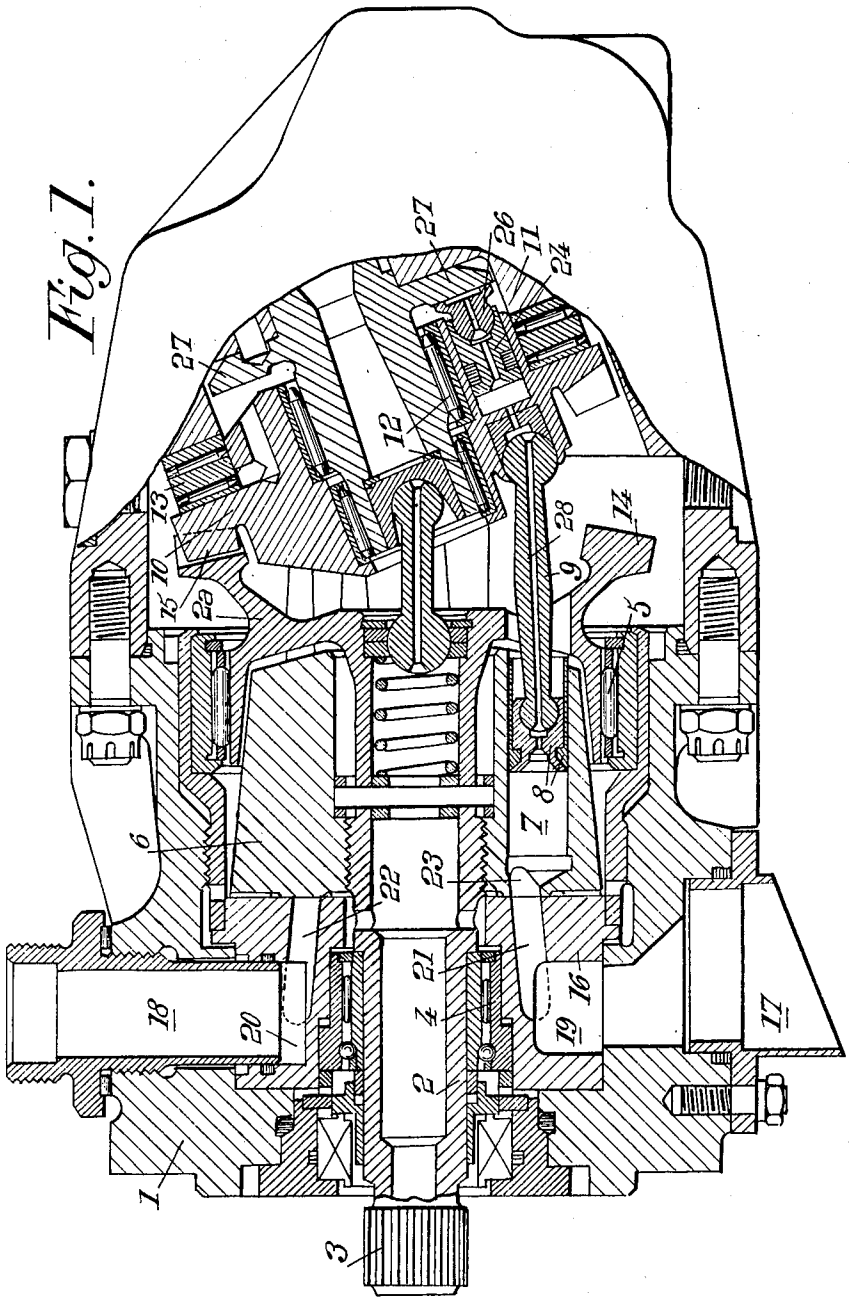
March 1, 1966 M. R. SCHOTT 3,237,570

HYDRAULIC MACHINES OF THE BARREL AND SWASH PLATE TYPE

Filed March 3, 1964 2 Sheets-Sheet 1

Fig. 1.

