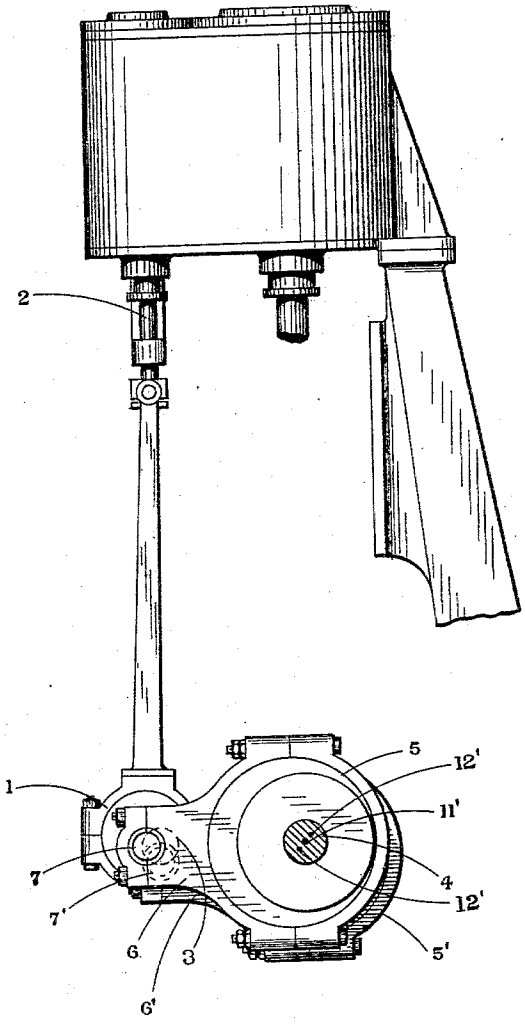
(No Model.) 4 Sheets—Sheet 1.

J. DEAM.

VALVE GEAR FOR ENGINES.

No. 546,419. Patented Sept. 17, 1895.

FIG. I



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(No Model.) 4 Sheets—Sheet 2.

