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R. W. DINZL

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CONSTANT LEAKAGE SYSTEM FOR HYDRAULIC APPARATUS

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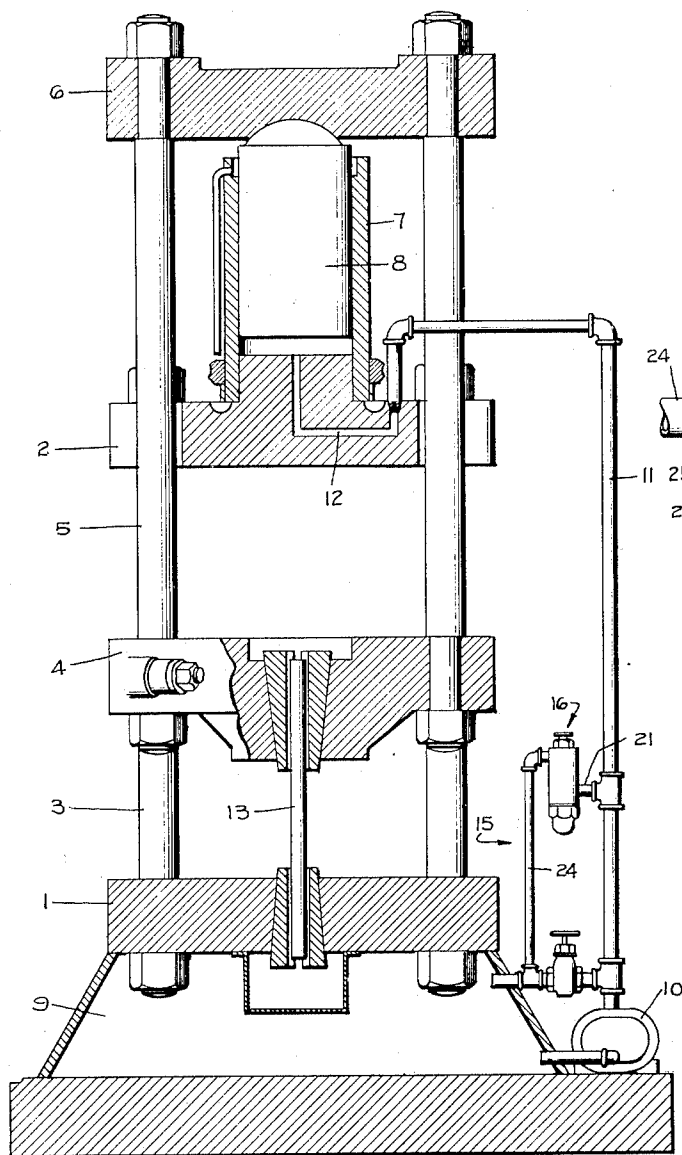


Fig. 1

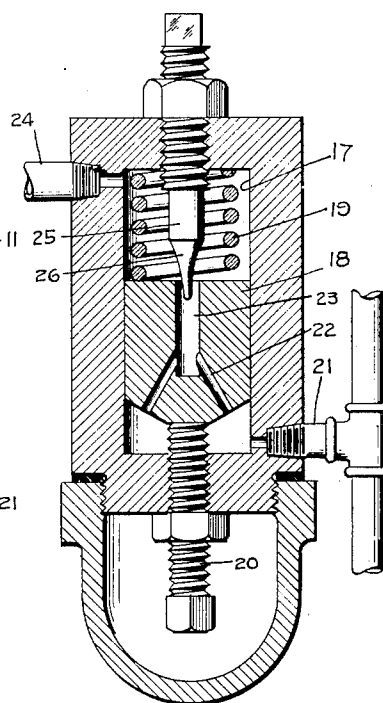


Fig. 2

INVENTOR

R. W. DINZL

BY

Edward J. McManus
ATTORNEY

UNITED STATES PATENT OFFICE

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CONSTANT LEAKAGE SYSTEM FOR
HYDRAULIC APPARATUSRichard W. Dinzi, Narberth, Pa., assignor to
Baldwin-Southwark Corporation, a corpora-
tion of Delaware

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1 Claim. (Cl. 137—152)

This invention relates generally to an improved hydraulic system and more particularly to an improved combination of a materials testing machine of the ram type and means for maintaining constant leakage in the hydraulic system thereof whereby for varying loads a substantially constant speed of loading may be effected.

A constant speed or rate of loading on a test specimen is highly desirable but this is rendered difficult in ram type machines because of leakage around the ram or in the other parts of the system.

A hydraulic ram in a materials testing machine cannot be made leakproof if it is desired to maintain maximum accuracy and sensitivity, and this factor taken with the fact that ram leakage varies with the load thereon, presents a complex problem. While constant speed systems have heretofore been proposed, yet they make no attempt to utilize the principle of a constant leakage system as herein disclosed, but on the contrary employ the principle of a variable leakage system.

It is an object of my invention to provide a hydraulic ram system having substantially constant leakage for varying loads.

A further object of the invention is to provide an auxiliary leakage valve mechanism in combination with a source of fluid pressure and ram type apparatus so that the valve mechanism permits a variable artificial leakage to compensate for variable ram leakage or other sources of leakage in the system as a whole, whereby for light loads and small ram leakage a high rate of artificial leakage occurs and vice versa for large loads and corresponding high ram leakage, thus maintaining constant leakage in the system.