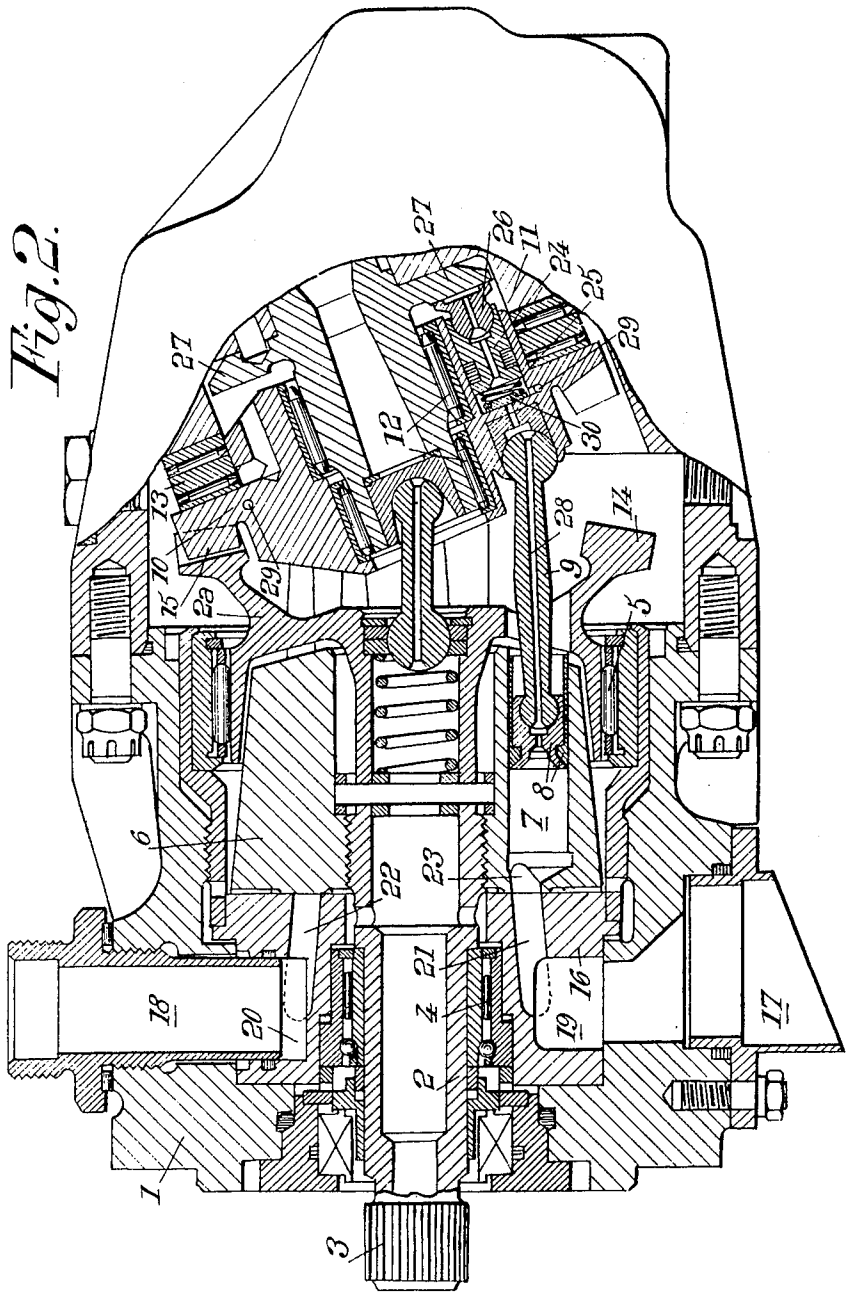


March 1, 1966 M. R. SCHOTT 3,237,570

HYDRAULIC MACHINES OF THE BARREL AND SWASH PLATE TYPE

Filed March 3, 1964 2 Sheets-Sheet 2

Fig. 2.



