Jan. 20, 1942. E. DAVIS 2,270,668

HYDRAULIC CHECK

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FIG. 1

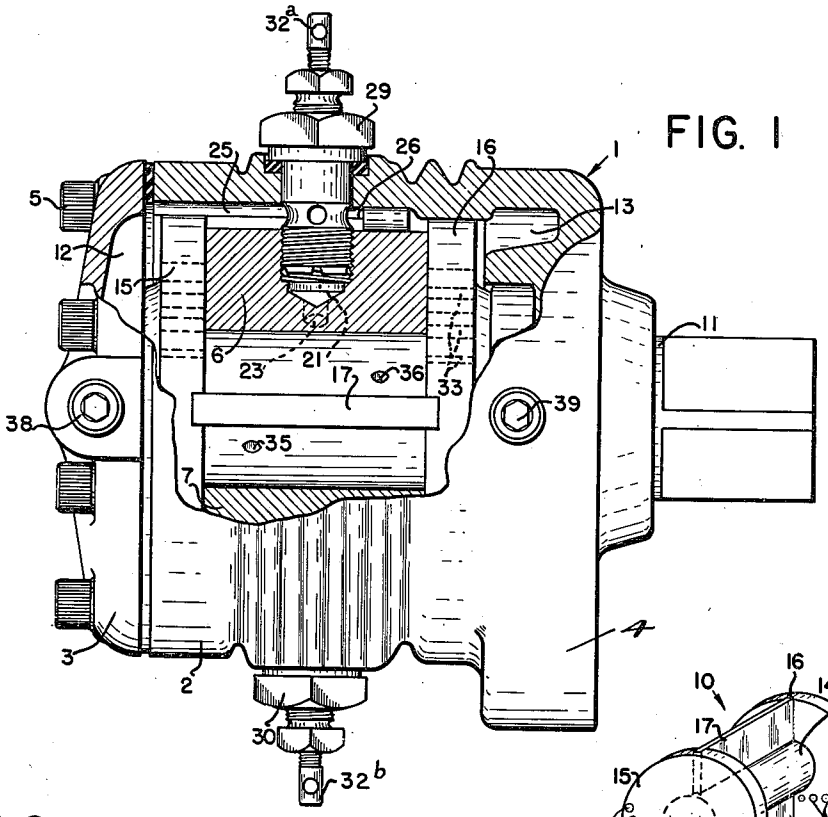
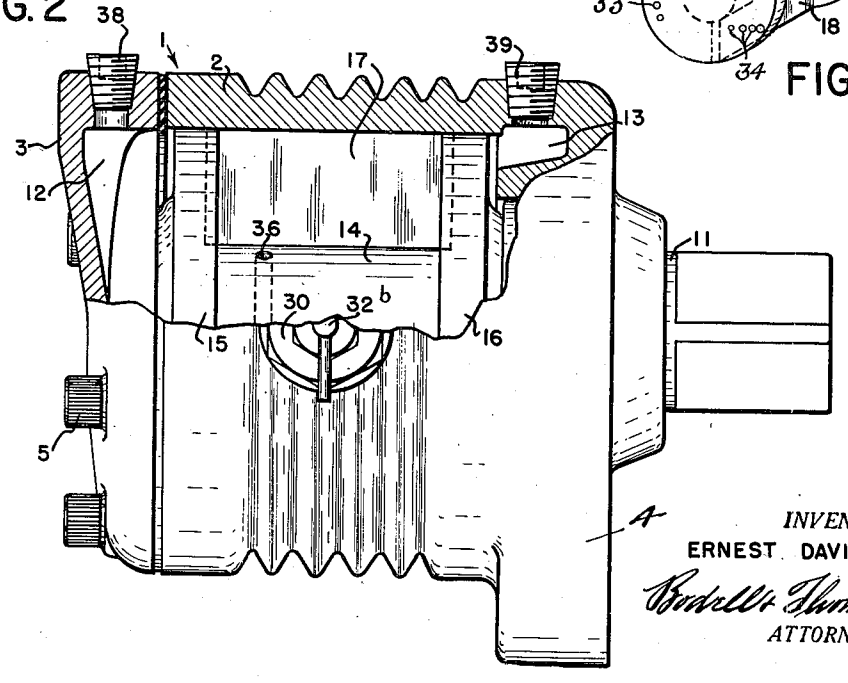


FIG. 2



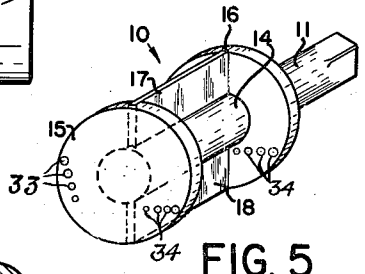


FIG. 5

INVENTOR.
ERNEST DAVIS
Bordell & Thompson
ATTORNEYS.

