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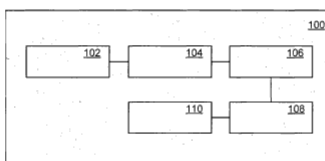
(71) Applicant(s): L&T TECHNOLOGY SERVICES LIMITED,

(72) Inventor(s): SHRIVASTAVA, SHAILENDRA  
MOURYA, AMITABH  
HOSSAIN, IQBAL

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(54) Title: HYDRAULIC SYSTEM

(57) Abstract: According to embodiments of the invention a test bench is disclosed. The test bench have a test bed and a load cell arrangement. The test bed has a cylinder mounting end and a load cell arrangement mounting end. The cylinder mounting end is configured to hold a barrel side of the hydraulic cylinder. The load cell arrangement mounting end is configured to detachably mount the load cell arrangement and has a passage for a rod of the hydraulic cylinder. According to an embodiment, the passage is available only when the load cell arrangement is not mounted on the test bed.



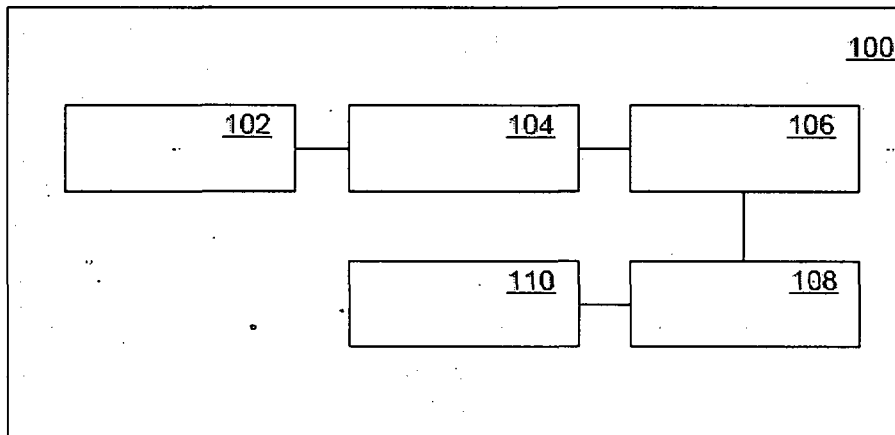
# HYDRAULIC SYSTEM

## ABSTRACT

According to embodiments of the invention a test bench is disclosed. The test bench have a test bed and a load cell arrangement. The test bed has a cylinder mounting end and a load cell arrangement mounting end. The cylinder mounting end is configured to hold a barrel side of the hydraulic cylinder. The load cell arrangement mounting end is configured to detachably mount the load cell arrangement and has a passage for a rod of the hydraulic cylinder. According to an embodiment, the passage is available only when the load cell arrangement is not mounted on the test bed.

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We Claim:

1. A hydraulic system 100 for conducting one or more test on a hydraulic cylinder on a hydraulic test bench, the system 100 comprising:

a pumping unit 102 in fluid communication with a fluid reservoir and configured to

5 enable fluid flow in the system 100;

a pressure control module 104 for controlling the pressure and flow rate in the hydraulic system;

a direction control module 106 for controlling the flow of fluid to a first and a second compartment of the cylinder;

10 a back pressure control module 108 for precise out flow of fluid from the first or second compartment of the cylinder; and

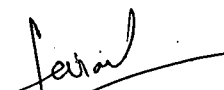
a gauging module 110 for monitoring the pressure at cylinder ports.

2. The hydraulic system 100 as claimed in claim 1, wherein the pumping unit 102 has at  
15 least one pump.

3. The hydraulic system 100 as claimed in claim 2, wherein the pumping unit 102 have at least two pump of different configuration.

20 4. The hydraulic system 100 as claimed in claim 1, wherein the direction control module 106 may have at least one proportional valve.

Dated this 6<sup>th</sup> day of January 2014

  
Mohammed Faisal (INPA No: 1941)  
Larsen & Toubro Limited

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## FIELD OF INVENTION

The invention generally relates to a hydraulic systems and more particularly to a hydraulic system for a hydraulic cylinder test bench.

