Jan. 2, 1923.

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S. G. WIGELIUS.

CONTROLLING MEANS FOR HYDRAULIC GENERATORS.

FILED JULY 6, 1921.

2 SHEETS-SHEET 1

Fig. 1.

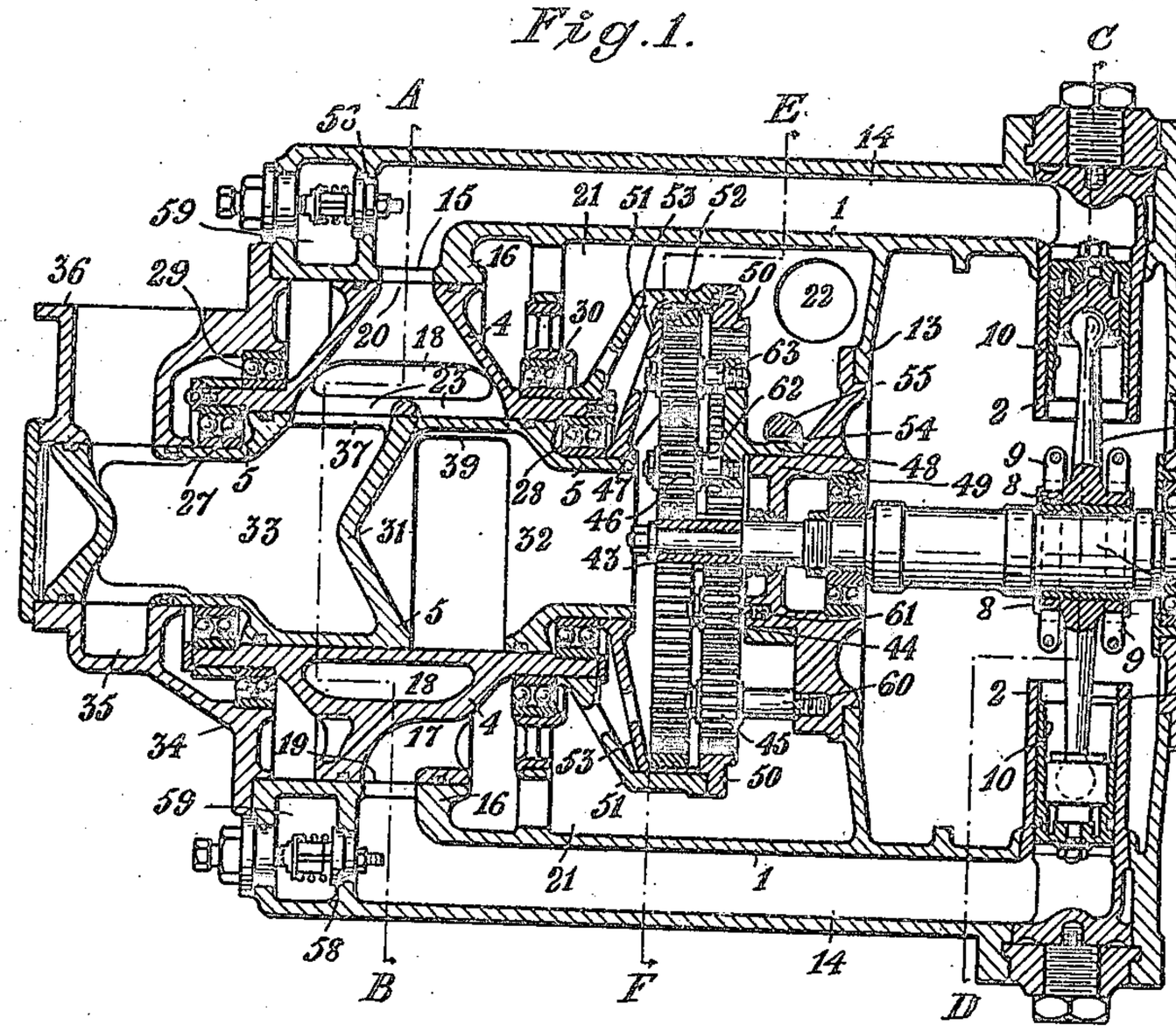
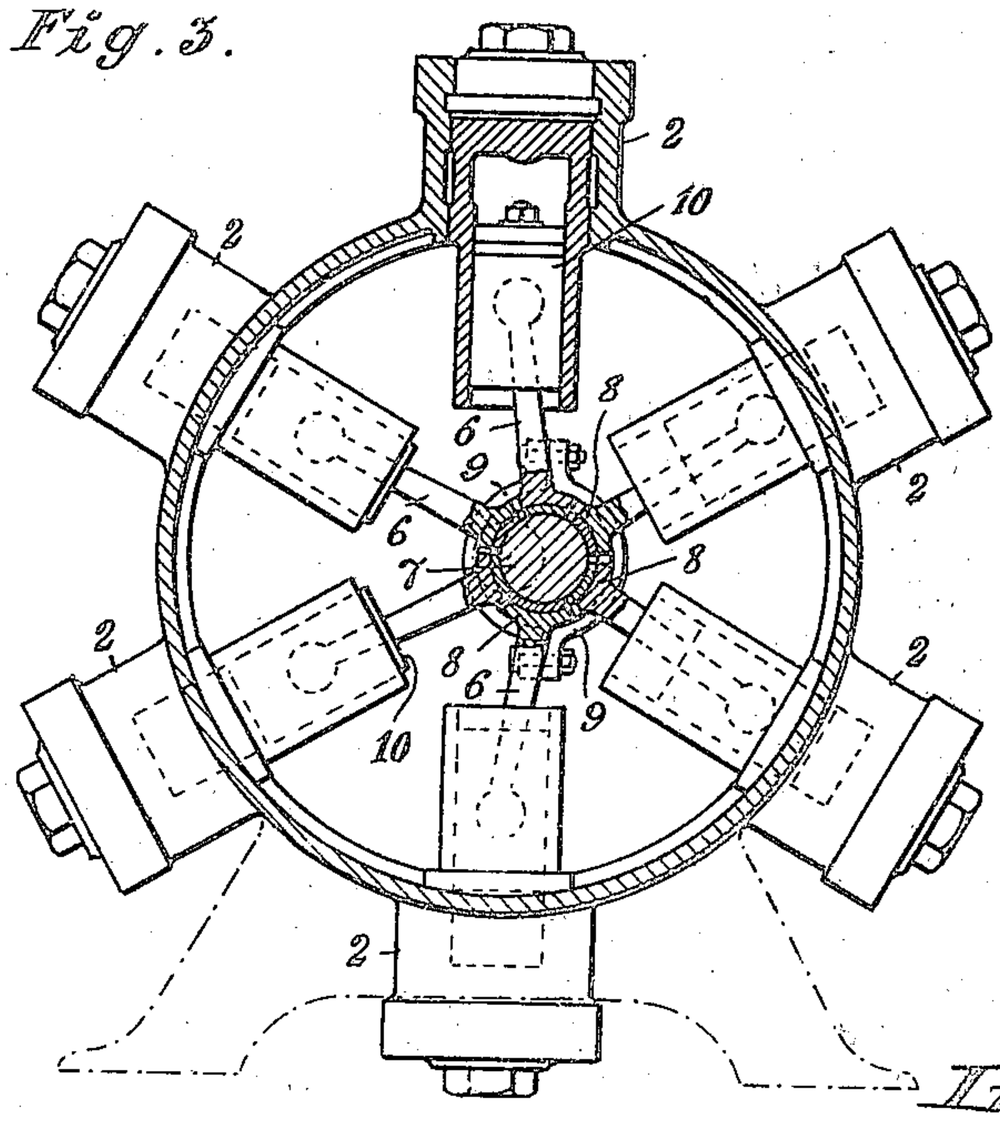