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HYDRAULIC CHECK

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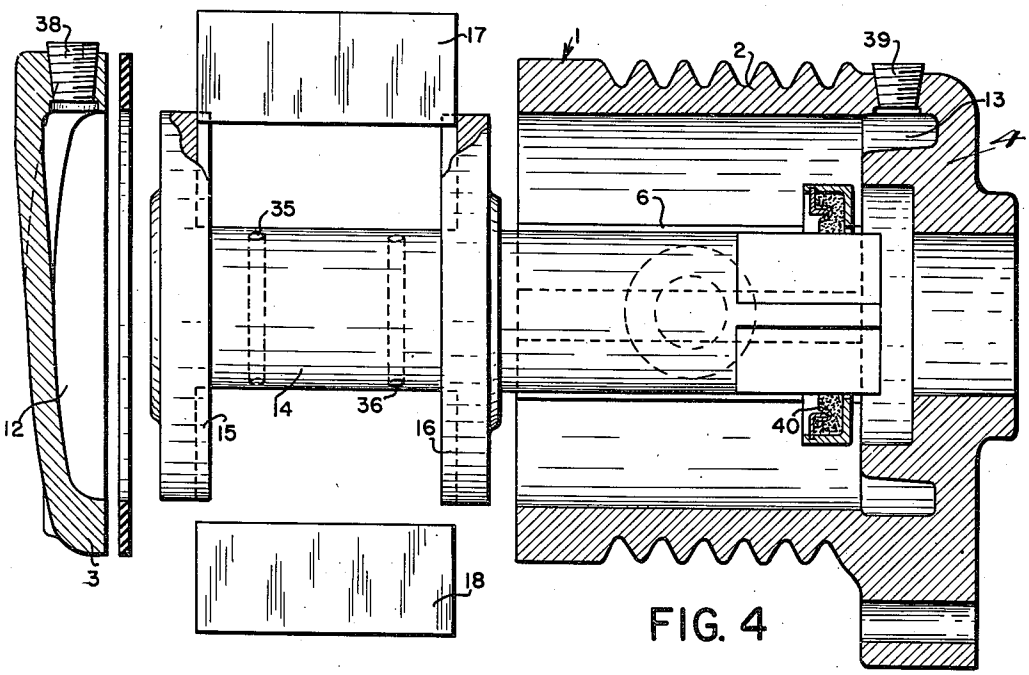
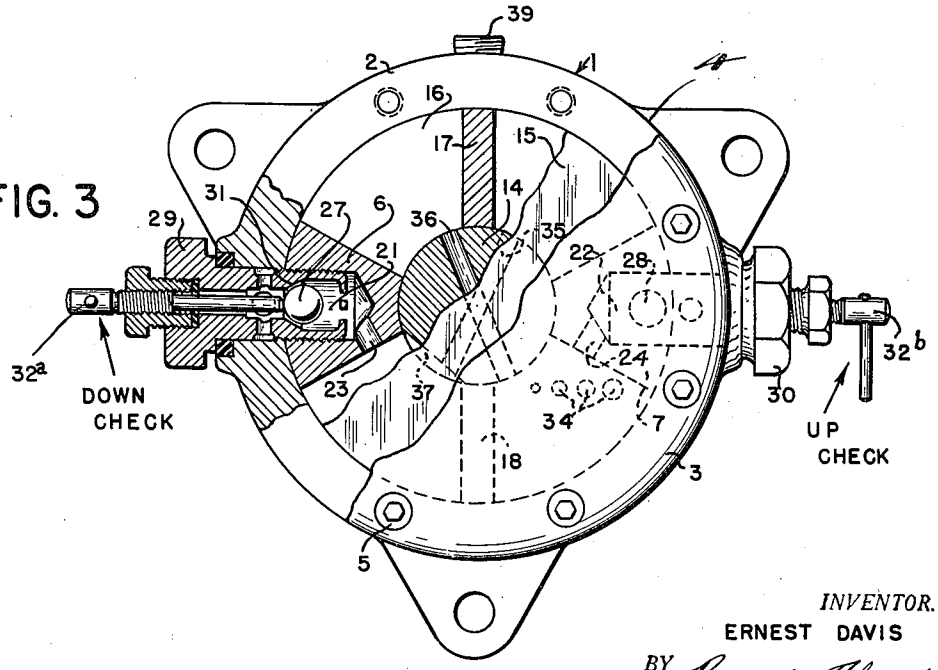


FIG. 4

FIG. 3



INVENTOR.
ERNEST DAVIS
BY Bodell & Thompson.
ATTORNEYS.