## BACKGROUND

Hydraulic cylinders are widely used in various industrial products and equipment's such as in construction equipment, manufacturing machinery, automobiles etc. It is normal practice to test such components under simulated working conditions. These tests may be for a new product or a repaired to ensure that they meet the rated specifications. The hydraulic cylinders may be tested on a test bench. Test bench is typical arrangement for conduction predefined test on a hydraulic cylinder under simulated working conditions. Typically a test bench may have an arrangement for holding the cylinder, a hydraulic actuator, a motor to drive the actuator, an arrangement for supplying fluid to the cylinder and arrangement for performing one or more predefined test such as Internal leakage test, Stroke length measurement test etc.

These test benches commonly have robust built and have various exposed components. Moreover such benches are restricted to conduct only one type of test such as the test bench that can perform stroke length test and leakage test is not capable of performing tensile and compressive load capacity test for hydraulic cylinder. As such different test benches are required for conducting different tests. The present invention is directed to overcoming one or more of the problems as set forth above.

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## SUMMARY OF THE INVENTION

According to embodiments of the invention a hydraulic system for conducting one or more test such as, but not limited to, internal leakage test, dynamic & static packing drag test, proof pressure test, stroke length measurement test, endurance test, compressive & tensile load capacity measurement test, pressure profiling, reliability test and/or hydraulics component calibration on a hydraulic cylinder on a hydraulic test bench is disclosed. The system includes a pumping unit in fluid communication with a fluid reservoir and configured to enable fluid flow in the system, a pressure control module for controlling the pressure and flow rate in the hydraulic system, a direction control module for controlling the flow of fluid to a first and a second compartment of the cylinder, a back pressure control module for precise out flow of fluid from the first or second compartment of the cylinder; and a gauging module for monitoring the pressure at cylinder ports.

## BRIEF DESCRIPTION OF DRAWINGS

Other objects, features, and advantages of the invention will be apparent from the following description when read with reference to the accompanying drawings. In the drawings, wherein like reference numerals denote corresponding parts throughout the several views:

Figure 1 illustrates a block diagram of the hydraulic system for a hydraulic test bench according to an embodiment of the invention.

## DETAILED DESCRIPTION OF DRAWINGS

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According to an embodiment of the invention, a hydraulic circuit for a hydraulic cylinder test bench is disclosed. Hydraulic cylinder is a mechanical actuator that gets its power from pressurized hydraulic fluid to generate unidirectional strokes. The hydraulic cylinder consists of a cylinder barrel, in which a piston connected to a piston rod moves back and forth. The barrel is closed on one end by the cylinder bottom that is called cap and at the other end the cylinder has an opening from where the piston rod comes out of the cylinder barrel. The barrel typically has two fluid compartments. A first fluid compartment is towards the cap side and second compartment is towards the rod side. The piston works as a separation between the first and second compartment. Each compartment further has at least one opening known as cylinder port for inflow and out flow of fluid. In order to conduct various tests on hydraulic cylinder, fluid is required to be selectively routed to the compartments. by a hydraulic system.

Figure 1 illustrates a block diagram of the hydraulic system 100 for a hydraulic test bench according to an embodiment of the invention. The disclosed system 100 enables different hydraulic test such as, but not limited to, stroke length test, leakage test, packing drag test etc. on a single test bench. The hydraulic system 100 includes a pumping unit 102, a pressure control module 104, a direction control module 106, a back pressure control module 108 and

a gauging module 110. The pumping unit 102 enables fluid flow in the system 100 and is connected to a fluid reservoir such as an oil tank. The pumping unit 102 is configured to draw fluid from the reservoir and pump the fluid to the pressure control module 104. According to an embodiment, the pumping unit 102 may have at least one hydraulic pump. According to yet another embodiment, the pumping unit 102 may have two or more pumps. According to yet another embodiment, the pumping unit 102 may have pumps with varied configuration such as high flow low pressure, low flow high pressure etc. The multiple pumps may be

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selectively operated to control the fluid pressure and flow in the hydraulic system 100 thereby optimizing the energy consumed by the test bench.

