F. H. CHEYNE.

SPEED VARYING TRANSMISSION.

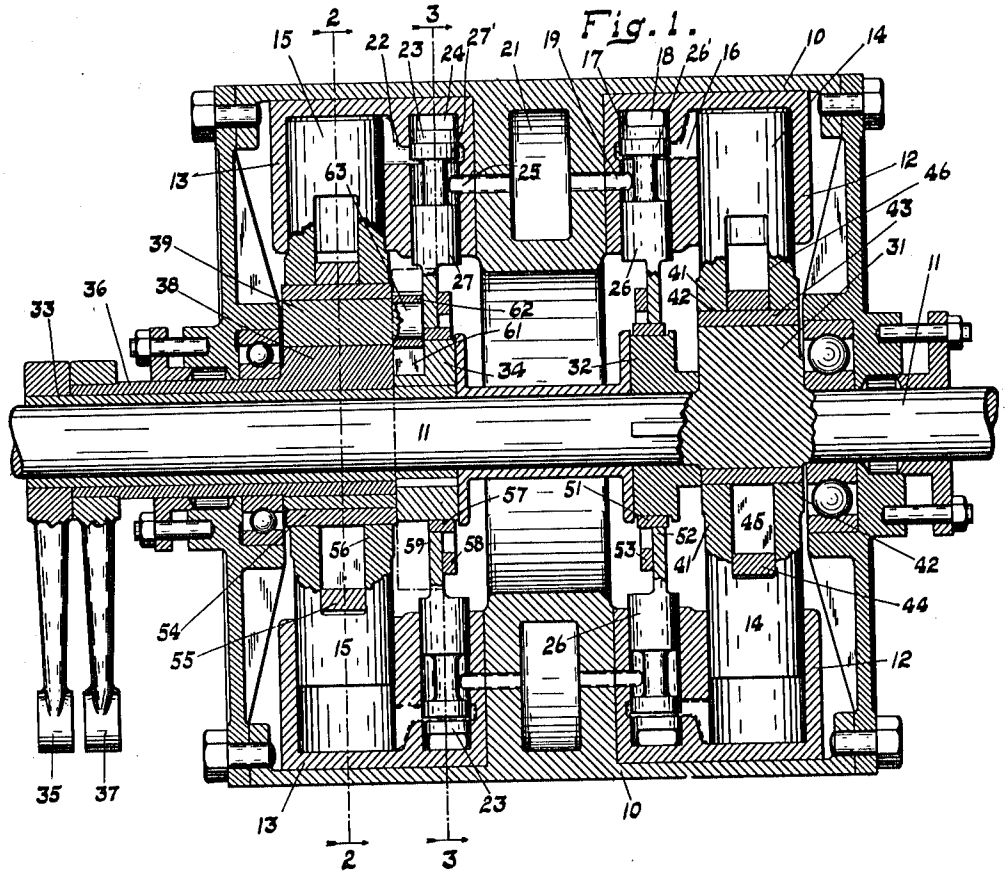
APPLICATION FILED AUG. 16, 1909.

950,368.

Patented Feb. 22, 1910.

4 SHEETS—SHEET 1.

Fig. 1.



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4 SHEETS—SHEET 2.

Fig. 2.

