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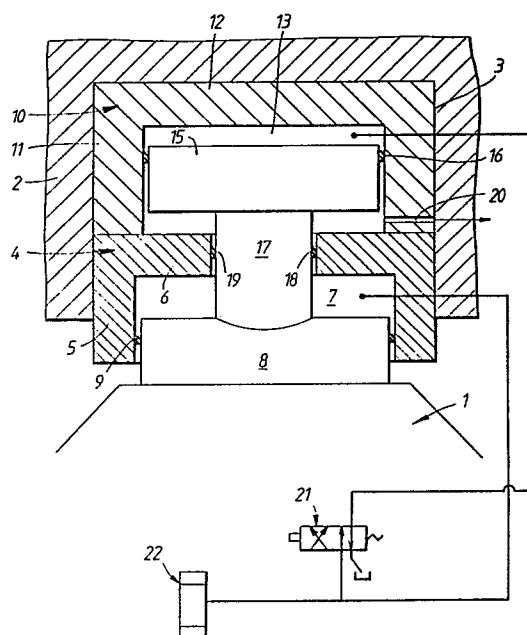
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⑤④ **Hydraulic RAM assembly.**

⑤⑦ A hydraulic ram assembly capable of providing a force varying over a wide range has a first ram with a fixed cylinder and a movable piston which is capable of supplying a force at the lower end of the range and a second ram with a fixed cylinder and a piston which is movable into engagement with the piston of the first ram to assist the first piston to thereby provide an increased load.



HYDRAULIC RAM ASSEMBLY

This invention relates to an assembly of two hydraulic rams.

5 In certain industrial applications, it is desirable for a hydraulic ram assembly to provide a force varying over a very wide range. It is very difficult to design a single hydraulic ram which is capable of acting accurately and efficiently over a
10 wide range of forces.

 Accordingly, the present invention relates to an assembly of a first ram comprising a housing defining an open-ended cylinder, a piston displaceable in the cylinder and means for introducing fluid under
15 pressure into the cylinder to displace the piston in the direction towards the open end of the cylinder; and a second ram comprising a housing defining a cylinder and a piston displaceable in the cylinder, characterised in that the cylinder of the second ram is
20 in communication with the cylinder of the first ram through an opening in the housing of the first ram which is opposite the open end of the cylinder, means for introducing fluid under pressure into the cylinder of the second ram to displace the piston in the
25 direction towards the opening and the piston of the second ram having an extension which projects through

the opening in the housing and is engageable with the piston of the first ram.

Preferably, the engaging surfaces of the extension and the piston of the first ram are such as to permit limited relative inclination between the axis of the extension and the axis of the cylinder of the first ram.

Depending on the force which is to be developed, either the first ram only is employed or the two rams can be operated together.

Since the extension of the piston in the second ram is engageable with the piston of the first ram, but is not permanently connected thereto, when hydraulic fluid is introduced into the cylinder of the first ram, it acts against the full surface of the piston therein and it also acts against the extension to displace the piston in the second ram in the direction to separate the extension from the piston in the first ram. When only the first ram is being used, only one seal, i.e. that between the piston of that ram and the cylinder wall, is employed. This permits slight tilting between the piston and the cylinder wall.

With both cylinders in operation, there are three seals in use, the seals being positioned between the pistons and the walls of their respective cylinders

and between the extension and the housing of the first ram.

In order that the invention may be more readily understood, it will now be described, by way of example only with reference to the accompanying drawing which is a diagrammatic section of a ram assembly according to the present invention.

In the arrangement shown in the figure, the ram assembly is used to displace a chock 1 of a rolling mill stand relative to a fixed housing 2 of the mill stand. An assembly according to the present invention is located in a recess 3 formed in the housing. The assembly consists of a housing 4 having a side wall 5 and an end wall 6 and together they define a cylinder 7 which is open-ended. A piston 8 having a wall seal 9 is displaceable in the cylinder 7 to constitute a ram.

Separate from, but mounted on this housing 4, there is a further housing 10 which has a slide wall 11 and an end wall 12 and together with the end wall 6 of the first ram they define a cylinder 13. A piston 15 is displaceable in the cylinder 13 to constitute a ram and there is a seal 16 between the piston 15 and the wall of the cylinder. The piston has an extension 17 which projects through an opening 18 in the end wall 6 of the housing 4 and there is a seal 19 between the extension and the wall of the opening.