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FIG. 6

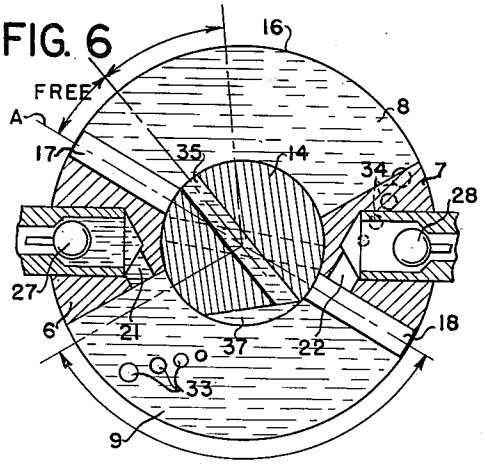


FIG. 10

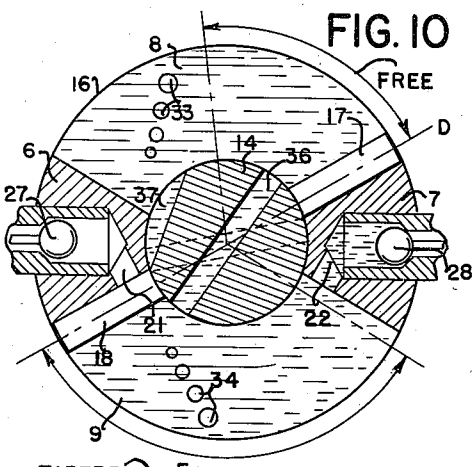


FIG. 7

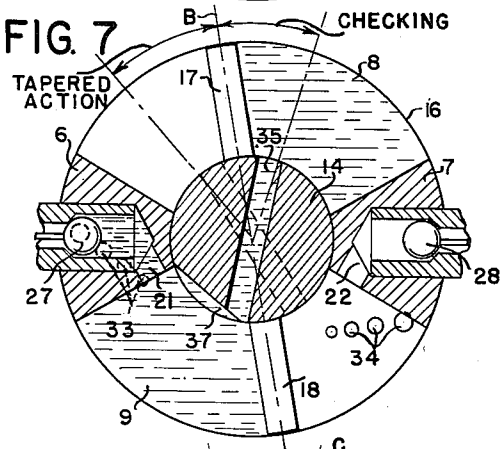


FIG. 11

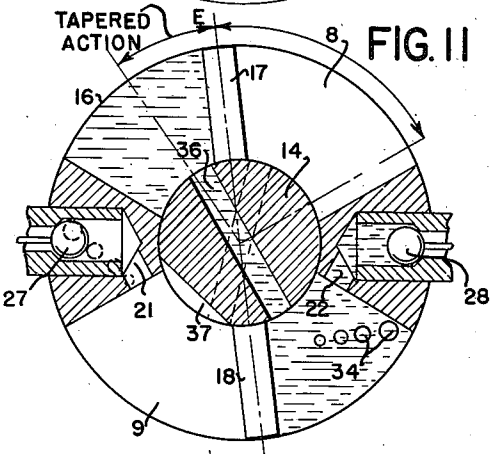


FIG. 8

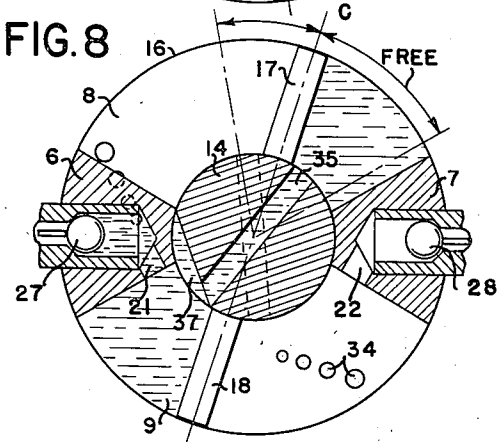
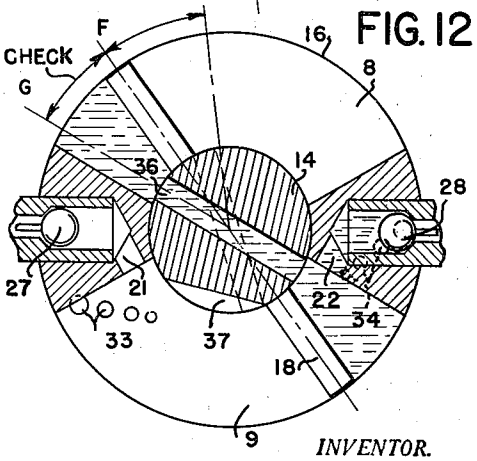


FIG. 12



INVENTOR.
ERNEST DAVIS
BY Bodell & Thompson
ATTORNEYS.