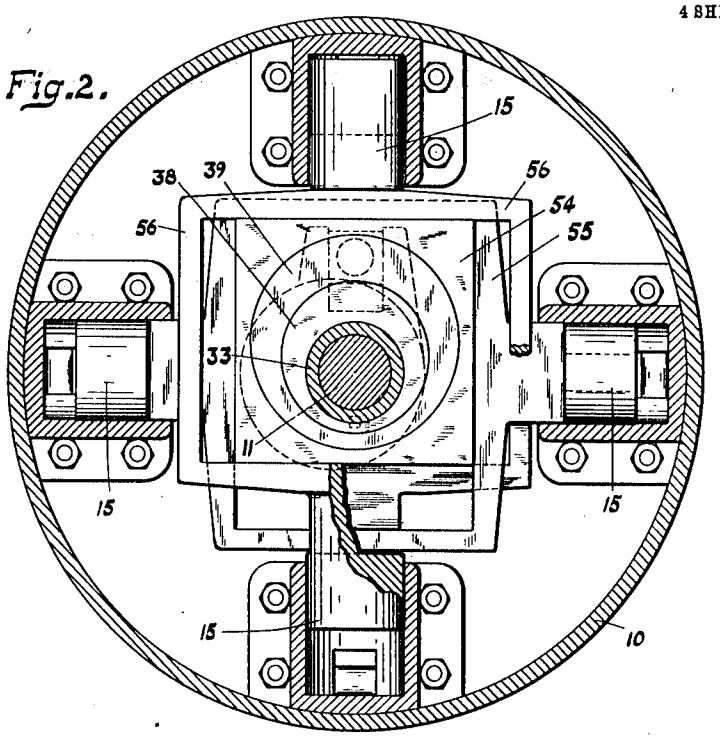
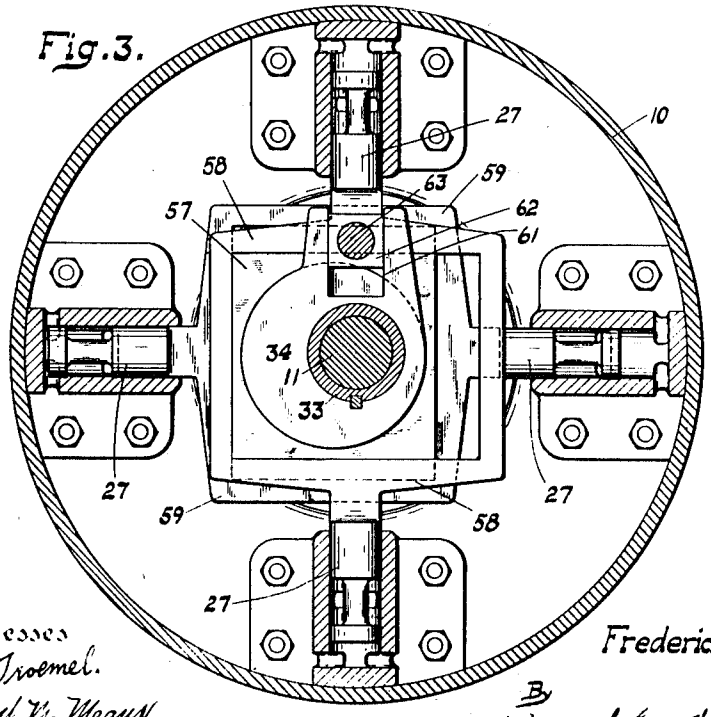


Fig. 3.



