United States Patent [19]

Cattanach

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[54] LOAD CONTROLLER

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[52] **U.S. Cl.**.....**417/270,** 417/281

[51] **Int. Cl.**.....**F04b 49/00**

[58] **Field of Search**.....417/13, 269, 271, 417/228, 281; 91/486, 489

[56] **References Cited**

UNITED STATES PATENTS

2,937,801	5/1960	Berkoben	417/281
2,999,463	9/1961	Cameron-Johnson	417/202
3,056,358	10/1962	Pedersen et al.	91/489
3,066,609	12/1962	Hann	91/489
3,085,514	4/1963	Budzich	417/203
3,143,973	8/1964	Budzich	417/270
3,257,960	6/1966	Keel	417/269
3,291,067	12/1966	North	417/272
3,411,453	11/1968	Chanal	417/269
2,298,850	10/1942	Vickers	91/487
2,715,875	8/1955	Towler et al.	417/269
2,735,407	2/1956	Born	91/488
3,085,514	4/1963	Budzich	417/269

FOREIGN PATENTS OR APPLICATIONS

1,004,080	9/1965	Great Britain	417/214

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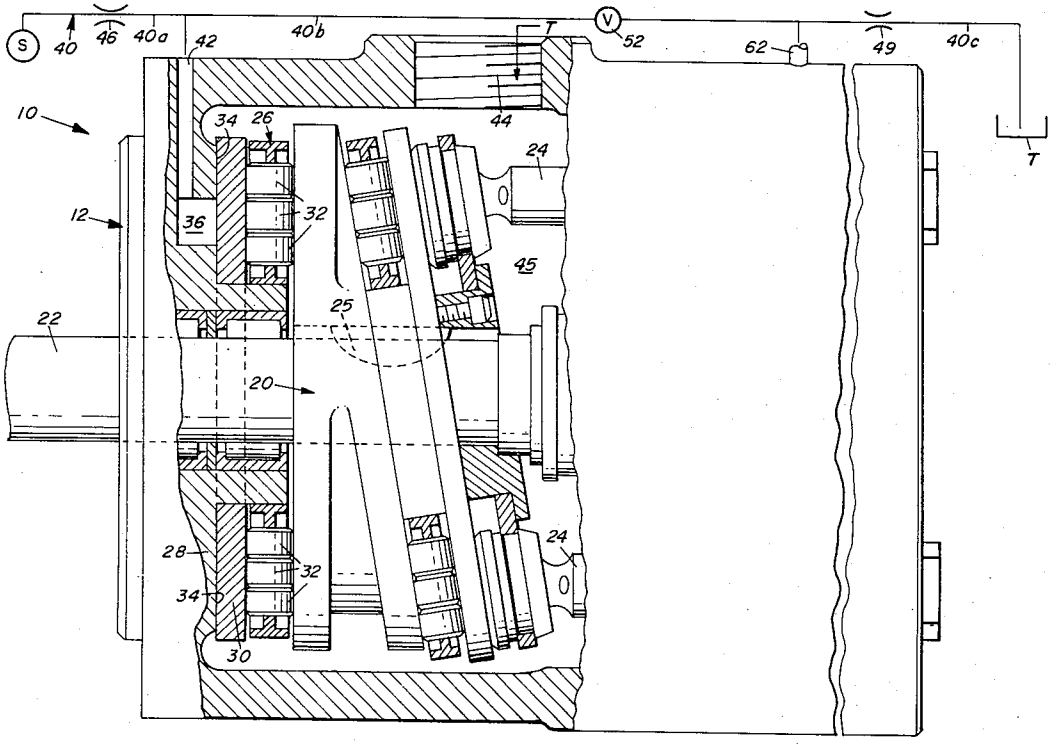
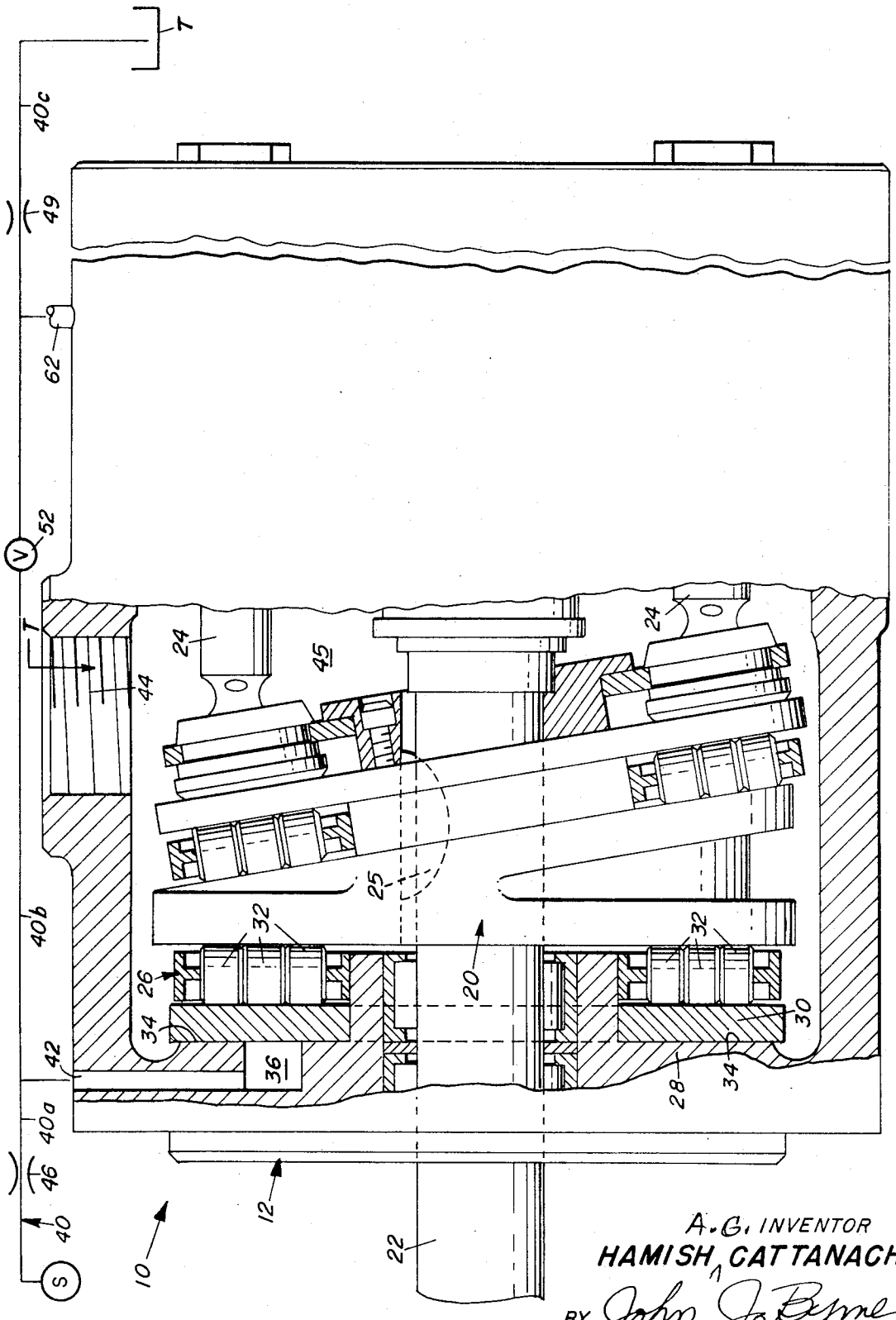
[57] **ABSTRACT**