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HYDRAULIC CHECK

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FIG. 9

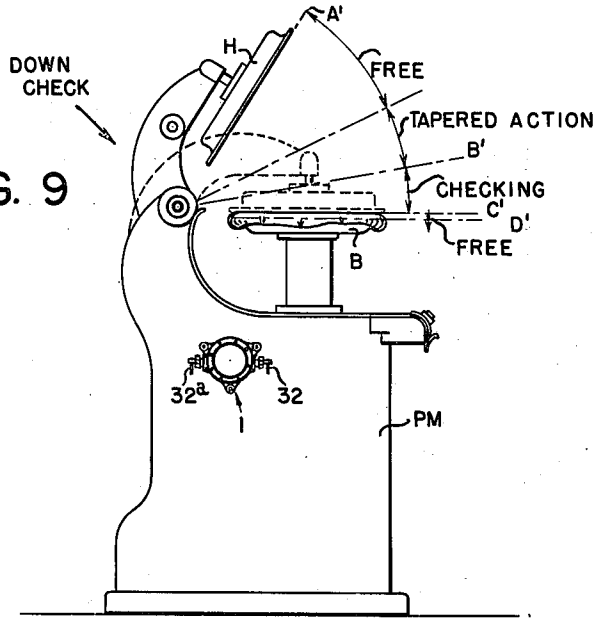
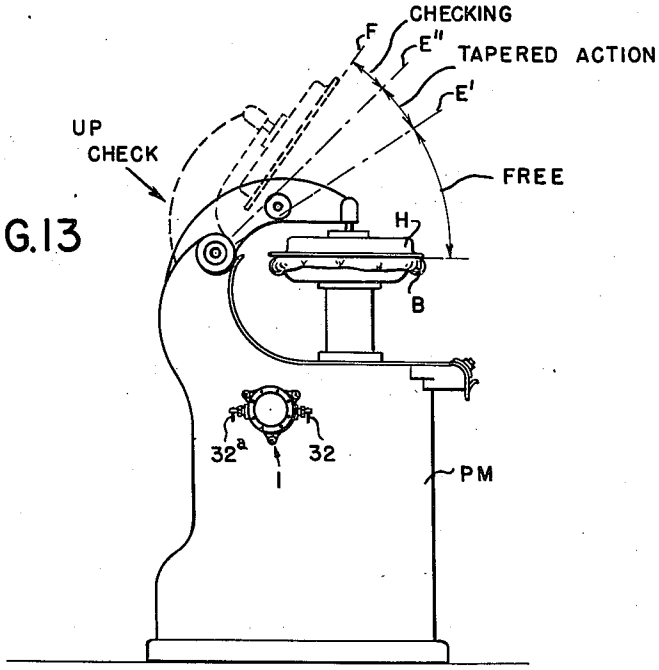


FIG. 13



INVENTOR.
ERNEST DAVIS
BY Bodell & Thompson.
ATTORNEYS.

Patented Jan. 20, 1942

2,270,668

UNITED STATES PATENT OFFICE

2,270,668

HYDRAULIC CHECK

Ernest Davis, Syracuse, N. Y.

Application May 28, 1940, Serial No. 337,670

15 Claims. (Cl. 188—93)

The invention relates to hydraulic checks, governors or movement controlling devices, and has for its general object a check of the vane type by which the checking effect can be accurately adjusted for the situation in which the check is installed.

It further has for its object an equalizing passage connecting the pressure spaces in front of the advance side of the vanes and extending through the piston, so that the checking movement is more accurately adjustable to the control of an adjustable valve in the outlet or fluid transfer port.

It further has for its object a check which is assembled by sleeving the body over the piston member including its vanes.

It further has for its object a piston member in the general form of a spool and with vanes located between the heads of the spool and extending to the axle or hub of the spool, with the heads of the spool having passages opening into end chambers in the body and with the valves, which are adjustable, to control the checking effect in opposite directions located in inwardly extending abutments in the body which divide the interior of the body into piston chambers in which the vanes work respectively.

Other objects will appear throughout the specification.

The invention consists in the novel features and in the combinations and constructions hereinafter set forth and claimed.

In describing this invention, reference is had to the accompanying drawings in which like characters designate corresponding parts in all the views.