Fig. 3.



Inventor
S. G. Wigelius,
By Marks & Clark
Attys.

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2 SHEETS-SHEET 2

Fig. 2.

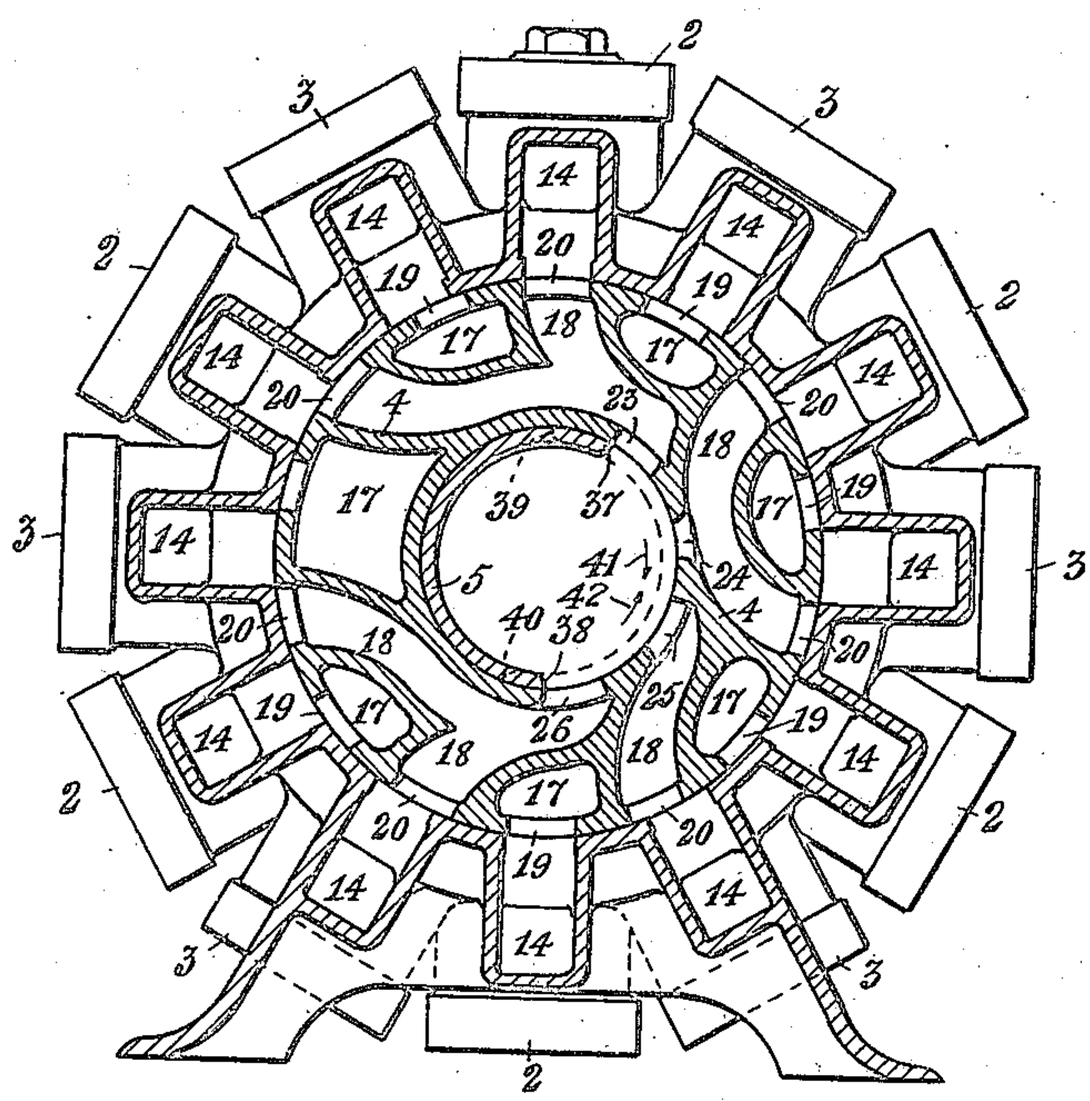
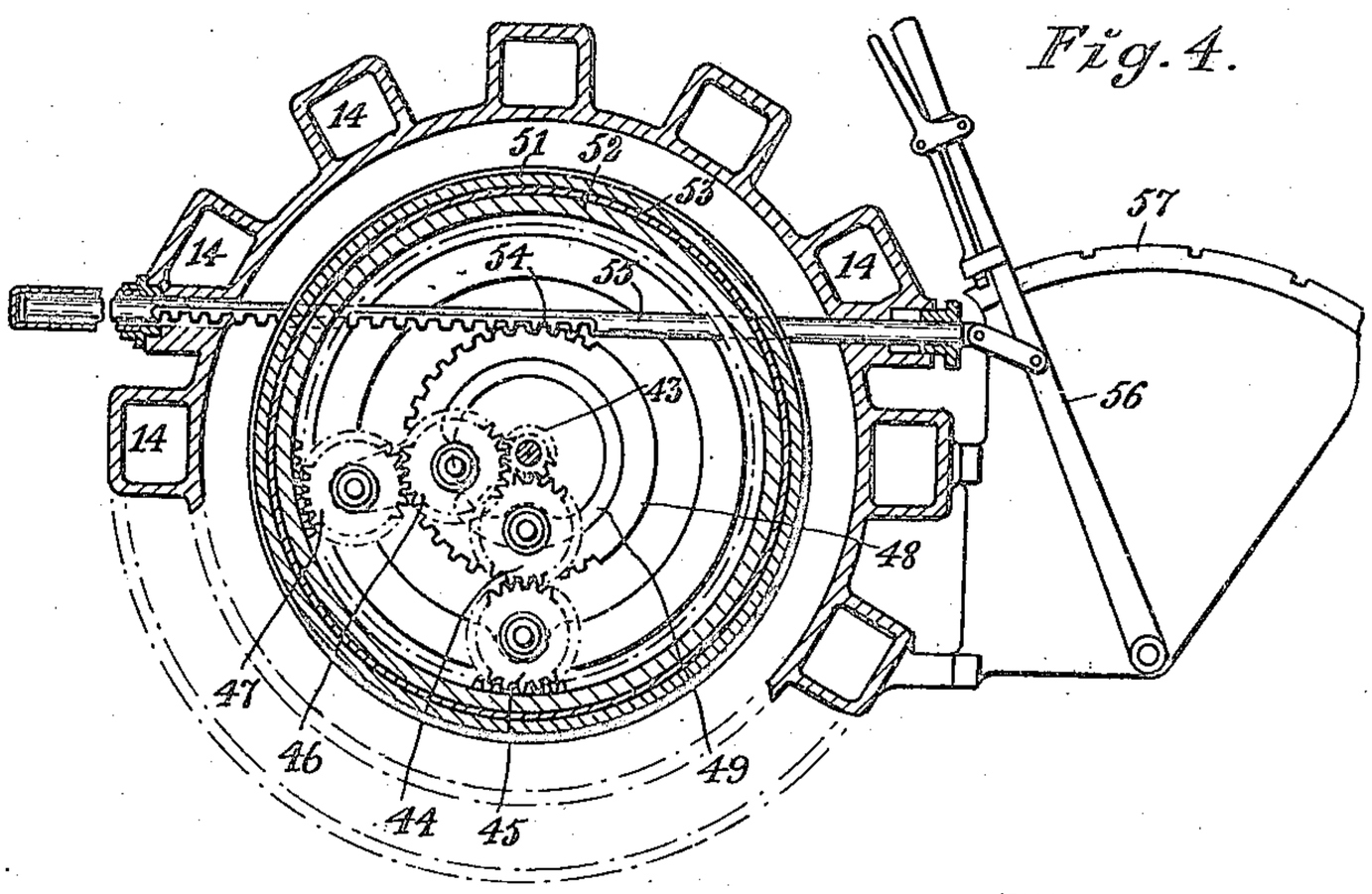