A system for regulating the output of a variable delivery hydraulic pump by sensing the load on the pumping members and adjusting the output of the pump in response thereto.

4 Claims, 1 Drawing Figure





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LOAD CONTROLLER

An object of this invention is to provide a control for a hydraulic pump for adjusting and limiting the pump flow to a predetermined value which may be fixed or adjustable.

A further objective of this invention is to provide a system for controlling the power of a hydraulic pump by sensing the force levels.

Another objective of this invention is to provide a system for controlling the power of a hydraulic pump adaptable to many pumping units of various design and function.

These and other objects of the invention will become more apparent to those skilled in the art by reference to the following detailed description when viewed in light of the accompanying diagrammatic-schematic drawing representing one embodiment of the invention.

Referring now to the drawing wherein like elements indicate like parts, numeral **10** indicates the system of this invention. A pump **12** of a variable delivery type is used within the system. The output from pump **12** is delivered to a motor or load represented by the numeral **14**. The pump **12** can be of the variable delivery type taught by my copending application 20,875, now U.S. Pat. No. 3,679,328, filed Mar. 27, 1970 which is a continuation of abandoned application U.S. Pat. No. 738,050 filed June 18, 1968, which in turn is a continuation-in-part application of abandoned application U.S. Pat. No. 660,507 filed Aug. 14, 1967. In a pump of that construction, fluid output is variable to a sensing pressure communicated to the interior of the pump through a conduit **62**. The conduit **62** as represented in the drawings of this invention corresponds to the conduit **62** of the above-mentioned copending application.