Figure 1 is a side elevation, partly in section, of this hydraulic check.

Figure 2 is a similar elevation, partly broken away, looking upwardly in Figure 1.

Figure 3 is an end view, partly in section, looking to the right in Figure 2 showing the adjustable valve construction.

Figure 4 is an exploded view in section showing the parts of the body element and the piston element as separated axially.

Figure 5 is a detail isometric view on a reduced scale of the piston element.

Figures 6, 7 and 8 are diagrammatic operation views showing the checking effect during relative rocking movement of the body and piston element in one direction for one situation to which this hydraulic check is applicable.

Figure 9 is a side elevation of a pressing machine showing the checking effect during the closing thereof effected by the operations shown in Figures 6, 7 and 8.

Figures 10, 11 and 12 are operation views similar to Figures 6, 7 and 8, showing the checking operation during the relative rocking movement of the body element and the piston element in the opposite direction or during the opening of a press.

Figure 13 is a view similar to Figure 9 illustrating the checking effect on the pressing machine during the opening movement.

The check includes a body element, a rotary piston of the vane type in the body element and an arrangement of ports and passages for a hydraulic fluid for controlling the checking effect during the operation of the piston in one direction or the other.

1 designates the body element, this being here shown as including a cylindrical portion 2 provided with a cylindrical interior and heads 3, 4 at its opposite ends, one of these heads, as the head 3, being removable and secured in position as by screws 5. The cylindrical portion 2 of the body is provided with inwardly extending abutments 6, 7, preferably located diametrically opposite each other, providing part-cylindrical piston or vane chambers 8, 9.

10 designates the piston element located in the body 1 or the cylindrical portion thereof and having a shaft 11 extending through one end of the body, that is, through the head 4 for connection to a part of the machine, apparatus, etc., the movement of which is to be controlled. The portion of the body 1 in the heads 3, 4 beyond the ends of the piston or the body constitutes end chambers 12 and 13 or reservoir or transfer chambers for the hydraulic fluid during the operation of the hydraulic check. The piston 10 is in the general form of a spool including a hub portion 14, heads 15, 16 and vanes 17 and 18 between the heads. The hub portion 14 coacts with the ends of the abutments 6 and 7 at 19 and 20, and the heads 15, 16 separate the part-cylindrical chambers 8, 9 from the end chambers or reservoirs 12, 13 which receive the fluid from the chambers 8, 9 during the operation of the check.

The body element 1 and the piston element 10 are connected to different parts of the machine, apparatus, etc., the motions of which are to be checked, and have a relative rocking movement, and in some situations, as when embodied in a pressing machine, the body 1 is stationary and the piston element is capable of rocking within the stationary body element. Each of the abutments 6, 7 is provided with a port 21 or 22, one

of which, as the port 21, opens at 23 into the part-cylindrical chamber 9, and the other port 22 opening at 24 also into the same part-cylindrical chamber 9. These ports 21, 22 also communicate through laterally extending transfer passages 25, 26 (Figure 1) formed in the cylindrical wall 2 of the body and opening into the end chambers 12, 13 respectively. Each of the ports 21, 22 is provided with a suitable valve 27, 28 mounted in a suitable cage 29 or 30 therein and held various distances off the valve seat 31 by an adjustable stem 32^a or 32^b, the stem 32^a being operable to adjust the checking action in one direction, and the stem 32^b in the opposite direction. The cages 29, 30 serve as means for securing the abutments to the body.

The part-cylindrical chambers 8, 9 also communicate with the end chambers 12 and 13 through ports 33 and 34 formed into heads 15 and 16 of the piston element, the ports 33 opening into the chamber 8, and the ports 34 into the chamber 9. These ports 33, 34 are arranged to finally pass alongside and be cut off by the abutments 6 and 7 but at different periods in the movement of the vanes 17, 18. These ports 33 or 34 are here shown as arranged in a series to be successively cut off by the abutments.

