C. E. PAINE.

HYDRAULIC POWER TRANSMISSION.

APPLICATION FILED JUNE 14, 1920.

1,373,568.

Patented Apr. 5, 1921.

2 SHEETS—SHEET 1.

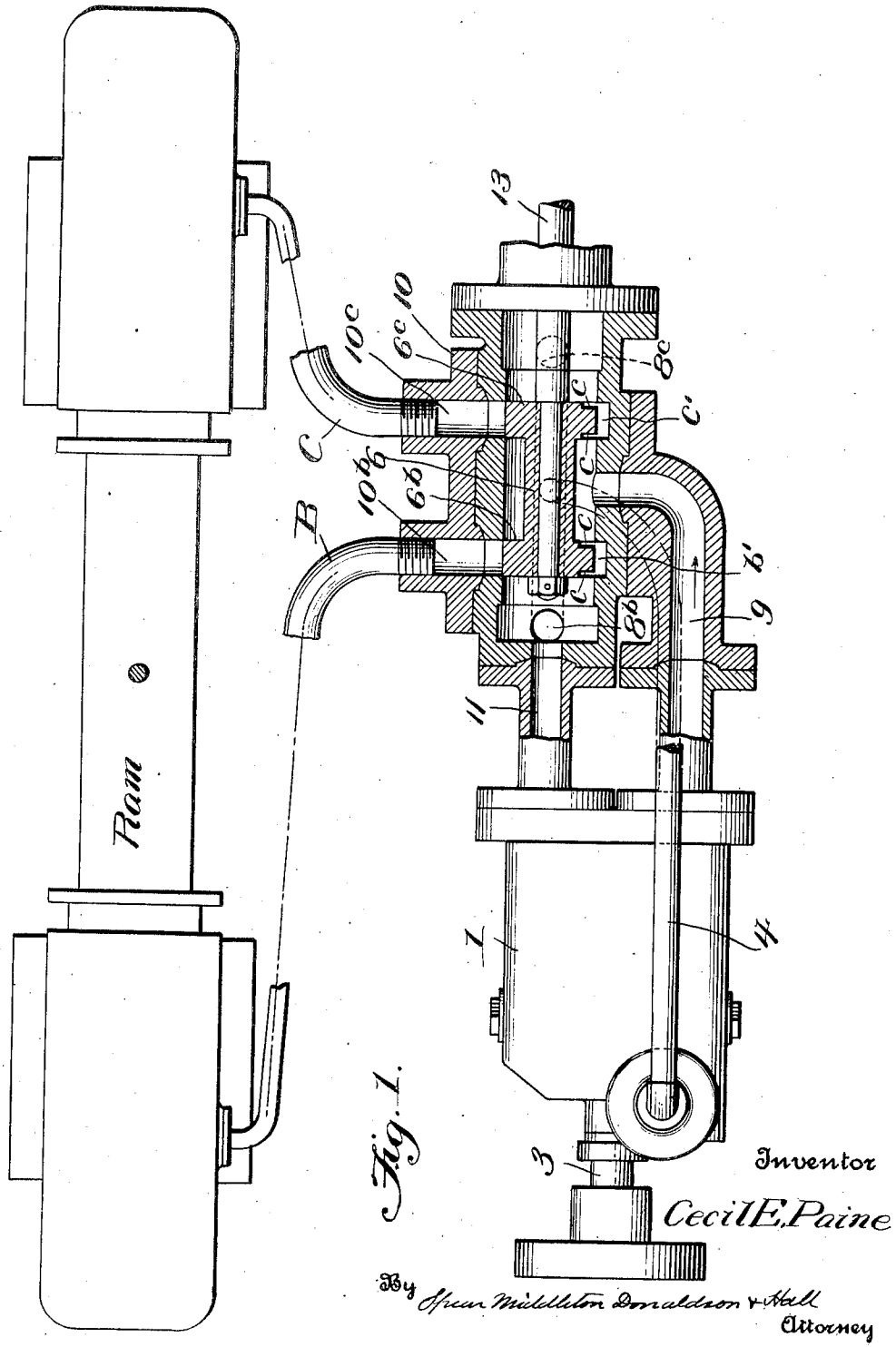


Fig. 1.