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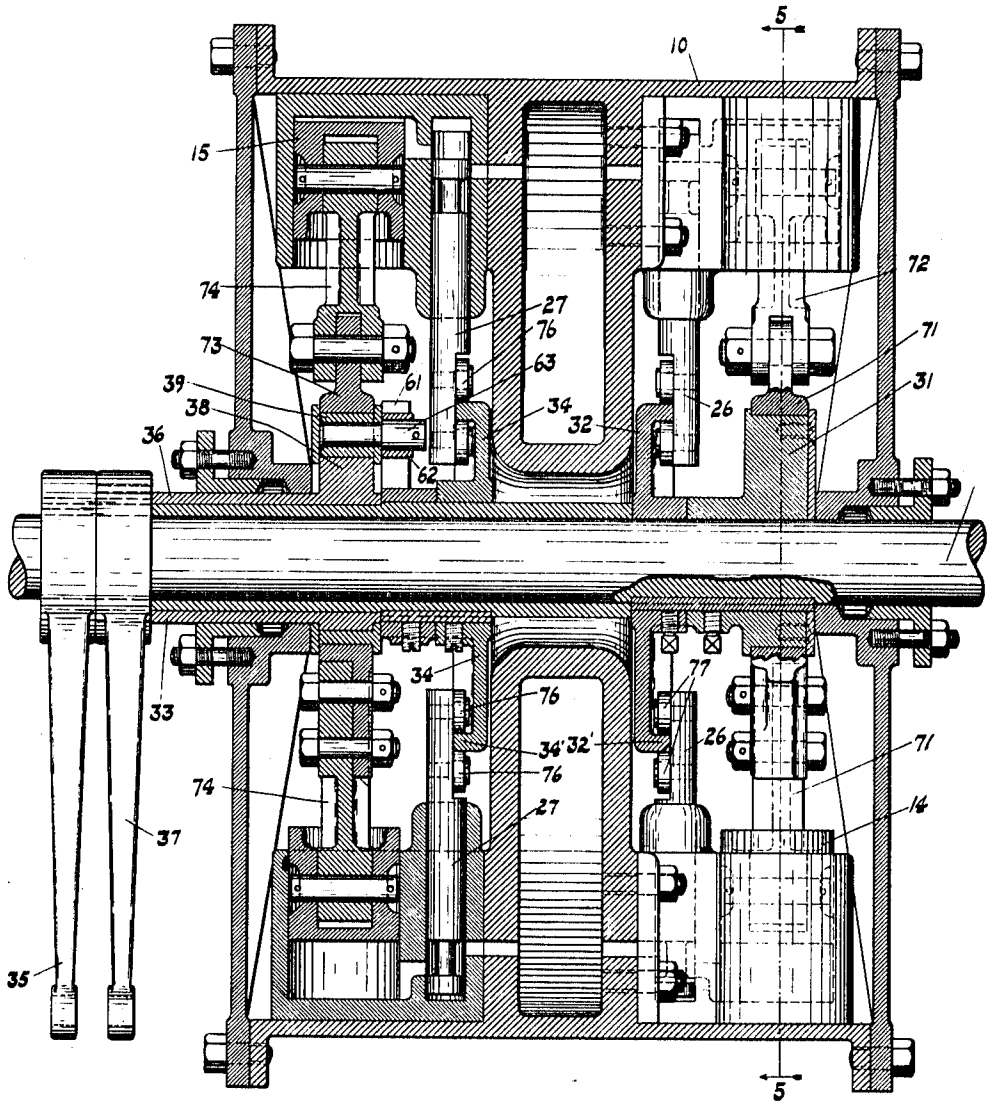
4 SHEETS—SHEET 3.

Fig. 4.



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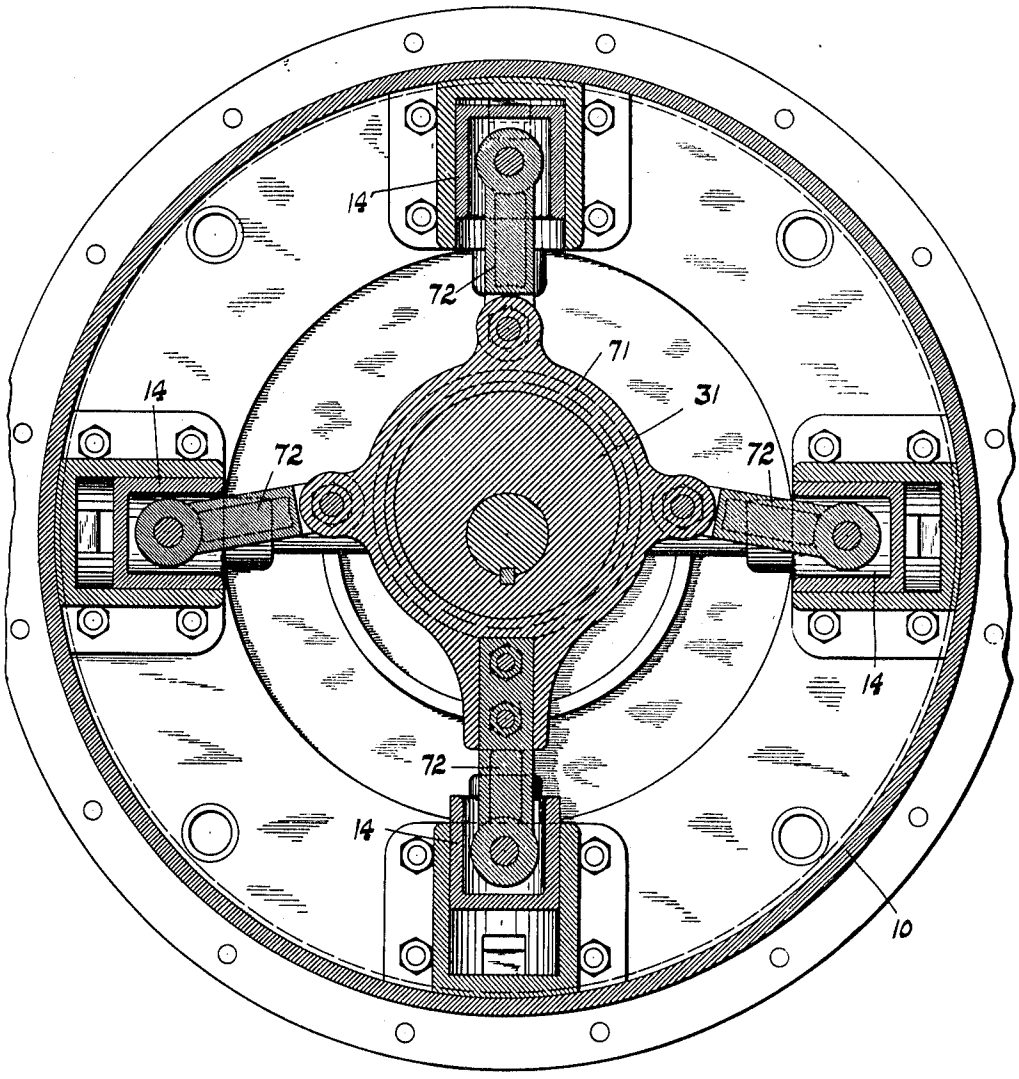
4 SHEETS—SHEET 4.