5 The pressure control module 104 controls the pressure and flow rate in the hydraulic system 100. According to an embodiment, the pressure control module 104 selectively operates the pumping unit 102 to obtain the desired pressure and flow rate. According to another embodiment, the pressure control module 104 may have arrangements such as, but not limited to, valves to further control or increase the fluid pressure. The pressure control module 104 is further configured to ensure that the system pressure do not exceeds a pre-  
10 defined system pressure. According to yet another embodiment, the pressure control module 104 may be operated manually or may be operated automatically using a computer system.

The direction control module 106 is provided to control the flow of fluid to the first and second compartment of the cylinder as per the test requirement. According to an  
15 embodiment, the direction control module 106 may have one or more proportional valves to control the flow of fluid in the system 100. The direction control module 106 enables a reciprocating motion of the piston in the cylinder barrel.

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20 The back pressure module 108 is provides the option for precise meter out control on the piston movement in the cylinder barrel by controlling the out flow of fluid from the first or second compartment of the cylinder. According to another embodiment, the back pressure module 108 may generate back pressure by throttling the outlet port for some specific test such as dynamic packing drag test. According to an embodiment, the direction control module 106 may have one or more proportional valves to control the back flow pressure.

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The gauging module 110 is provided to monitoring the pressure at the cylinder ports during testing. The gauging module 110 monitors the data and provides information to the pressure control module 104, the direction control module 106 and the back pressure control module 108.

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It is understood that the above description is intended to be illustrative, and not restrictive. It is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined in the appended claims. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

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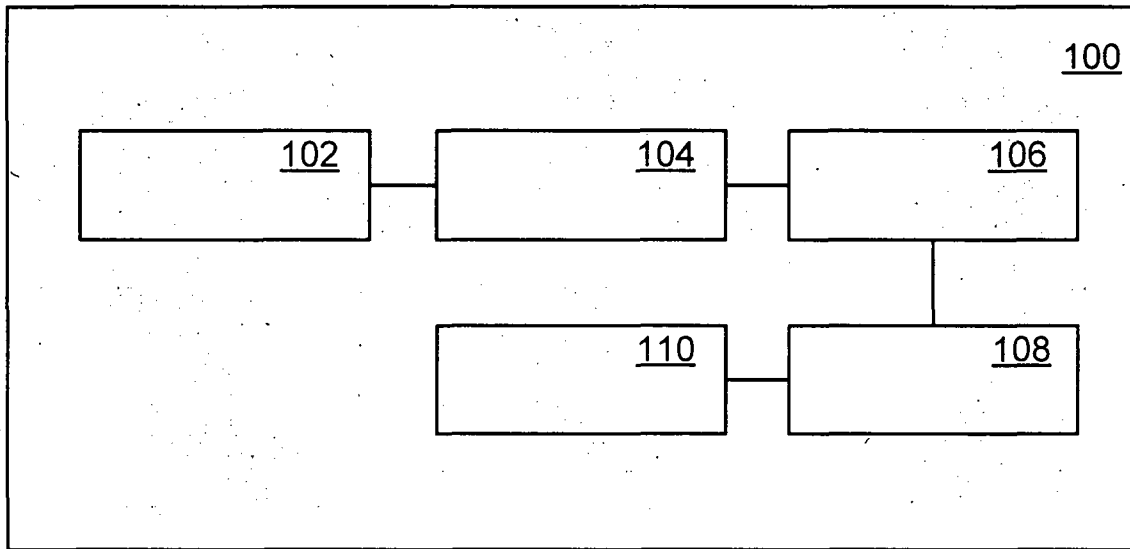


Figure 1

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*Mohammed Faisal*  
Mohammed Faisal (INPA No: 1941)  
Larsen & Toubro Limited  
DLE 3rd Block, 2nd Floor,  
Manapakkam, Chennai, TN, 600089