35 and 36 are equalizing passages extending through the hub portion of the piston element 14 connecting the portions of the chambers 8, 9 on the pressure sides of the piston vanes 17, 18 with respect to the direction in which the piston is moving or rocking, as one side of each vane is the pressure side, when the rocking movement is in one direction, and the reverse side of each vane is the pressure side, when the rocking movement is in the opposite direction. The hub 14 is also provided with a relief passage 37 arranged to by-pass the hydraulic fluid from one chamber, as the chamber 9, to the chamber 8, which relieves the pressure in the chamber 9 at the final movement of the piston in one direction which, in this embodiment of the invention, is the final portion of the closing movement of the press, so that the press can go under final pressure without checking effect. The end chambers 12 and 13 are provided with suitable filler openings closed by plugs 38, 39. The shaft 11 of the piston member 10 is provided with an oil tight joint or bearing 40 between it and the head 4 of the body. Preferably, the vanes are assembled in the piston element by a radial movement thereof, the heads 15 and 16 being provided with radial grooves 41 which receive the margins of the vanes 17 and 18, the vanes, if desired, being permanently secured in position, as by welding or otherwise assembled in the piston element 14. The heads 15, 16 are integral with or fixedly secured to the shaft 14 and the shaft 14 held from displacement in the body or cylinder 1 by the abutments 6, 7, which are in turn fixed in position by the valve casings 29, 30 which extend through the cylindrical wall of the body 1 and thread into these abutments 6, 7. After the piston has been placed in the cylinder with the abutments loose therein, the shaft 14 can be turned to lift one abutment into position, so that the cage can be threaded thereinto and then the shaft 14 is turned to carry the other abutment into juxtaposition to receive its companion cage. The head 12, which closes the open end of the body or cylinder 1 through which the parts are assembled in the cylinder, is demountably held in position by the screws 5.

This hydraulic check is here shown (Figures 9 and 13) as applied to a pressing machine PM including a stationary buck B and a press head H movable toward and from the buck to control the closing and opening movements of the head.

The operation of this hydraulic check or movement controlling device in a pressing machine is as follows:

During the closing of the head H from open position A', as seen in Figure 9, the parts of the check are in the position shown in Figure 6, the reservoirs 12 and 13 and piston chambers 8 and 9 are substantially filled with oil or hydraulic fluid. In a pressing machine, during the initial starting of the press head from open position, it is desirable to have no checking effect until the static inertia of the head is overcome, and then to have an intermediate checking effect, while the press head is closing to nearly closed position, and then the checking effect to be again released to minimum, while the press head is going under final pressure. Initially the vanes 17 and 18 are in the position A (Figure 6) and the press head H in position A' (Figure 9). Thus on the starting of the closing of the press, the hydraulic fluid is free to flow comparatively easily from the chamber 9 through the ports 33, valve controlled port 21 and transfer passages 25, 26 to the reservoir or end chambers 12 and 13. The hydraulic fluid runs freely through the equalizing passage 35 from the advance side of the vane 17 to the advance side of the vane 18. During this stage of the operation of the hydraulic check, the vanes 17 and 18 move into position B (Figure 7) and the press head into position B' (Figure 9) and the ports 33 move one by one behind the abutment 6 and are cut off progressively, thereby causing a tapering checking action, so that the only outlet for the oil to the reservoir is through the valve controlled port 21. At the start, as seen in Figure 6, the ports 34 are cut off by the abutment 7 and then into position to permit a free follow-up transfer of fluid from the end chambers 12, 13 into chamber 9 behind the vane 18. When the press head is in position C' (Figure 9) and the piston in position C (Figure 8), the relief passage 37 moves into position to by-pass the hydraulic fluid or from the position shown in Figure 8 into the position shown in Figure 10, during the final closing operation in position D' (Figure 13). The vanes are now in position D (Figure 10). During the opening movement of the press, the parts start in the position shown in Figure 10. During the first part of the opening movement, the hydraulic fluid transfers through the ports 33, 34 into the end chambers 12, 13 and also through the valve controlled port 22, and thence, as before, to the end chambers of the body and equalizes through the passage 36. During this movement, the peripheral transfer passage 37 first is opened by being opposite to the abutment 6. During the greater part of the movement, the passage 37 is out of register with the abutment and located entirely in the chamber 9, so that it is ineffective, in so far as transferring pressure is concerned, during the greater part of the movement of the vanes 18 toward the abutment 7 when the oil is being transferred through the valve controlled passage 22, the transfer passage 36 and the passages 34. The fluid in the chambers 8 and 9 passes through the ports 33, 34 until the piston vanes reach the position E and the head in its opening movement reaches position E' (Figure 13), and in the movement to position E, the relief passage 37 has passed out of alinement

or register with the abutment 6. During the final opening movement of the press, the fluid flow is, as shown in Figure 12, through the valve-controlled port 22 and the equalizing passage 36, as the ports 33 are cut off by the abutment 7, as are also the ports 34 by the abutment 6, so that there is a maximum checking effect, while the piston moves back into position A (Figure 6) and the press head moves into complete open position F (Figure 13).

This checking device consists of few easily assembled parts and the checking for opening and closing, up and down, or movements in opposite directions, can be varied to suit the conditions, regardless of the apparatus in which the checking device or shock absorber or movement controlling device is installed.