Fig. 4.



Inventor
S. G. Wigelius
By Marks Clark
Attys.

Patented Jan. 2, 1923. 1,440,428

UNITED STATES PATENT OFFICE.

SVEN GUSTAF WIGELIUS, OF GOTTENBORG, SWEDEN, ASSIGNOR TO AKTIEBOLAGET WIGELIUS MOTORER, OF GOTTENBORG, SWEDEN, A CORPORATION.

CONTROLLING MEANS FOR HYDRAULIC GENERATORS.

Application filed July 6, 1921. Serial No. 482,799.

To all whom it may concern:

Be it known that I, SVEN GUSTAF WIGELIUS, subject of the King of Sweden, residing at Gottenborg, Sweden, have invented certain new and useful Improvements in Controlling Means for Hydraulic Generators, of which the following is a specification.

The present invention relates to controlling means for hydraulic generators of the kind which are used in systems of hydraulic power transmissions, and which consist of a plurality of pump- or working cylinders connected to a common pressure piping. The invention more particularly refers to such generators of the said kind, the operation of which is controlled by means of a rotating distributing member which is inserted in the circulating system of the driving liquid and which is driven from the shaft of the generator, the said distributing member during the rotation thereof bringing the cylinders alternately in communication with a pressure chamber or a suction chamber respectively, in accordance with the pistons changing their direction of movement. In generators of this type, the control of the quantity of active liquid supplied by the generator has heretofore been effected by varying the quantity of liquid supplied by each separate pump cylinder, in that part of the liquid coming from the cylinder was caused to circulate within the generator. Such a control, however, could not be satisfactorily effected in a practical manner, owing to throttling actions setting in and causing a material decrease in the efficiency.

According to the present invention, the said drawback is avoided by a controlling member inserted between the distributing member and the common pressure piping, an adjustment of said controlling member causing one or more, or all of the pump cylinders to be rendered inactive, either separately or groupwise, by the respective cylinders being entirely cut off from the pressure piping.

The invention will be described more fully hereinbelow, reference being had to the accompanying drawings, in which Fig. 1 shows a hydraulic generator together with distributing- and controlling members integral therewith. Fig. 2 is a section on line A—B in Fig. 1. Fig. 3 a section on line C—D in Fig. 1, and Fig. 4 a section on line E—F in Fig. 1.

The generator mainly consists of two so called star pumps 2, 3 arranged within a cylindrical casing 1, only one of said pumps being shown in Fig. 1, as at 2, and of a combined distributing- and controlling member 4, 5 in the form of rotary slide-members, all of the said parts being journaled co-axially within the cylinder 1. The construction of the star pumps is clearly disclosed in Fig. 3, which shows one of them. The different pump cylinders 2, which are six in number, are arranged radially with the pitmen 6 connected in known manner with ring-segments 8 sliding on the crank pin 7 and held together by means of clamps 9, the pistons 10 thus operating with a certain displacement in the movement, corresponding to the angle between adjacent cylinders. The cylinders 3 of the other star pump are arranged similarly, but with a displacement of half a pitch with respect to the cylinders 2 of the first star pump, as will be seen from Fig. 2, besides which the crank of this second star pump is displaced 180° relatively to the crank 7. These two cranks are mounted on a shaft 11, Fig. 1, which is driven by the primary motor (not shown) and which is journaled at one end in the one fore plate of the generator casing, and at the other end in an intermediate partition 13. The pumps are single-acting, and their outer ends are in constant communication with pressure passages 14, arranged on the outside of the casing 1 so as to be easily accessible, and to afford an effective cooling of the driving liquid. The passages lead into rectangular or preferably circular openings 15 arranged in a portion 16 of the wall 1 forming a fluid-tight bearing surface for the rotating distributing slide 4. The latter consists of a ring provided with suction- and pressure passages 17 and 18 respectively, which are successively brought in communication, through the openings 19 and 20 respectively with the openings 15 in the wall 1 during the rotation of the distributing member. The suction passages 17 open at the side of the distributing slide into a space 21 enclosed between the partition 13 and the slides 4, 5, the outer suction piping 22 leading into the said space 21 (see Fig. 1.) The pressure passages 18 open into openings 23, 24, 25, 26, 27 (Fig. 2) on the inside of the distributing slide, the said openings being controlled by the controlling slide 5 arranged concentri-

