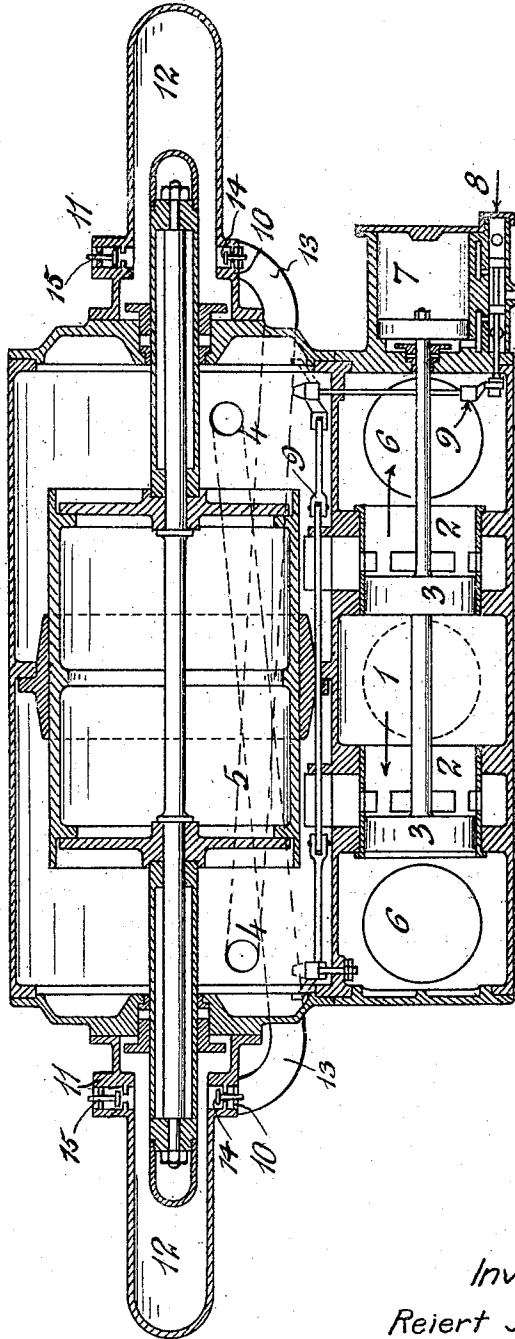


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HYDRAULIC TRANSFORMER.
APPLICATION FILED JULY 18, 1919.

1,377,585.

Patented May 10, 1921.



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1,377,585.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, REIERT JOHANSON, a subject of the King of Norway, residing at Odda, Hardanger, Norway, have invented certain new and useful Improvements in Hydraulic Transformers; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The present invention has for its object a hydraulic transforming device of the kind which acts as a combined motor and pump and serves to pump part of its driving fluid up to a pressure which is higher than the pressure of the driving fluid, all the energy consumed by the working part of the transformer being utilized for this purpose of pressing part of the fluid up to a higher pressure.

The apparatus according to the invention is of the kind comprising a differential piston, the larger part of which is reciprocated by means of the low pressure driving fluid, while the narrower part of the piston works as a pump.

On the drawing is illustrated a form of the invention in axial section.

The transformer comprises a double acting low pressure cylinder 4 with a low pressure piston 5 carrying at each end an extension which operates in the corresponding high pressure cylinder 12, one of which is mounted at each end of the low pressure cylinder 4.

In combination with the low pressure cylinder 4 there is arranged a piston slide valve 2 with pistons 3. In combination with the slide valve gates there is arranged a regulating cylinder 7 with governor slide 8.

Said governor slide 8 is controlled from the low pressure piston 5 by means of a system of rod connections generally indicated at 9.

The governor slide 8 may be dispensed with, and slide 2, 3 is then controlled directly by the piston 5 by means of a suitable controlling device.