United States Patent Office

3,237,570

Patented Mar. 1, 1966

3,237,570

HYDRAULIC MACHINES OF THE BARREL AND SWASH PLATE TYPE

Marcel René Schott, Colombes, France, assignor to Societe d'Exploitation des Materiels Hispano-Suiza, Bois-Colombes (Seine), France, a society of France

Filed Mar. 3, 1964, Ser. No. 348,973
Claims priority, application France, Mar. 12, 1963, 927,689
3 Claims. (Cl. 103—162)

The present invention relates to machines wherein pistons reciprocating in respective parallel cylinders provided in a barrel are connected through respective rods with a swash plate rotating in synchronism with said barrel. The invention is more particularly concerned with hydraulic pumps of this type, especially for transmission liquids.

The chief object of this invention is to provide a machine of this kind which is better adapted to meet the requirements of practice, in particular concerning the duration of life thereof.

In a machine of the type with which the present invention is concerned, the swash plate bears, through a thrust bearing, upon a cam support having its axis inclined with respect to the axis about which the barrel is journalled.

Now, according to the present invention, on the one hand the swash plate is provided with a plurality of cylinders parallel to its axis and in which are fitted pistons each bearing, through a respective member, on a circular track rigid with the cam support and coaxial therewith and on the other hand, there is provided, during at least a portion of every revolution of the barrel, in each of the last mentioned cylinders, a hydraulic pressure which is transmitted, through the corresponding piston, to said track so as to relieve the thrust bearing through which the swash plate is mounted on the cam support.

Preferred embodiments of the present invention will be hereinafter described with reference to the appended drawing, given merely by way of example, and in which:

FIG. 1 is an elevational view, partly in axial section, of a hydraulic barrel pump made according to a first embodiment of the invention;

FIG. 2 is a view similar to FIG. 1 but showing a second embodiment of the invention.

A liquidtight casing **1** carries, journalled therein, a driving shaft **2** one end of which projects from said casing and carries a driving pinion **3**. The other end of shaft **2** forms a head **2***a*. Driving shaft **2** is carried by bearings **4** and **5**.

On driving shaft **2** there is rigidly mounted a barrel **6** provided with a plurality of cylinders **7** distributed about shaft **2** and parallel to the axis thereof.

In these cylinders **7** are fitted pistons **8** linked through connecting rods **9** with a swash plate **10** the axis of which is oblique with respect to barrel **6**. Swash plate **10** bears upon a cam support **11** the axis of which coincides with that of swash plate **10**. Between swash plate **10** and cam **11** are provided a guiding bearing **12** and a thrust bearing **13**.

Coupling means are provided for causing barrel **6** and swash plate **10** to turn in synchronism with each other. For this purpose the head **2***a* of driving shaft **2** and swash plate **10** carry, fixed thereto, two gears **14** and **15**, respectively, these two gears having the same number of teeth and forming a bevel coupling.

The pump further includes distributing means comprising a fixed valve **16** cooperating with a suction conduit **17** and a delivery conduit **18** in communication with valve chambers **19** and **20** respectively. Chamber **19** is provided with an inlet port **21** extending along a circular arc. Chamber **20** is similarly provided with a

port **22** extending along a circular arc and located in opposition to port **21**. These two ports **21** and **22** are disposed opposite the path of travel of the end walls of cylinders **7** during the rotation of barrel **6**. The end wall of every cylinder **7** is provided with a passage **23** so that every cylinder is in communication, during a complete revolution of the barrel, successively with inlet port **21** and delivery port **22**.

If the pump were made as described up to now the whole pressure exerted on pistons **8** during the delivery stroke thereof would be transmitted through connecting rods **9** and swash plate **10**, to the thrust bearing **13** interposed between said swash plate and cam support **11**.

It will be understood that it is of interest, in order to increase the life of thrust bearing **13**, to relieve it at least partly from the thrust exerted by the pistons during the delivery strokes thereof.

The object of the present invention is to permit such a relief action.

For this purpose, according to the present invention:

On the one hand, swash plate **10** carries a plurality (for instance a number equal to that of the pump pistons **8**) of cylinders **25** having their axes parallel to the axis of said plate **10**, in which cylinders are slidably fitted pistons **24** bearing each, through a shoe **26** joined therewith, on a circular track **27** carried by cam support **11**.

