detail the operation of the regulating valves in connection with Figures 4 and 5.

The Figures 5A and 5B (in Figure 5 the right-hand regulating valve according to Figure 3 is shown) relate to situations which already have been discussed hereinbefore; Figure 5A shows the inoperative position of the regulating plunger 74, in which position the supply line 12 for lowering and the supply line 14 for raising the main piston 8 are in open communication with the force pump and the oil reservoir, respectively; Figure 5B shows the position in which both the supply line 12 and the supply line 14 are entirely closed.

If, however, the position 5B is reached, it depends on the circumstances what will happen next. In this connection reference is also made to Figure 4. Let is be assumed in the first place that a workpiece 114 is located between a pressing element 115 and a table 116. Let it furthermore be assumed that the supply line 12 and the supply line 14 are already closed (in accordance with Figure 5B). The upwardly directed reaction pressure of the right-hand portion of the pressing element 115 is taken up then by the oil located above the main piston 8. The pressing element 115 then tends to assume a position exaggeratedly shown by the line A—A. If the pressing element 115 would indeed move in said direction this would result in the regulating plunger 74 also moving slightly upwards (Figure 5C). As soon as this happens the supply line 12 will again receive some oil under high pressure, so that the cushion of oil above the main piston 8 is slightly replenished in such a manner that the pressing element 115 is forced back into the horizontal position.

If, on the other hand, the pressing element and the table extend on both sides of the main piston rods, as shown in dotted lines in Figure 4 and if a workpiece 114' is located between these extensions an entirely different action takes place. Again the entirely closed position 5D (corresponding with the position 5B) is the starting position. If now the piston 7 continues exerting pressure, while the main cylinder 6 is closed, the pressing element 115 will try and assume a position according to a line B—B because of the reaction force.

This means that the main piston 8 will try and move downwardly. If this should happen the regulating plunger 74 will likewise move slightly further downwardly, so that the groove 111 will be aligned with the outlet port 78. As a result the space below the main piston 8 will be supplied with oil under pressure via the passage 113, the groove 111, the outlet port 78 and the supply line 14 for raising said main piston. The pressing element 115, therefore, is again returned to its horizontal position.

It will be clear that both in the one and in the other case the movement of the regulating plunger is a floating one, so that in this fully automatical manner a very accurate horizontal adjustment of the pressing element is obtained.

We claim:

1. A hydraulic compensating system for moving a body comprising two main pistons for moving said body, two substantially closed main cylinders within which said main pistons move, a source of fluid pressure, supply lines connecting said source of pressure to the upper and lower ends of said main cylinders, an operating member in said supply lines between said pressure source and said main cylinders to place said cylinders into or out of connection with said pressure source, a pair of auxiliary cylinders secured one to each of said main cylinders, a pair of auxiliary pistons rigidly connected one to each of said main pistons and movable in each of said auxiliary cylinders, cross conduits connecting the upper portions of each of said auxiliary cylinders with the lower portions of the other of said auxiliary cylinders, a pair of double regulating valves, one in each pair of supply lines connecting the upper and lower ends of said main cylinders to said source of pressure, said valves being positioned to permit fluid to pass through said supply lines when said valves are in the inoperative position, spring means opposing movement of said valves, plunger cylinders ad-

jacent said valves, actuating plungers movable in said cylinders to move said valves, fluid conduits connecting said plunger cylinders to the lower part of the auxiliary cylinders associated with the main cylinders in the supply lines in which the respective valves and actuating plungers are located.

2. A system as claimed in claim 1 in which the regulating valve and the associated actuating plunger are formed in one, the plunger cylinder being extended and forming the housing for said regulating valve.

3. A system as claimed in claim 2 in which the actuating plunger is kept urged against the regulating valve by spring means, but is adapted to be moved away from said regulating valve in opposition to said spring means.

4. A system as claimed in claim 3 having an equalization valve comprising a housing and a plunger, each cross conduit being connected with a pressure fluid reservoir by a fluid conduit through said equalization valve, the interior of said equalization valve housing communicating with the source of pressure, and spring means urging said plunger towards its opened position.

5. A system as claimed in claim 4 in which each equalization valve is in direct communication with the interior of the cylinder of the associated actuating plunger.

6. A system as claimed in claim 5 having a common casing submerged in the fluid reservoir, the operating member, the regulating valves, the actuating plungers and the equilization valves being housed in said casing.

7. A system as claimed in claim 6 in which said operating member comprises a cylindrical bore in the said common casing and a cylindrical operating plunger slidable in said bore, said operating plunger having three annular grooves that are interspaced in an axial direction, each of said grooves forming a displaceable annular chamber, the middle chamber which is in communication with the source of pressure, admitting of being brought either before a set of single or multiple inlet ports of the regulating valves leading to the supply lines for lowering the main pistons, or before a second set of single or multiple inlet ports leading to the supply lines for raising the main pistons, the arrangement being such that each time one of the outer chambers, which are each in permanent communication with the fluid reservoir, is located before the other set of inlet ports.

8. A system as claimed in claim 7 in which said operating plunger is provided with a longitudinal bore which is in open communication with the fluid reservoir and which in addition is connected with each of the outer chambers via transverse bores.

9. A system as claimed in claim 8 in which each regulating valve comprises a plunger consisting of two axially spaced parts, said plunger being adapted to slide in a bore, said bore having inlet ports for the supply lines for lowering and raising the main pistons, respectively, as well as outlet ports for said lines, each outlet port being so spaced relatively to the associated inlet port that upon a displacement of said two part plunger, first each of the two outlet ports are simultaneously closed by a part of the plunger, said bores for the regulating plungers being located at equal distances on either side of the bore for the operating plunger in the common casing, the axes of the three bores being parallel.

10. A system as claimed in claim 9 in which each regulating valve is provided with a blocking member that is movable under the influence of the operating plunger such that when the operating plunger is in the position in which the supply lines for raising the main pistons communicate with the source of pressure, each regulating plunger is blocked by its associated blocking member in the position in which said regulating plunger permits fluid to pass.

11. A system as claimed in claim 10 in which the plunger part of each regulating valve adapted to close the outlet port of the supply line for raising the main piston is provided with an annular groove and a passage connecting one side of the said plunger part with the other, said groove being located at a distance from the other side of said plunger part, a distance at least equal to the axial dimension of the outlet port of the supply line for raising the main piston.

12. A system as claimed in claim 1 in which the interior of each plunger cylinder is connected via fluid conduits with the lower side of each auxiliary cylinder, which fluid conduits comprise a multi-way valve which in its one position leaves free passages for connecting the first and the second plunger cylinder, respectively, with the lower sides of the first and the second auxiliary cylinder, respectively, and in its other position leaves free passages for connecting the first and the second plunger cylinder, respectively, with the lower side of the second and the first auxiliary cylinder.

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