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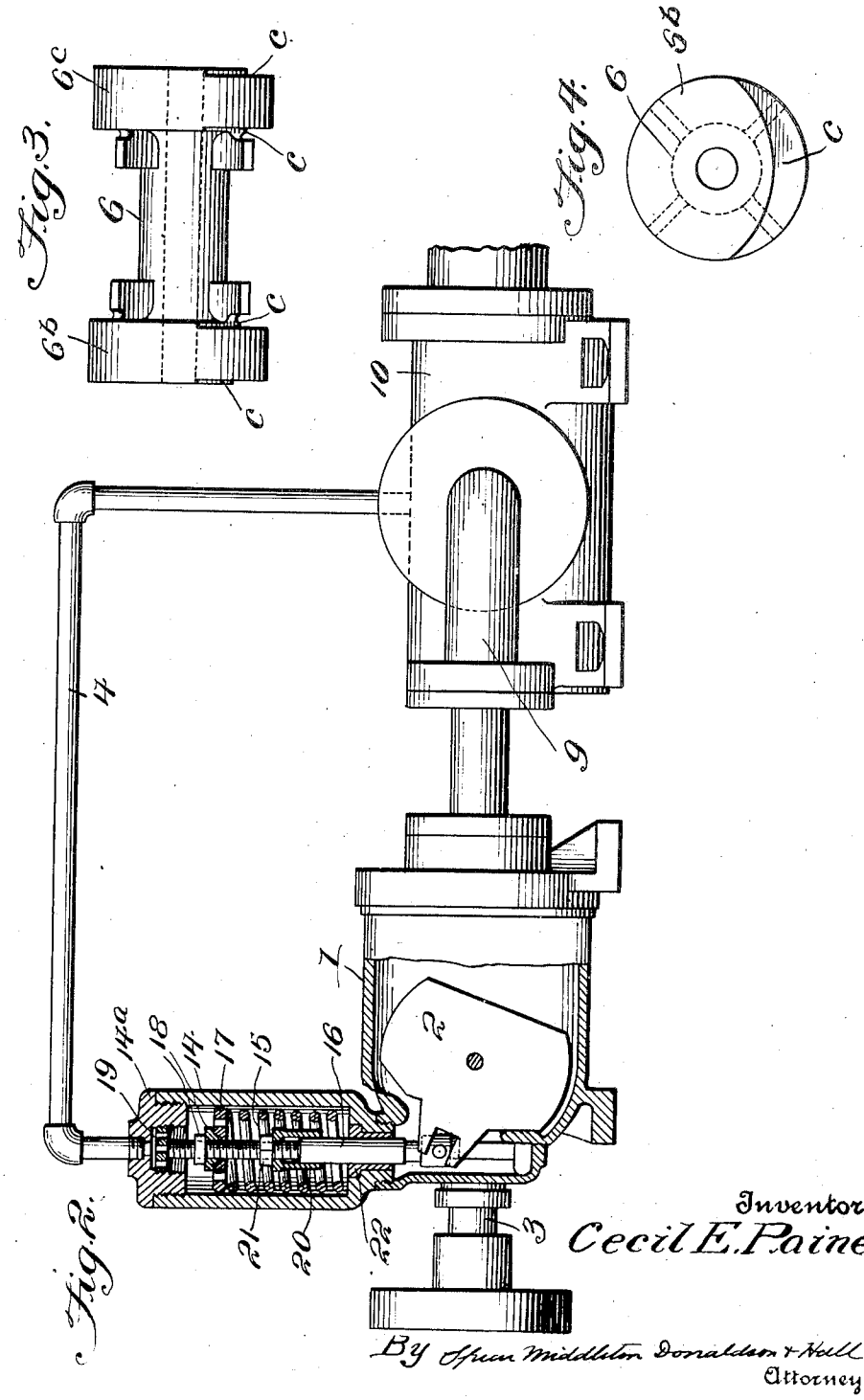
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UNITED STATES PATENT OFFICE.

CECIL E. PAINE, OF BATH, MAINE.

HYDRAULIC POWER TRANSMISSION.