The pump **12** is of a type having a swash plate **20** driven by a power shaft **22**. Rotation of the swash plate reciprocates a plurality of circularly arranged pistons **24** in the manner well known to the art. The shaft **22** is keyed to the swash plate via the key **25**. The piston thrust loads are taken by the bearing assembly **26** which is disposed between the swash plate and the end plate **28** of the pump. An annular plate **30** is disposed between the roller bearing members **32** of the bearing assembly and the interior surface **34** of the end plate **28**. A recess **36** is formed in the surface **34** of the end plate **28**. This recess (or recesses if desired) is communicated to a conduit **40** via a passageway means **42**. The plate **30** covers the recess **36**.

The drive shaft **22** is rotated by an external power source such as an electric or internal combustion engine. As the swash plate **20** is turned the pistons **24** are reciprocated through their intake and discharge strokes. The fluid source for the pistons is delivered to the pump assembly via the intake port **44**. The intake chamber **45** is generally at reservoir pressures.

Disposed along the conduit **40** in that portion indicated as **40a**, between the fluid source S and the passageway **42**, is a fluid restrictor element **46**. Disposed along conduit portion **40b** is an adjustable valve member **52** which is communicated to tank via conduit portion **40c**. As can be seen in the drawing, line **62** senses the pressure in conduit element **40c** which extends between valve **52** and tank. An orifice **49** is disposed between point of junction of lines **62** and conduit element **40c** and tank. The orifice **49** may be an independent element or, in some pump arrangement, the existing leakage paths can be utilized for these purposes. As hereinafter described, the system will adjust the output of the pump to limit the load to a predetermined value which may be fixed or adjusted.

In operation, the source of fluid S is applied to conduit system **40**. The leakage of fluid through passageway **42** and recesses **36** to tank pressures in intake chamber **45**, is limited by the degree of restriction imposed by plate **28**. The pressures the pistons exert against the swash plate **20** will be directly proportioned to the degree of restriction the plate **28** exerts. In other words, a hydrostatic pressure cell variable with thrust loads is provided which varies flow in the conduit system **40** in response to thrust force.

The valve **52** in conduit portion **40b** is set open at a predetermined pressure which can be regulated or constant as required by the system involved. The valve **52** is a means for adjusting the torque input level on the pump inlet shaft; it being understood that the thrust forces of the pistons acting on the swash plate are converted to shaft torque. The valve **52** is set to open at predetermined levels to thereby bypass (via a control signal through passageway **62**) the pumping chambers decreasing the piston thrust forces and the pump output. As fluid passes through the valve member, pressure will rise in conduit **62** which reduces the output of the pump in the manner known in the art. This will continue until the flow in conduit **40** is reduced.

Pressure in conduit portion **40c** will fall as fluid escapes to tank through orifice **49**. This causes the output of pump **12** to increase until a state of balance is achieved. As will be understood by those skilled in the art, the mechanism by which the delivery pump is made variable can be easily adapted for use with this system.

The system can be easily modified to vary the output of many know types of pumps. For instance, with a small modification to translate hydraulic pressures or flow to proportional mechanical movements, the system is adaptable for use with the U.S. Pat. Re. No. 25,298 issued to Stewart. In other words, the system is not limited to the particular variable control mechanism used by different pumping units. An essential part of the invention is that the load is sensed relative to the thrust forces absorbed by the pumps and these force levels are used to vary pump output.

In a general manner, while there has been disclosed an effective and efficient embodiment of the invention, it should be well understood that the invention is not limited to such an embodiment as there might be changes made in the arrangement, disposition, and form of the parts without departing from the principles of the invention herein described.

I claim:

1. A hydraulic pump system comprising

a pump housing having one or more fluid inlet passages and one or more fluid output passages,

pumping members between said passages for delivering fluid to said output passages at greater pressures than exist at said inlet passages,

first means for varying the fluid output from said pumping members,

bearing means within said pump for carrying at least a portion of the forces developed by said pumping members,

a source of control fluid under pressure communicated to said bearing means, and

second means for generating an output signal through said control fluid in response to the level of said forces applied to said bearing means,

said first means being responsive to said output signal to vary the fluid output from said pumping members.

2. The system of claim 1 wherein said control fluid is hydraulic fluid.

3. The system of claim 1 wherein said pumping members are pistons riding on a swash plate assembly, said bearing means are located between said assembly and said housing and said output signal is generated responsive to the force level between said swash plate means and said housing.

4. A hydraulic pumping system including a pump having a control means for adjusting the fluid output therefrom in response to hydraulic, signals, the improvement comprising:

bearing means within said pump,

a source of fluid flow,

first means to vary said flow in response to thrust force levels in said bearing means,

second means detecting the variations in fluid flow and adjusting said control means in accordance therewith.

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