The lower end of the extension projects into the cylinder 7 and is engageable with the adjacent surface of the piston 8. It is preferable for the end face of the extension 17 and the adjacent face of the piston 8 to be of convex and concave form, respectively, so that limited inclination can take place between the piston 8 and the extension and there can be relative inclination between the longitudinal axis of the extension and that of the cylinder 7.

The part of the cylinder 13 which is between the piston 15 and the wall 6 of the housing 4 is kept open by way of a permanent connection 20 to drain. The part of the cylinder 13 above the piston 15 is connected by a fluid line to a port on a solenoid valve 21 and the cylinder 7 is also connected to a port on the solenoid valve 21 by a fluid line. In the arrangement shown, the solenoid valve has a connection from a controllable hydraulic source 22 directly to the cylinder 7 and the part of the cylinder 13 above the piston 15 is connected through the solenoid valve to drain. In this way, the hydraulic fluid supplied to the cylinder 7 causes a force to be applied to the piston 8, and the piston 15 is forced upwardly to the top of its cylinder so that it is not in contact with the piston 8 by the force of the fluid acting on the extension 17. Thus, the force of the fluid in the

cylinder 7 acts over the entire surface of the piston
8. When the solenoid valve 21 is connected in its
opposite operating position, fluid under pressure is
supplied to the cylinder 7 and to the cylinder 13 above
5 the piston 15 and, hence, the extension 17 is forced
downwardly into engagement with the piston 8 to provide
a combined force acting on the chock 1. It will be
seen, therefore, that either the ram consisting of the
piston 8 in the cylinder 7 can be brought into
10 operation on its own, or it can be in operation along
with the piston 15 in the cylinder 13, thus providing a
much greater force on the chock 1.

Even when both rams are in operation, the
extension 17 can be inclined slightly with respect to
15 the axis of the piston 8. When both rams are in
operation, there are three seals in use, but the seal
friction is not so critical when large operating forces
are being produced.

Various forms of transducers (not shown) can
20 be employed to give an indication of the relative
positions of the pistons with respect to the fixed mill
 housings 2.

Claims:

1. An assembly of a first ram comprising a housing (4) defining an open-ended cylinder (7), a piston (8) displaceable in the cylinder and means for introducing fluid under pressure into the cylinder to displace the piston in the direction towards the open end of the cylinder;

 and a second ram comprising a housing (10) defining a cylinder (13) and a piston (15) displaceable in the cylinder, characterised in that the cylinder of the second ram is in communication with the cylinder of the first ram through an opening (18) in the housing (4) of the first ram which is opposite the open end of the cylinder, means for introducing fluid under pressure into the cylinder of the second ram to displace the piston in the direction towards the opening and the piston of the second ram having an extension (17) which projects through the opening in the housing and is engageable with the piston (8) of the first ram.

2. An assembly as claimed in claim 1, characterised in that the piston (8) of the first ram is provided with one peripheral seal (9) which permits limited tilting of the piston relative to the cylinder

(7).

3. An assembly as claimed in claim 1 or 2,
characterised in that the surface of the extension (17)
5 which is engageable with the piston (8) of the first
ram is of convex form and the corresponding surface of
the piston (8) is of concave form thereby permitting
limited inclination between the axis of the extension
and that of the piston.

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4. An assembly as claimed in claim 1, 2 or 3,
characterised in that it includes control valve means
(21, 22) which permits fluid to be supplied to the
cylinder of the first ram and optionally to the
15 cylinder of the second ram.

5. An assembly as claimed in claim 2,
characterised in that there is one peripheral seal (19)
between the extension and the wall of the housing which
20 defines the opening and one peripheral seal (16) on the
piston of the second ram.



European Patent
Office

EUROPEAN SEARCH REPORT

0203794

Application number

EP 86 30 3944

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	GB-A-1 600 733 (A.C. MIDGLEY) * The whole document *	1	F 15 B 15/14
A	---	2, 5	
X	FR-A-1 602 570 (GIRLING Ltd.) * The whole document *	1, 3, 4	
A	--- US-A-3 053 294 (A.E. ANDERSSON et al.)		
A	--- GB-A- 944 223 (D.H. BALLARD) -----		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.4) F 15 B
Place of search THE HAGUE		Date of completion of the search 29-08-1986	Examiner FRANKS N.M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			