Another object is to provide a pressure actuated valve mechanism functioning automatically to vary the artificial leakage in accordance with the ram pressure.

Other objects and advantages will be more apparent to those skilled in the art from the following description of the accompanying drawing in which:

Fig. 1 is a vertical section through one form of ram type materials testing apparatus showing diagrammatically the application of my constant leakage system;

Fig. 2 is an enlarged vertical section through the valve mechanism for effecting the constant leakage.

In the particular embodiment of the invention which is disclosed herein merely for the purpose of illustrating one specific form among possible

others that the invention might take, I have shown generally a ram type testing machine such as disclosed in the application of G. S. von Heydekampf, Serial No. 666,315, filed April 15, 1933, although it will of course be understood that various other forms of ram type machines may be employed. This machine is provided with lower and upper stationary platens 1 and 2 held in fixed spaced relation by a series of joining columns 3. A lower or intermediate movable platen 4 is secured by a series of rods 5 to an upper crosshead 6. The hydraulic ram includes a cylinder 7 supported by the upper stationary platen 2, the cylinder being specifically shown as of the rotatable sleeve type although this could be non-rotatably secured to platen 2 as in certain types of ram machines. The rotatable feature of sleeve 7 is merely for the purpose of reducing friction of rest as outlined in said Von Heydekampf application. Reciprocally disposed within cylinder 7 is a ram 8 resting against crosshead 6.

Hydraulic pressure may be supplied from a sump 9, thence through a motor-driven pump 10 of any suitable form such as gear pump or positive displacement pump. The fluid is passed through pipe 11 and passages 12 in platen 2 to the interior of cylinder 7, thereby to move ram 8 upwardly. As the ram moves upwardly, crosshead 6 and rods 5 will likewise pull platen 4 upwardly to impose a test load on a specimen 13 which is held by suitable grips in base 1 and platen 4. In the event of a compression test in distinction to the tension test illustrated in Fig. 1, a specimen is interposed between platens 2 and 4, thereby allowing hydraulic pressure to load the specimen in the same manner as for a tension test.

It is desirable to maintain a constant rate or speed of loading of the specimen and to this extent it is necessary to compensate for leakage between the ram 8 and its cylinder 7 and any other sources of leakage in the system. To do this I have disclosed herein the principle of a constant leakage system whereby the ram or other leakage is supplemented by an artificial leakage, the sum of the two leakages remaining constant for varying load pressures. This artificial leakage is effected by the provision of an improved combination of elements including a bypass generally indicated at 15 controlled by a valve 16. This valve has a bore 17 and a piston 18 normally urged downwardly by a spring 19. At its lower or maximum leakage position the piston engages an adjustable stop stud 20. Fluid pressure from the ram or pump side is admitted beneath piston 18

as through a pipe 21, this fluid flowing through a series of preferably inclined passages 22 to a central passage or orifice 23 from which it flows outwardly through a pipe 24 to return to sump 9.

5 To automatically vary the artificial leakage through piston 18, there is provided a needle valve 25 having a point of curvature 26 determined in accordance with varying loads and ram leakage characteristics. At low pressure, and therefore

10 minimum ram leakage, piston 18 is in the position shown in Fig. 2 thereby permitting maximum artificial leakage, whereas when the load pressure increases and leakage past ram 8 also increases, the increased fluid pressure will move

15 piston 18 upwardly against the action of spring 19 so that the curvature 26 of needle 25 will reduce the outlet area of orifice 23 and restrict the artificial leakage to maintain a constant total leakage in the system. While the artificial leakage is thereby varied, the ram leakage varies also

20 but the sum of the two leakages remains constant throughout variations in load due to the particular shape 26 of needle valve 25. Hence it is seen that so long as fluid pressure is supplied

25 at a constant rate the ram 8 will move at a constant speed irrespective of the load. The shape of the needle valve or its cooperating orifice will of course be different for rams of different leakage characteristics, this being determined experimentally.

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From the foregoing disclosure it is seen that I have provided an extremely simple and effective means for overcoming the problem of leakage and I am able to do this without auxiliary apparatus

for increasing either the speed or discharge of the pump to make up for a varying leakage; and it is also seen that my improved constant leakage system is applicable whether the load is increasing or decreasing as the spring 19 will cause downward movement of piston 18 to increase the artificial leakage when the load decreases.

It will of course be understood that various changes in details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as set forth in the appended claim.

I claim:

A constant speed mechanism for a hydraulic loading system comprising, in combination, a 15 main pipe through which fluid is supplied to the system, a valve mechanism having a casing and a piston therein, a passage for bypassing fluid out of said pipe to one end of said casing beneath said piston, a free atmospheric outlet communicating with the other end of said casing above said piston whereby the top of the piston is subjected to atmospheric pressure, means on the top of said piston for mechanically biasing the same against the pressure acting on the bottom of the piston, an orifice for allowing flow of pressure fluid from the under side of the piston to the top atmospheric side thereof, and means responsive to movement of said piston caused by progressive increases of pressure in said main pipe for automatically progressively restricting said orifice so as to maintain a substantially constant rate of flow through said pipe.

RICHARD W. DINZL.