Fig. 5.



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UNITED STATES PATENT OFFICE.

FREDERICK H. CHEYNE, OF INDIANAPOLIS, INDIANA.

SPEED-VARYING TRANSMISSION.

950,368. Specification of Letters Patent. Patented Feb. 22, 1910.

Application filed August 16, 1909. Serial No. 513,054.

To all whom it may concern:

Be it known that I, FREDERICK H. CHEYNE, a citizen of the United States, residing at Indianapolis, in the county of Marion and State of Indiana, have invented certain new and useful Improvements in Speed-Varying Transmission, of which the following is a specification.

The object of my invention is to produce a speed varying transmission mechanism by means of which any desired variation of speed between a driving member and a driven member may be obtained by a variation of circulation of a practically incompressible liquid between the driving and driven members. It has heretofore been proposed to produce a mechanism of this kind and a fair illustration of the type of such a construction is to be found in Patent No. 912,487 issued Feb. 2, 1909, to P. M. Ramsey. In such a construction the flow of liquid produced by the interaction of one set of elements carried by the driving member and another set of elements carried by the driven member, is supposedly controlled by means of valves arranged in the line of flow, but in practice it is found that it is practically impossible to provide an ordinary valve mechanism by means of which the flow can be controlled with any degree of certainty or with a nicety of variation. It is for that reason that I have abandoned all valve mechanism and, instead, have provided measuring receptacles to definitely determine and measure the circulation of the controlling fluid.

The accompanying drawings illustrate my invention.

Figure 1 is an axial section of a mechanism embodying my invention; Fig. 2 a section on line 2—2 of Fig. 1; Fig. 3 a section on line 3—3 of Fig. 1; Fig. 4 an axial section of another form of my invention, and Fig. 5 a section on line 5—5 of Fig. 4.