What I claim is:

1. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body element coaxially with said chambers coacting with the ends of the abutments and having radial vanes extending into the chambers respectively between the abutments, adjustable valve-controlled ports in the abutments, one in each, opening into only one and the same chamber, and passages in the piston for transferring the fluid from one part cylindrical chamber to the other.

2. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior having diametrically opposite inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body element coaxially with said chambers, and coacting at its periphery with the ends of the abutments, and having radial vanes extending into the chambers respectively between the abutments, and outlet ports in the abutments leading from one only of the chambers, and adjustable valves in the ports.

3. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior having inwardly extending abutments dividing the interior into part-cylindrical chambers, and the body being formed with a chamber at at least one end thereof, and the piston element being mounted in the body and including a hub portion coacting at its periphery with the inner ends of the abutments and mounted coaxially with the cylindrical interior and the piston element being formed with a head dividing the part-cylindrical chambers from the end chamber, said head being formed with ports movable past the abutments to be closed thereby at predetermined stages in the relative rocking movement, the piston element also having radial vanes extending into the chambers respectively between the abutments, ports in the abutments communicating with one of the chambers and also communicating with the end chamber.

4. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior having inwardly extending abutments dividing the interior into part-cylindrical chambers, and the piston element including a hub portion mounted in the body element coaxially with said chambers and coacting at its periphery with the ends of the abutments and having radial vanes in the part-cylindrical chambers respectively, the body element having an end chamber at at least one end thereof, and one of said elements being formed with ports for permitting the passage of the hydraulic fluid from the part-cylindrical chambers to the end chamber, and equalizing passages extending through the hub portion of the piston and communicating at its opposite ends with the piston chambers on the advance sides of the vanes.

5. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body element coaxially with said chambers coacting with the ends of the abutments, and having radial vanes extending into the chambers respectively between the abutments, and adjustable valve-controlled ports in the abutments, one in each, communicating with one only of the chambers, the piston element having heads forming side walls of the part-cylindrical chambers and separating the same from the end portions of the body forming end chambers, and having ports through said heads arranged to pass alongside the abutments and be cut off thereby during the relative rocking movement.

6. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body element coaxially with said chambers coacting with the ends of the abutments, and having radial vanes extending into the chambers respectively between the abutments, adjustable valve-controlled ports in the abutments, one in each, opening into one only of the chambers, the piston element having heads forming side walls of the part-cylindrical chambers and separating the same from the end portions of the body forming end chambers and having ports through said heads arranged to pass alongside the abutments and be cut off thereby during the relative rocking movement, the ports in the heads being so located that the ports opening into one cylindrical chamber are cut off at different periods of relative rocking movement from the ports opening into the other part-cylindrical chamber.

7. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body element coaxially with said chambers coacting with the ends of the abutments, and having radial vanes extending into the chambers respectively between the abutments, adjustable valve-controlled ports in the abutments, one in each, opening into one only of the chambers, the piston element having heads forming side walls of the part-cylindrical chambers and separating the same from the end portions of the body, forming end chambers and having ports through said heads arranged to pass

alongside the abutments and be cut off thereby during the relative rocking movement, the piston element being formed with equalizing passages connecting the portions of the part-cylindrical chambers on the pressure sides of the vanes, with respect to the direction of relative rocking movement.

8. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body element coaxially with said chambers coacting with the ends of the abutments, and having radial vanes extending into the chambers respectively between the abutments, adjustable valve-controlled ports in the abutments, one in each, opening into one only of the chambers, the piston element having heads forming side walls of the part-cylindrical chambers and separating the same from the end portions of the body forming end chambers and having ports through said heads arranged to pass alongside the abutments and be cut off thereby during the relative rocking movement, the piston element being formed with a by-pass arranged to connect the pressure portion of one part-cylindrical chamber with the reverse portion of the other part-cylindrical chamber, as the elements approach the end of their rocking movement in one direction.

9. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body element coaxially with said chambers coacting with the ends of the abutments, and having radial vanes extending into the chambers respectively between the abutments, and adjustable valve-controlled ports in the abutments, one in each, opening into one only of the chambers, the piston element having heads forming side walls of the part-cylindrical chambers and separating the same from the end portions of the body forming end chambers and having ports through said heads arranged to pass alongside the abutments and be cut off thereby during the relative rocking movement, the piston element being formed with a peripheral by-pass arranged to come into register with the end of one of the abutments, as the elements approach the end of the relative rocking movement in one direction, and thereby connect the pressure portion of one part-cylindrical chamber with the reverse portion of the other part-cylindrical chamber.

10. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body element coaxially with said chambers coacting with the ends of the abutments, and having radial vanes extending into the chambers respectively between the abutments, adjustable valve-controlled ports in the abutments, one in each, opening into one only of the chambers, the piston element having heads forming side walls of the part-cylindrical chambers and separating the same from the end portions of the body forming end chambers and having ports through said heads arranged to pass alongside the abutments and be cut off thereby during the relative rocking movement, the piston element being formed with equalizing passages connecting the portions of the part-cylindrical chamber on the pressure sides of the vanes with respect to the direction of relative rocking movement, the piston element being formed with a normally ineffective by-pass arranged to connect the pressure portion of one part-cylindrical chamber with the reverse portion of the other part-cylindrical chamber, as the elements approach the end of their relative rocking movement in one direction.

11. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body element coaxially with said chambers coacting with the ends of the abutments, and having radial vanes extending into the chambers respectively between the abutments, adjustable valve-controlled ports in the abutments, one in each, opening into one only of the chambers, the piston element having heads forming side walls of the part-cylindrical chambers and separating the same from the end portions of the body forming end chambers and having ports through said heads arranged to pass alongside the abutments and be cut off thereby during the relative rocking movement, the ports in the heads being so located that the ports opening into one cylindrical chamber are cut off at a different period during relative rocking movement than the ports opening into the other part-cylindrical chamber, the piston element being also formed with equalizing passages connecting the portions of the part-cylindrical chambers on the pressure sides of the vanes with respect to the direction of relative rocking movement, and the piston element being also formed with a by-pass arranged to connect the pressure portion of one part-cylindrical chamber with the reverse portion of the other part-cylindrical chamber, as the elements approach the end of the rocking movement in one direction.

12. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body and including a portion mounted in the body in the form of a spool having a hub portion, and discoidal heads at opposite ends of the hub separating the part-cylindrical chambers from the end portions of the body and thereby providing end chambers, the hub of the spool coacting with the ends of the abutments, the heads being provided with ports therethrough arranged to pass alongside of and be cut off by the relative rocking movement, outlet ports extending into the abutments and opening into one part-cylindrical chamber only, and independently operable adjustable valves in the ports.

13. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body and including a por-

tion mounted in the body in the form of a spool having a hub portion and discoidal heads at opposite ends of the hub separating the part-cylindrical chambers from the end portions of the body, and thereby providing end chambers, the hub of the spool coacting with the ends of the abutments, the heads being provided with ports therethrough arranged to by-pass alongside of and be cut off by the relative rocking movement, outlet ports extending into the abutments and opening into one part-cylindrical chamber only, and independently operable adjustable valves in the ports, the hub portion being formed with equalizing passages extending therethrough connecting the pressure portions of the part-cylindrical chambers on the pressure sides of the vanes with respect to the direction of the relative rocking movement.

14. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and having inwardly extending abutments dividing the interior into part-cylindrical chambers, the piston element being mounted in the body and including a portion mounted in the body in the form of a spool having a hub portion and discoidal heads at opposite ends of the hub separating the part-cylindrical chambers from the end portions of the body, and thereby providing end chambers, the hub of the spool coacting with the ends of the abutments, the heads being provided with ports therethrough arranged to pass alongside of and be cut off by the relative rocking movement, outlet ports extending into the abutments and opening into one part-cylindrical chamber only, and independently operable adjustable valves in the ports, the hub portion being formed with equalizing passages extending therethrough connecting the pressure portion of the part-cylindrical chamber on the pressure sides of the vanes with respect to the direction of the relative rocking movement, and the hub being also formed with a peripheral by-pass normally out of effective position and movable into position during the relative rocking movement to connect the pressure portion of the part-cylindrical chamber into which the outlet ports open and the reverse portion of the other part-cylindrical chamber, as the elements approach the end of their rocking movement in one direction.

15. A hydraulic check comprising a body element and a piston element having relative rocking movement, the body element being formed with a cylindrical interior and heads at its opposite ends, one head being removable, the body also having inwardly extending radial abutments demountably secured in the body and forming part-cylindrical chambers, the piston element being in the form of a spool having a hub portion and discoidal heads rotatably mounted in the cylindrical wall of the body on opposite sides of the abutments, and also having radial vanes between the head portions movable in the part-cylindrical chambers respectively, the hub of the spool formation being rotatably mounted on the end faces of the abutments, the piston element being mountable in the body through the end thereof provided with the demountable head and also having an axial shaft extending through one of the heads of the body, the piston and body elements and the abutments being provided with ports for permitting transfer of hydraulic fluid from and to the part-cylindrical chambers and the body.

ERNEST DAVIS.