On the other hand, means are provided for exerting, at least during a portion of every barrel revolution, in each of the cylinders **25** a hydraulic pressure which, through a corresponding piston **24**, applies against track **27** the shoe **26** carried by said piston in such manner as to reduce the effort applied to thrust bearing **13**.

Preferably, as shown, the liquid in cylinders **25** is supplied by the delivery of the pump.

In a first embodiment of the invention, illustrated by FIG. 1, this compensating pressure is formed only in the cylinders **25** that are located in positions where they are connected to pump pistons **8** working on their delivery strokes. Of course all the cylinders **25** are successively placed under pressure during one revolution of barrel **6** and swash plate **10**.

It will be supposed that the number of cylinders **25** is equal to the number of cylinders **7**. Every cylinder **25** is located opposite the point of fixation of a connecting rod **9** to swash plate **10**. There is provided, in the piston **8** corresponding to a connecting rod, in said connecting rod and in swash plate **10**, a continuous passage **28** connecting the pump cylinder **7** corresponding to said piston **8** with the cylinder **25** that is considered.

Thus when cylinder **7** and the corresponding piston **8** move with respect to each other to produce a delivery stroke, and during the whole of this stroke, the delivery pressure of the pump will be transmitted to the inside of this cylinder **25**, thus relieving the corresponding portion of thrust bearing **13**.

It will be understood that such a compensated system has the advantage of producing a relief directly proportional to the load to be compensated.

According to another embodiment of the invention, illustrated by FIG. 2, it is desired to obtain a constant balancing of the efforts exerted on swash plate **10**. In this case instead of leaving compensated cylinders **25** separate from one another, these cylinders are connected together by a conduit **29** and the respective conduits leading into said cylinders are fitted with check valves **30** preventing an outflow of liquid from the cylinders **25** that is considered when it is connected with inlet port **21**.

In a general manner, while the above description discloses what are deemed to be practical and efficient embodiments of the present invention, said invention is not

limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the invention as comprehended within the scope of the appended claims.

What I claim is:

1. A hydraulic machine which comprises, in combination,

a fixed casing,

a barrel journalled in said casing about a first axis, said barrel forming a plurality of first cylinders parallel to said axis and distributed about it,

a plurality of first pistons fitting slidably in said cylinders, respectively,

a cam mounted in said casing, said cam being of revolution about a second axis intersecting said first axis,

a swash member pivotally mounted on said cam about said second axis,

a thrust bearing between said swash member and said cam,

cooperating gear means carried by said barrel and said swash member for causing them to rotate about said first arm and said second axis, respectively, with the same respective speeds of revolution,

a plurality of links each pivoted at one end to one of said pistons and at the other end to said swash member at a point thereof located in the plane passing through said point of intersection and perpendicular to said second axis,

a fixed valve member in said casing adjacent said barrel and provided with a suction chamber and a delivery chamber,

said valve member having a surface of revolution about said first axis and said barrel having a surface identical to said valve member surface and slidable thereon, said cylinders opening into said barrel surface, and said valve member being provided with ports opening into said valve member surface and communicating with said suction chamber and said delivery chamber, respectively,

said swash member being provided with a plurality of second cylinders formed therein parallel to said second axis and distributed about it,

a plurality of second pistons fitting slidably in said second cylinders, respectively,

a circular track fixed with respect to said cam and coaxial therewith,

a member swivelled to each of said second pistons respectively and bearing slidably on said track,

and means for supplying a fluid under pressure into the spaces, between said second cylinders and the respective second pistons fitting slidably therein, located on the other sides of said second pistons from said track for at least those of said second cylinders that are nearest to said barrel, whereby the forces applied on said thrust bearing are reduced.