In the drawings, 10 indicates a rotatable pulley-like casing and 11 a shaft upon which the casing 10 is journaled. In the further description the casing 10 may be referred to as the driving member or driver, and the shaft 11 as the driven member. The casing 10 is hollow and so mounted upon shaft 11 as to be freely rotatable thereon, as fluid-tight. Mounted within casing 10 is a series of motor cylinders 12 and a series of measuring cylinders 13. Mounted within each motor cylinder 12 is a piston 14 and mounted within each measuring cylinder 13 is a piston 15. Leading from each cylinder 12 is a passage 16 which communicates with a valve chamber 17 having a passage 18 which forms a communication with the interior of casing 10, and also having a passage 19 which forms a communication with an intermediate equalizing chamber 21 formed within casing 10 but having no direct communication with the interior thereof. Similarly, each cylinder 13 is provided with a passage 22 which forms a communication between its cylinder and the valve chamber 23 which is provided with a passage 24, giving access to the interior of casing 10, and a passage 25 giving access to the chamber 21. Mounted in each valve chamber 17 is a valve 26 having a portion 26′ which may be brought into position to shift communication from passage 16 to passage 18 or from passage 16 to passage 19. Mounted in each valve chamber 23 is a valve 27 which is provided with a portion 27′ which is adapted to shift communication between passage 22 and passage 24 or passage 22 and passage 25. Secured to or formed integral with shaft 11 in alinement with cylinders 12 is an eccentric 31, and in alinement with valve chamber 17 is an eccentric 32. Sleeved upon shaft 11 is a sleeve 33 which, at its inner end carries an eccentric 34 which is in alinement with valve chambers 23. Sleeve 33 is provided at its outer end with a lever 35 by means of which it may be rocked upon shaft 11. Sleeved upon sleeve 33 is a sleeve 36 provided at its outer end with an operating lever 37 and at its inner end with an eccentric 38 upon which is sleeved an eccentric ring 39, the eccentricity of the eccentrics 38 and 39 being equal to half the eccentricity of eccentric 31 so that, when added together they will have an eccentric value equal to the eccentric 31, but, when opposed to each other, will have a resultant which is concentric with shaft 11. Thus far the mechanism illustrated in Figs. 1, 2 and 3 is the same as the mechanism illustrated in Figs. 4 and 5.

Turning now to Figs. 1, 2 and 3 it will be seen that two diametrically opposed pistons 14 are rigidly carried by a cross head frame 41 having a guideway 42 therein at right angles to the axis of the two pistons 14 which it carries. Slidably mounted in its guideway is a block 43 which is journaled upon eccentric 31. The other two diametrically opposed pistons 14 are carried by a similar cross head 44 which is provided with a

guideway 45 lying at right angles to the axis of these pistons 14, and therefore at right angles to the other guideway 42, and the block 43 is also arranged in its guideway 45. For the sake of compactness the cross head 44 is mounted within the slot or guideway 46 formed within cross head 41. Mounted upon eccentric 32 is a square block 51 upon which is slidably mounted, a cross head 52 which carries two diametrically opposed valves 26, and a cross head 53 which similarly carries the other two diametrically opposed valves 26. Similarly a square block 54 is mounted upon an eccentric ring 39 and carries, a cross head 55 which carries two diametrically opposed pistons 15, and a cross head 56 which carries the other two diametrically opposed pistons 15. Mounted upon eccentric 34 is a square block 57 upon which is slidably mounted a cross head 58 carrying two of the valves 27 and a cross head 59 carrying the other two of the valves 27. For the purpose of adjusting the eccentric ring 39 relative to the eccentric 38, in either form shown, eccentric 34 or sleeve 33, is provided with a radial slot 61 in which is mounted a block 62 which is journaled upon a pin 63 carried by the eccentric ring 39.

In the form shown in Figs. 4 and 5 the eccentric 31 carries an eccentric strap 71 to which is connected a series of pitmen 72 which extend to the several pistons 14, one of said pitmen being rigidly connected to the strap 71 while the rest are pivotally connected thereto. All of the pitmen are pivotally connected to their respective pistons. Similarly the eccentric ring 39 carries an eccentric strap 73 to which is connected a series of pitmen 74 which extend to the several pistons 15. The eccentric 34 is provided with an annular flange 34′ which is straddled by rollers 76 carried by the valves 27 and eccentric 32 is provided with a similar annular flange 32′ which is similarly straddled by rollers 77 carried by the valves 26.