The high pressure cylinders 12 are provided with suction and pressure openings

10, 11, the valves of which are indicated at 14 and 15. The suction openings 10 are connected by means of tubes 13 with the opposite ends of low pressure cylinder 4, so that the right hand high pressure cylinder 12 is fed from the left hand side of low pressure cylinder 4 and vice versa.

The pump operates in the following manner:

The low pressure fluid is let in through inlet opening 1 into the slide valve casing and from there is conducted into the left hand side of cylinder 4 as indicated by the arrow. Hereby piston 5 is moved toward the right, and the fluid on its right hand side is forced out through the openings in the right part of the slide valve case and to outlet 6 as indicated by the arrow.

Part of the fluid from the right hand side of cylinder 4 enters the left hand cylinder 12 during this stroke, while at the same time the fluid in the right hand high pressure cylinder is pressed out through opening 11.

When the low pressure piston 5 has reached its extreme position on the right it strikes the member 9 thereby moving the governor slide 8, whereby in the ordinary manner the piston of the regulating cylinder or servomotor 7 is moved to the right pulling with it the slide valve pistons 3 so that the same are brought into their right hand position. Thereby the conditions as to entrance and outlet in the several cylinders are reversed and piston 5 moves to the left. When arriving at its extreme left hand position the piston 5 again strikes the controlling mechanism 9 removing governor slide 8 to its original position and so on.

The low pressure cylinder 4 may be provided with air buffers in order to prevent shocks and facilitate the reversing operation.

I claim as my invention:—

1. A hydraulic transformer, comprising a low pressure cylinder; a high pressure cylinder at each end of the low pressure cylinder, both high pressure cylinders communicating with the low pressure cylinder to receive fluid therefrom; a differential piston embodying a low pressure section operating in the low pressure cylinder and a pair of high pressure sections operating in the high pressure cylinders, the high pressure sections serving to pump to a higher pressure the

fluid supplied to the high pressure cylinders from the low pressure cylinder by the low pressure sections; and fluid supply and exhaust means associated with the low pressure cylinder.

2. A hydraulic transformer, comprising a low pressure cylinder having fluid supply and exhaust means associated therewith; a pair of high pressure cylinders mounted one at each end of the low pressure cylinder, each high pressure cylinder communicating with the end of the low pressure cylinder remote therefrom to receive from said low pressure cylinder a portion of the fluid exhausting from the same; and a differential piston embodying a central section working in the low pressure cylinder and a pair of end sections connected to opposite ends of the central section and working in the high pressure cylinders.

3. A hydraulic transformer, comprising a low pressure cylinder; a valve casing in communication therewith and having fluid supply and exhaust openings; a piston valve in said casing for controlling such communication; a regulating cylinder; a piston therein connected to operate said piston valve; a governor slide associated with said piston to control the movements thereof; a high pressure cylinder at each end of the low pressure cylinder, both high pressure cylinders communicating with said low pressure cylinder to receive fluid therefrom; a differential piston embodying a low pressure section operating in the low pressure cylinder and a pair of high pressure sections operating in the high pressure cylinders; and means operatively associated with the differ-

ential piston for actuating said governor slide.

4. A hydraulic transformer, comprising a low pressure cylinder having fluid supply and exhaust means associated therewith; a pair of high pressure cylinders mounted one at each end of the low pressure cylinder, each high pressure cylinder communicating with the end of the low pressure cylinder remote therefrom to receive from said low pressure cylinder a portion of the fluid exhausting from the same; a differential piston embodying a central section working in the low pressure cylinder and a pair of end sections connected to opposite ends of the central section and working in the high pressure cylinders; a valve casing having communication adjacent each end with the low pressure cylinder; a pair of connected piston valves working in the valve casing for controlling such communication; a regulating cylinder; a piston therein operatively connected to one of said piston valves; a governor slide associated with the regulating cylinder piston to control its movements; and a system of operating connections attached to said governor slide to actuate the same, said connections being operable by the central section of the differential piston during its movements in opposite directions.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

REIERT JOHANSON.

Witnesses:

MOGUAS BRIGGE,
SIGNE JOHNSEN.