1,373,568. Specification of Letters Patent. Patented Apr. 5, 1921.

Application filed June 14, 1920. Serial No. 388,930.

To all whom it may concern:

Be it known that I, CECIL E. PAINE, a citizen of the United States, and resident of Bath, Maine, have invented certain new and useful Improvements in Hydraulic Power Transmissions, of which the following is a specification.

My present invention relates to improvements in power transmitting means of the fluid type and is designed more especially for use in connection with apparatus for steering ships, though not limited to such use, the invention being in fact an improvement upon the apparatus disclosed in Letters Patent of the United States granted to me on the 8th day of July, 1919, No. 1,309,076.

The invention aims to provide a simple, economical, durable and efficient form of apparatus in which a non-reversible pump may be used to secure movements of the part to be moved in either of two directions, and in which, while the part to be moved is held stationary, with the control valve closed, there will be practically no pressure on the oil or other liquid which would tend to heat the same.

The invention also aims to provide a construction in which upon movement of the controlling valve the full force of the pump will be instantly available and which will be automatically responsive to reduce the pressure to a degree commensurate with the resistance offered, and the stroke of the pump reduced to zero when the maximum resistance for which the apparatus is adjusted, is encountered.

With these and other objects in view the invention includes the novel features of construction and arrangement and combination of parts hereinafter described and particularly defined by the appended claims.

An embodiment of my invention is illustrated in the accompanying drawings, in which:

Figure 1 is a plan view, partly in section.

Fig. 2 is a sectional elevation.

Fig. 3 is a side elevation of the reversing valve, and

Fig. 4 is an end view thereof.

Referring by reference characters to this drawing, the numeral 1 designates the casing of a suitable variable stroke non-reversing pump having means for varying the stroke of the pump in the manner well understood by those skilled in the art. The pump is illustrated conventionally and I have selected as a convenient type of pump one having a tilting head, the rocking of which in the proper direction will vary the pump action from zero to maximum and vice versa, such tilting head being indicated at 2.

The pump is provided with an operating shaft 3 which is designed to be coupled to any suitable continuously running and non-reversible prime mover (not shown). The forcing or delivery and suction sides of the pump are connected by flow and return pipes 9 and 11 with a valve casing 10 which has an interior valve chamber preferably of cylindrical form within which is located the spool-shaped reversing valve 6. The delivery pipe 9 is connected with the central portion of the valve chamber so as to be in communication with the annular space formed around the reversing valve between the heads 6^b, 6^c thereof, while the return pipe 11 is connected with the ends of said valve chamber.

The pipe 11 may conveniently be connected directly to one end of the valve chamber as shown in Fig. 1, and this end of the chamber placed in communication with the opposite end by a passage indicated by dotted lines Fig. 1 the end ports being shown at 8^b—8^c.

The valve casing is provided with ports 10^b and 10^c which are designed to be connected by pipes B and C with the opposite sides of the reversible motor or ram to which movement is to be imparted such for example as a rudder operating ram indicated conventionally in the drawings and designated "Ram." The ports 10^b and 10^c are located in such position that when the reversing valve is in neutral position, as shown in Fig. 1, the heads 6^b and 6^c aline respectively with the ports 10^b and 10^c and the relative dimensions are such that in this position the flow of oil or other liquid to and from the pipes B and C is cut off.

When, therefore, the reversing valve is in such neutral position the fluid will be shut up or confined in the pipes B and C and the ram and the movable element of the ram is therefore locked against movement, which, in the case of a rudder actuating ram would result in the rudder being held immovable.

By-passes b' and c' are provided in con-

nection with the heads 6^b and 6^c of the valve, which, when the valve is in neutral position place the central portion of the valve chamber, and the end portions in communication, and hence the delivery pipe 9 in unobstructed communication with the ends of the valve chamber and therefore with the return or suction pipe 11.

The liquid is therefore free to circulate freely through the pump and valve chamber and connecting pipes, without any appreciable pressure thereon so that there is no tendency for it to heat up, and the pump can be run continuously at maximum speed with no detrimental effects such as the heating above referred to and without any danger of stalling the motor.