The operation is as follows: The entire interior of the casing 10, including all of the cylinders, valve chambers, passages, and chamber 21, is filled with a fluid, preferably an incompressible liquid such as a high grade of lubricating oil. Force is applied to casing 10, by means of a belt, train of gearing, or other driver, to rotate it, and lever 35 is anchored against movement. If the eccentric ring 39 is located upon eccentric 38 so as to produce a maximum eccentricity, and movement of shaft 11 is resisted by an applied load, pistons 14 will be reciprocated in cylinder 12 and, valves 26 will be reciprocated in their chambers so that oil will be caused to flow from the interior of shell 10 through passages 18 and 16 into cylinders 12 and from said cylinders through passages 16 and 19 into chamber 21 and from thence through passages 25 and 22 into cylinders 13 and from thence through passages 22 and 24 back into casing 10 and thence through passages 18 etc. The eccentricity of the combined eccentrics 38 and 39 being equal to the eccentricity of eccentric 31, and the pistons 15 being of the same size as the pistons 14, there will be a free circulation of oil through the system and consequently no material pressure will be exerted by the piston 14 on eccentric 31 and therefore there will be no rotation of shaft 11. Of course if the free circulation of the oil is not permitted, by reason of the shape of the various passages etc., there may possibly be a very slight movement of shaft 11 but a proper construction of the parts will prevent movement. If now arm 37 be swung so as to rotate eccentric 38 within ring 39 the position of the eccentrics relative to the cylinders 13 will not be changed but the amount of eccentricity will be diminished and consequently the stroke of the pistons 15 will be diminished so that for a given number of strokes of pistons 15, *i. e.* for a given number of rotations of shell 10, a fewer number of strokes of pistons 14 will be required and a resistance will be offered to the free circulation of oil from cylinders 12 and this resistance acting through the connections between the pistons 14 and shaft 11 will cause a rotation of shaft 11 in the direction of rotation of casing 10, the amount of this rotation approximating, to a greater or less extent, the amount of rotation of the casing 10, depending upon the adjustment of the compound eccentric 38—39, the speed of shaft 11 reaching the speed of casing 10 whenever the eccentricity of the compound eccentric 38—39 is reduced to zero at which time all reciprocation of the piston 15 is prevented, thus preventing any circulation of oil from one set of cylinders to the other, the parts being at this time locked together. It is true that, at this time, there will be a continued reciprocation of the valves 27 but this will result merely in a slight circulation of oil between the outer ends of the valve chambers 23 through the interior of casing 10.

I claim as my invention:—

1. The combination of a driving member and a driven member, a set of fluid pumps, one element of said pumps connected to the driver and the other element of said pumps connected to the driven member, a set of measuring pumps, one of the elements thereof being connected to the driving member, connections between the fluid pumps and the measuring pumps and return connections between the measuring pumps and the fluid pumps, and means for varying the stroke of one set of pumps.

2. The combination of a driving member and a driven member coaxial therewith, a set of fluid pumps, one element of said pumps

connected to the driver and the other element of said pumps connected to the driven member, a set of measuring pumps, one of the elements thereof being connected to the driving member, connections between the fluid pumps and the measuring pumps and return connections between the measuring pumps and the fluid pumps, and means for varying the stroke of one set of pumps.

3. The combination of a driving member and a driven member, a set of fluid pumps, one element of said pumps connected to the driver and the other element of said pumps connected to the driven member, a set of measuring pumps, one of the elements thereof being connected to the driving member, connections between the fluid pumps and the measuring pumps and return connections between the measuring pumps and the fluid pumps, and means for varying the stroke of the measuring pumps.

4. The combination of a driving member and a driven member coaxial therewith, a set of fluid pumps, one element of said pumps connected to the driver and the other element of said pumps connected to the driven member, a set of measuring pumps, one of the elements thereof being connected to the driving member, connections between the fluid pumps and the measuring pumps and return connections between the measuring pumps and the fluid pumps, and means for varying the stroke of the measuring pumps.

5. The combination of a driven shaft, a hollow fluid containing driving casing journaled on said shaft, a set of fluid pump cylinders arranged within said casing, a set of pistons coöperating with said cylinders and eccentrically connected to the shaft, a set of measuring cylinders mounted within the casing, a set of coöperating pistons eccentrically supported on the shaft, and connections between each set of cylinders and the interior of the casing and between the two sets of cylinders.

6. The combination of a driven shaft, a hollow fluid containing driving casing journaled on said shaft, a set of fluid pump cylinders arranged within said casing, a set of pistons coöperating with said cylinders and eccentrically connected to the shaft, a set of measuring cylinders mounted within the casing, a set of coöperating pistons eccentrically supported on the shaft, connections between each set of cylinders and the interior of the casing and between the two sets of cylinders and means for varying the eccentricity of the connection of one set of pistons with the shaft.