cally within the distributing slide 4. Slide 5 is journaled in the distributing slide 4 by means of ball bearings 28, and the distributing slide 4 is, in turn, journaled in the casing 1 by means of ball bearings 29. The controlling slide 5 is divided by means of a partition 31 into a suction chamber 32 communicating at one end of the slide with the space 21, and a pressure chamber 33 communicating at the opposite end of the slide with annular passages 35 arranged in the end wall 34, the said passages communicating with a pipe socket 36 to which the common outer pressure piping 30 is connected. On either side of the partition 31 the controlling slide is provided with recesses in the cylindrical wall which recesses are so arranged between guiding edges 37, 38 and 39, 40 respectively, Fig. 2, that the openings 23, 24, 25, 26, 27 in the distributing slide will be successively covered by the edge 37 and uncovered by the edge 39 on rotating the slide in the direction of the arrow 41, whereby the corresponding pressure passages 18 will be successively cut off from the pressure chamber 33 in the slide and instead brought in communication with the suction chamber 32. On rotating the controlling slide 5 in the direction of the arrow 42, the shifting is taking place in the opposite order at the guiding edges 38 and 40. The openings 23 may be made common for a plurality of pressure passages 18 in the distributing slide, so that the shifting of these passages is taking place in groups comprising two or more passages. In the example shown, each of the openings 23, 24 and 26 is common for two passages 18, while the opening 25 is in communication with only one passage 18.

The adjustment of the controlling slide 5 with respect to the distributing slide 4 is effected by means of a system of gear wheels 43, 44, 45, 46, 47 (Figs. 1 and 4) engaging with one another, the said wheels forming at the same time a gearing for the transmission of motion from shaft 11 to the slides 4, 5. The gear wheel 43 is secured to the end of the shaft 11, whereas the gear wheels 44 and 45 are mounted on studs 60 and 61 rigidly attached in the partition 13, and the gear wheels 46 and 47 on studs 62 and 63 attached to a ring 48 which is rotatably mounted on a cylindrical flange 49 projecting from the said partition. Moreover, gear 45 engages with a toothed rim 50 arranged on a part 51 which is rigidly connected with the distributing slide 4, and gear 47 engages with a toothed rim 52 arranged on a part 53 which is rigidly connected with the controlling slide 5. The gear wheels 44, 45, 46, 47 being of the same size, the two slides 4 and 5 will be driven at the same speed from shaft 11, it being assumed that the ring 48 is secured in a certain position, the ratio between the number of revolutions of the shaft 11 and the slides being so selected with regard to the control, that a whole revolution of shaft 11 corresponds to a peripheral movement of the distributing slide equivalent to the distance between two consecutive suction openings 19 and pressure openings 20 respectively. The ring 48 is provided with a toothed rim 54 engaging with a toothed rack 55 mounted for reciprocation in the casing 1 of the generator, Fig. 4, the said rack being connected, with an operating lever 56 which may be secured in known manner in various positions on a slotted bar segment 57. By the adjustment of the operating lever 56, the gear wheels 46, 47 evidently may be adjusted and secured in different positions during the operation of the generator, the controlling slide being then brought along and adjusted in corresponding positions relatively to the distributing slide.

The mode of operation is as follows: When the distributing slide 4 holds the position shown in Fig. 2, the piston of the uppermost cylinder 2 is at the end of its compression stroke. It is assumed that the generator rotates in the direction indicated by the arrow 41, Figs. 2 and 3, the slides 4, 5 then rotating in the direction of the arrow 42. In the said position of the distributing slide, the passage 14 is shut off entirely. On the piston reversing its direction and commencing its suction stroke, communication is being established by degrees with the suction passage 17, and when the piston passes the centre position of its suction stroke, the opening 19 registers with the opening 15. Thus, the connection between the said two pressure passages is complete, when the piston has its greatest speed. On the piston reaching its innermost position, the passage 14 is again shut off entirely, and when the piston on reversing its direction commences its pressure stroke, the passage 14 is again brought in communication with the next pressure passage 18 in the distributing slide. The control of the remaining cylinders is effected in the same manner, but with a time interval corresponding to the angular displacement of the cylinders.

Assuming that the controlling slide has the relative position disclosed in Fig. 2, the whole quantity of liquid pumped by all of the cylinders, will be forced through the openings 23, 24, 25, 26, 27 into the pressure chamber 33 in the controlling slide and thence into the outer pressure piping. If the controlling slide 5 is adjusted so that the opening 23 is shut off from the pressure chamber 33 and brought in communication with the suction chamber 32, two cylinders will evidently be shut off from the pressure chamber 33 during the pressure stroke, that

is to say each cylinder will be shut off periodically from the said pressure chamber during two consecutive pressure strokes, this being repeated once for every revolution of the controlling slide 5. The result of this is that the total quantity of outgoing active liquid is reduced by a quantity corresponding to the quantity of liquid supplied by two cylinders. In like manner, the active quantity of liquid may be further reduced by a continued rotation of the slide 5. If the slide 5 has been rotated so that all of the openings 23, 24, 25, 26, 27 have been shut off from the pressure chamber 33 and instead put in communication with the suction chamber 32, the generator obviously does not supply any liquid to the outer pressure piping, but the whole quantity of liquid pumped is circulating through the generator.