The valve is provided with a valve stem extending through one end of the valve casing as indicated at 13, which stem may be connected with any suitable operating mechanism, such as shown for example in my prior patent aforesaid.

The by-passes b' and c' are so arranged that movement of the valve in either direction to open the ports 10^b and 10^c instantly closes both by-passes. This may be conveniently accomplished by providing the heads 6^b and 6^c with crescent shaped reduced or rabbeted portions c and providing corresponding recesses b' and c' in the inner wall of the valve casing.

Thus when the valve is moved in either direction the by-passes are immediately closed and the entire volume of liquid from the pump at maximum flow or pressure is at once directed into one or the other of the ports 10^b and 10^c according to the direction of movement of the valve, the port not so connected being placed in communication with the suction side of the pump.

In order to cut down the flow according to requirements and to prevent the building up of excessive pressure the central or inlet portion of the valve chamber is connected by a pipe 4 with an automatic pump controlling device as follows:

Pipe 4 communicates with a cylinder or chamber 14 secured to the pump casing within which works a reciprocating stem or piston member 16, passing through a suitably packed or bushed opening in the cylinder casing as indicated at 22 and being connected inside said casing with the tilting head of the pump.

A spring 15, bearing at its inner end against the end wall of the casing, and at its outer end against a washer or contact plate or member 17 on the rod or stem 16 tends to press the stem outwardly and tilt the pump head in a direction to cause the pump to give a maximum flow of liquid. As pressure is built up in the cylinder 14 due to the liquid backing up in pipe 4, the tilting head will be swung back toward zero position thus reducing the stroke of the pump to prevent pressure being accumulated beyond the maximum desired.

The pressure of the spring may be adjusted by nuts 18 threaded on the outer portion of the stem against which nuts the member 17 bears.

The maximum output of the pump may be regulated by an adjusting nut 19 threaded into a recess in the end wall or closing cap 14^a of the cylinder 14 and adapted to act as a stop for the outer end of the stem. The limit of inward movement of the stem may be accurately adjusted by an adjusting collar 20 threaded on the stem and locked in position by lock nut 21, said collar contacting against bushing 22 and accurately determining the zero position of the tilting head.

It will be understood that any suitable means may be provided for operating the valve, such for example as shown in my aforesaid patent, such operating means being omitted from the present disclosure as forming *per se* no part of the present invention.

Having thus described my invention what I claim is —

1. In combination, a driven motor, a continuously operable variable stroke pump for supplying motive fluid to operate said motor, a reversing valve for reversing the flow of fluid between the pump and motor, and means for by-passing the liquid around said reversing valve when the latter is in neutral position.

2. In combination, a driven motor, a continuously operable variable stroke pump for supplying motive fluid to operate said motor, a reversing valve for reversing the flow of fluid between the pump and motor, and adapted when in neutral position to cut off flow of fluid to said driven motor, and means for enabling the motive fluid to flow freely from the forcing side to the suction side of said pump when the reversing valve is in said neutral position.

3. In combination, a driven motor, a continuously operable variable stroke pump for supplying motive fluid to operate said motor, a reversing valve for reversing the flow of fluid between the pump and motor, pressure operated means for varying the stroke of the pump to prevent accumulation of excessive pressure and means enabling the motive fluid to flow freely from the discharge to the intake of said pump to eliminate pressure when the valve is in neutral position.

4. In combination, a continuously operable variable stroke pump, a valve casing having a central portion connected with the delivery side of said pump, and end portions connected with the suction side thereof, a driven fluid motor having fluid transmitting connections to said valve casing, a

reversing valve having heads adapted to reverse the connections to said driven motor, said heads in neutral position of the valve cutting off said connections to the driven motor, said heads having rabbeted portions and said valve casing corresponding recesses forming by-passes around the heads of said valve when the latter is in neutral position.

5. In combination, a reversible motor, a continuously operable irreversible pump having a tilting head for varying the stroke of the pump, and provided with connections for supplying fluid to said motor, valve means for reversing said connections and also for cutting off the fluid connections to said motor, and means for passing the liquid freely from the delivery to the suction side of said pump when the valve cuts off the fluid connections to the motor.

In testimony whereof, I affix my signature.

CECIL E. PAINE.