7. The combination of a driven shaft, a hollow fluid containing driving casing journaled on said shaft, a set of fluid pump cylinders arranged within said casing, a set of pistons coöperating with said cylinders and eccentrically connected to the shaft, a set of measuring cylinders mounted within the casing, a set of coöperating pistons eccentrically supported on the shaft, connections between each set of cylinders and the interior of the casing and between the two sets of cylinders, and means for varying the eccentricity of the connection between the measuring pistons and the shaft.

8. The combination of a driven shaft, a hollow fluid containing driving casing journaled on said shaft, a set of fluid pump cylinders arranged within said casing, a set of pistons coöperating with said cylinders and eccentrically connected to the shaft, a set of measuring cylinders mounted within the casing, a set of coöperating pistons eccentrically supported on the shaft, connections between each set of cylinders and the interior of the casing and between the two sets of cylinders, and valves for controlling the connections between the two sets of cylinders and between each set of cylinders and the interior of the casing.

9. The combination of a driven shaft, a hollow fluid containing driving casing journaled on said shaft, a set of fluid pump cylinders arranged within said casing, a set of pistons coöperating with said cylinders and eccentrically connected to the shaft, a set of measuring cylinders mounted within the casing, a set of coöperating pistons eccentrically supported on the shaft, connections between each set of cylinders and the interior of the casing and between the two sets of cylinders, means for varying the eccentricity of the connection of one set of pistons with the shaft, and valves for controlling the connections between the two sets of cylinders and between each set of cylinders and the interior of the casing.

10. The combination of a driven shaft, a hollow fluid containing driving casing journaled on said shaft, a set of fluid pump cylinders arranged within said casing, a set of pistons coöperating with said cylinders and eccentrically connected to the shaft, a set of measuring cylinders mounted within the casing, a set of coöperating pistons eccentrically supported on the shaft, connections between each set of cylinders and the interior of the casing and between the two sets of cylinders, means for varying the eccentricity of the connection between the measuring pistons and the shaft, and valves for controlling the connections between the two sets of cylinders and between each set of cylinders and the interior of the casing.

11. The combination of a driven shaft, a fluid containing driving casing journaled thereon, a set of cylinders mounted within said casing, a set of coöperating pistons eccentrically connected to the shaft, a second set of cylinders, a second set of pistons cooperating with said second set of cylinders, a compound eccentric arranged between said

second set of pistons and the shaft, means for rotating one of the members of said compound eccentric relative to the other to vary the effective eccentricity of the compound eccentric, fluid circulating connections between the two sets of cylinders and between each set of cylinders and the interior of the casing, and means for controlling said fluid circulating connections.

12. The combination of a driven shaft, a fluid containing driving casing journaled thereon, a set of cylinders mounted within said driving casing, a set of coöperating pistons eccentrically connected to the shaft, a second set of cylinders, a second set of pistons coöperating with said second set of cylinders, a compound eccentric arranged between said second set of pistons and the shaft, means for rotating one of the members of said compound eccentric relative to the other to vary the effective eccentricity of the compound eccentric, and fluid circulating connections between the two sets of cylinders and between each set of cylinders and the interior of the casing.

13. The combination of a driven shaft, a fluid containing driving casing journaled thereon, a set of cylinders mounted within said casing, a set of coöperating pistons eccentrically connected to the shaft, a second set of cylinders, a second set of pistons cooperating with said second set of cylinders, a compound eccentric arranged between said second set of pistons and the shaft, means for rotating one of the members of said compound eccentric relative to the other to vary the effective eccentricity of the compound eccentric, fluid circulating connections between the two sets of cylinders and the casing, a set of valves arranged adjacent the first mentioned set of cylinders to alternately connect the same with the interior of the casing and with an intermediate chamber, operating connections between said valves and the shaft, a second set of valves arranged adjacent the second set of cylinders to alternately connect the same with the interior of the chamber and with the intermediate chamber, and operating connections between said valves and the shaft.

In witness whereof, I have hereunto set my hand and seal at Indianapolis, Indiana, this thirteenth day of August, A. D. one thousand nine hundred and nine.

FREDERICK H. CHEYNE. [L. S.]

Witnesses:

ARTHUR M. HOOD,

THOMAS W. MCMEANS.