When the controlling slide 5 is adjusted, the openings 23, 24, 25, 26, 27 respectively will be shut off entirely, during a short time interval, from the pressure chamber 33 as well as from the suction chamber 32. In order to provide for the requisite outlet for the liquid during this moment, there are arranged spring-actuated valves 58 at the ends of the passages 14, Fig. 1, the said valves establishing communication, at a pressure which is above the normal, with a space 39 which is preferably connected with the outer pressure piping.

If the generator operates as a motor, reversing is effected by rotating the distributing slide 4 in the one or the other direction so that the respective suction passages will assume the positions of the adjacent pressure passages.

What I claim as new and desire to secure by Letters Patent of the United States is:—

1. The combination in a hydraulic generator, of a plurality of working cylinders, fluid conducting passageways connected to said cylinders, a rotatable distributing member adapted to convey the driving liquid, a pressure chamber and a suction chamber, a generator shaft for driving said member to bring the cylinders alternately in communication with the pressure chamber and the suction chamber respectively, according as the pistons change their direction of movement, a common pressure piping, a controlling member arranged between the distributing member and the common pressure piping, and means for adjusting said controlling member to cause one or more or all of the working cylinders to be cut out from the pressure piping for the purpose of controlling the active quantity of liquid.

2. A combination as claimed in claim 1 in which the controlling member is adapted to control two series of openings corresponding to different cylinders, or groups of cylinders, one of the said series of openings forming the connection of the fluid conducting passageways with the pressure piping, and the other series their connection with a suction chamber, the same being further so arranged that one series of openings will be covered successively, simultaneously as the other series of openings is being uncovered, on effecting an adjustment of the controlling member.

3. A combination as claimed in claim 1 in which the controlling- and distributing members consist of rotatable sleeves arranged concentrically and adapted to be displaced with respect to each other.

4. A combination as claimed in claim 1 in which the controlling and distributing members consist of rotatable concentric sleeves provided with openings, the controlling sleeve being arranged within the distributing sleeve and the interior of said controlling sleeve being divided into two chambers communicating through the openings of the controlling sleeve with the openings in the distributing sleeve, the said last mentioned chambers being connected with the pressure chamber and suction chamber respectively.

5. A combination as claimed in claim 1 in which the distributing member is provided with pressure passages and the controlling member is provided with openings, said pressure passages being so arranged with respect to said openings that the different pressure passages will, on an adjustment of the controlling member be cut off successively from the pressure piping and brought into communication with the suction chamber or vice versa.

6. A combination as claimed in claim 1 in which the distributing chamber has two or more pressure passages communicating with a common opening controlled by the controlling member.

7. A combination as claimed in claim 1 in which the control and distributing members function to cut out the different pump or working cylinders periodically and successively from the pressure piping.

8. A combination as claimed in claim 1 in which the control and distributing members function to cut out the different pump or working cylinders periodically and successively from the pressure piping, the periodical cutting out of the cylinders from the pressure piping being effected by means of the rotating distributing member, which is provided with pressure passages that are successively brought into communication with the different cylinders and are controlled by the controlling member, one or more of said pressure passages being permanently cut out from the pressure piping, according to the adjustment of the controlling member.

9. A combination as claimed in claim 1 in which the controlling member is connected with the shaft of the generator in such a manner as to receive a motion whereby the different cylinders are cut out periodically and in succession, either separately or groupwise.

10. A combination as claimed in claim 1, including an enclosing casing, said fluid conducting passageways leading from the cylinders to the distributing member and being arranged on the outside of said casing, partly to facilitate an effective cooling of the oil, and partly to render the passages easily accessible.

In testimony whereof I affix my signature in presence of two witnesses.

SVEN GUSTAF WIGELIUS.

Witnesses:
E. De la Wuter,
Nils G. Lundstedt.