2. A hydraulic machine which comprises, in combination,

a fixed casing,

a barrel journalled in said casing about a first axis, said barrel forming a plurality of first cylinders parallel to said axis and distributed about it in respective radial planes at equal angular intervals from one another,

a plurality of first pistons fitting slidably in said cylinders, respectively,

a cam mounted in said casing, said cam being of revolution about a second axis intersecting said first axis,

a swash member pivotally mounted on said cam about said second axis,

a thrust bearing between said swash member and said cam,

cooperating gear means carried by said barrel and said swash member for causing them to rotate about said first arm and said second axis, respectively, with the same respective speeds of revolution,

a plurality of links each swivelled at one end in one of said pistons and at the other end in said swash member about a point thereof located in the plane passing through said point of intersection and perpendicular to said second axis,

a fixed valve member in said casing adjacent said barrel and provided with a suction chamber and a delivery chamber,

said valve member having a surface of revolution about said first axis and said barrel having a surface identical to said valve member surface and slidable thereon, said cylinders opening into said barrel surface and said valve member being provided with ports opening into said valve member surface and communicating with said suction chamber and said delivery chamber, respectively,

said swash member being provided with a plurality of second cylinders formed therein parallel of said second axis and distributed about it in respective radial planes at equal angular intervals from one another, the number of said second cylinders being equal to that of said first cylinders and every second cylinder being located at least substantially opposite one first cylinder, respectively,

a plurality of second pistons fitting slidably in said second cylinders, respectively,

a circular track fixed with respect to said cam and coaxial therewith,

and a member swivelled to each of said second pistons respectively and bearing slidably on said track,

each of said links being provided with an axial conduit extending throughout it and communicating with the chamber, between the corresponding second cylinder and the respective second piston, located on the other side of said second piston from said track, whereby the forces applied on said thrust bearing are reduced.

3. A hydraulic machine which comprises, in combination,

a fixed casing,

a barrel journalled in said casing about a first axis, said barrel forming a plurality of first cylinders parallel to said axis and distributed about it in respective radial planes at equal angular intervals from one another,

a plurality of first pistons fitting slidably in said cylinders, respectively,

a cam mounted in said casing, said cam being of revolution about a second axis intersecting said first axis,

a swash member pivotally mounted on said cam about said second axis,

a thrust bearing between said swash member and said cam,

cooperating gear means carried by said barrel and said swash member for causing them to rotate about said first arm and said second axis, respectively, with the same respective speeds of revoltuion,

a plurality of links each swivelled at one end in one of said pistons and at the other end in said swash member about a point thereof located in the plane passing through said point of intersection and perpendicular to said second axis,

said swash member being provided with a plurality of swivel sockets to accommodate said other ends of said links,

a fixed valve member in said casing adjacent said barrel and provided with a suction chamber and a delivery chamber,

said valve member having a surface of revolution about said first axis and said barrel having a surface identical to said valve member surface and slidable thereon, said cylinders opening into said barrel surface and said valve member being provided with ports opening into said valve member surface and communicating with said suction chamber and said delivery chamber, respectively,

said swash member being provided with a plurality of second cylinders formed therein parallel to said second axis and distributed about it in respective radial planes at equal angular intervals from one another, the number of said second cylinders being equal to that of said first cylinders and every second cylinder being located at least substantially opposite one first cylinder, respectively,

a plurality of second pistons fitting slidably in said second cylinders, respectively,

a circular track fixed with respect to said cam and coaxial therewith,

a member swivelled to each of said second pistons respectively and bearing slidably on said track,

each of said links being provided with an axial conduit extending throughout it, said swash member being provided with passages extending between said swivel sockets and the chambers, between said second cylinders and the respective second pistons, located on the other sides of said second pistons from said track, and check valves in said second cylinders for controlling said passages to permit only the flow of liquid from said swivel sockets toward said chambers, said swash member being provided with a conduit interconnecting all of said chambers, whereby the forces applied on said thrust bearing are reduced.

References Cited by the Examiner

UNITED STATES PATENTS

2,155,455	4/1939	Thoma	103—162
2,661,701	12/1953	Ferris	103—162
3,076,345	2/1963	Leclercq	103—162
3,188,963	6/1965	Tyler	103—162

SAMUEL LEVINE, *Primary Examiner.*