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FIG. II

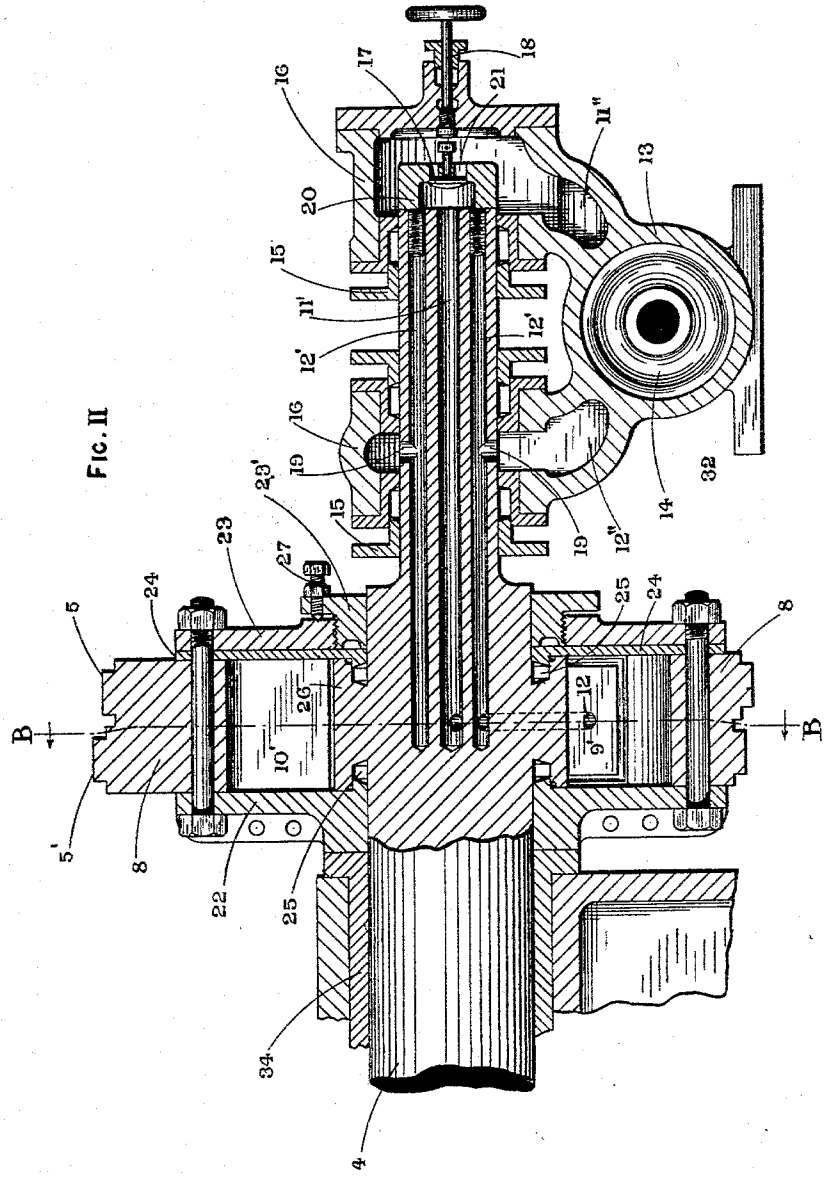

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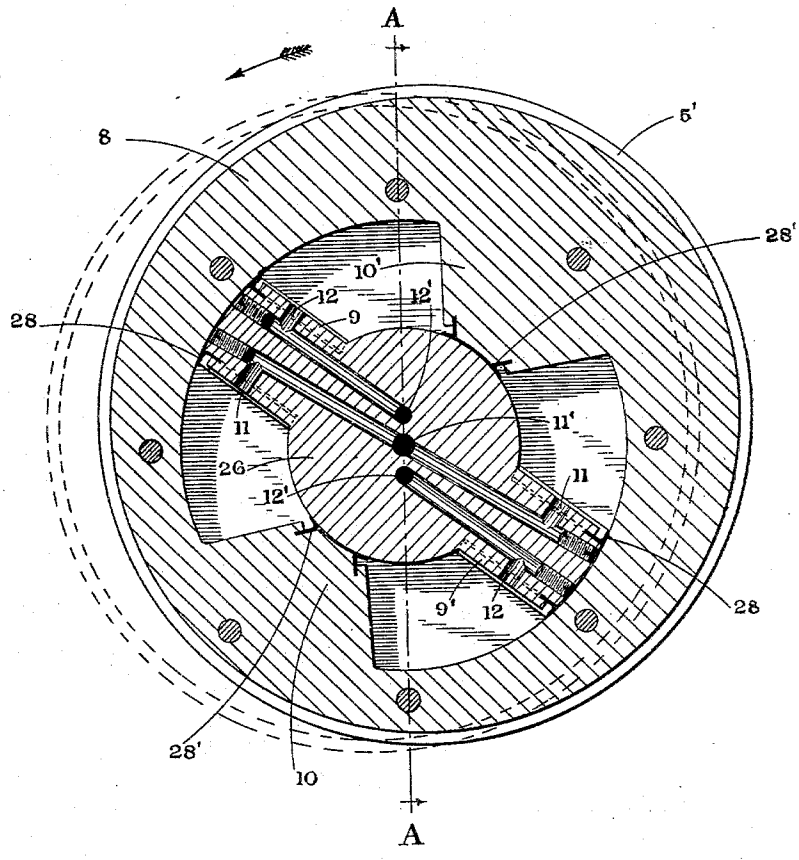
FIG. III.



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VALVE GEAR FOR ENGINES.

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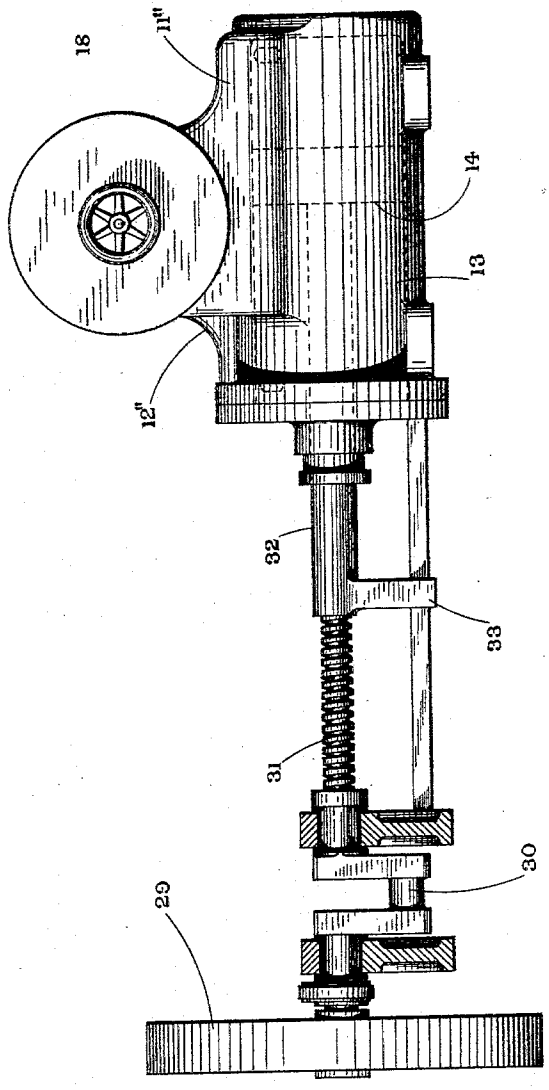

FIG. IV

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UNITED STATES PATENT OFFICE.

JOHN DEAM, OF SHANNON HARBOUR, IRELAND.

VALVE-GEAR FOR ENGINES.

SPECIFICATION forming part of Letters Patent No. 546,419, dated September 17, 1895.

Application filed April 27, 1895. Serial No. 547,368. (No model.)

To all whom it may concern:

Be it known that I, JOHN DEAM, a subject of the Queen of Great Britain, residing in Shannon Harbour, near Banagher, Kings county, Ireland, have invented certain new and useful Improvements in Valve-Gear for Fluid-Pressure Engines, of which the following is a specification.

This invention relates to valve-gears and is specially applicable to the valve-gears of marine engines of the triple-expansion type, and for convenience of description I will describe my invention with reference to such engines.

In the accompanying drawings, which illustrate my invention, Figure I is an end view of the general arrangement in which the connecting-gear between the crank-shaft and secondary shaft is shown, but in which, to avoid confusion, only one cylinder of the engine and its corresponding eccentric are shown. Fig. II is a longitudinal section on the line A A of Fig. III of the arrangement for moving the driving-eccentrics on the crank-shaft. Fig. III is a transverse section on the line B B of Fig. II, and Fig. IV is a detail view of the hydraulic cylinder.

Throughout the drawings similar parts are indicated by the same reference-figures, and in the case of sections the direction in which they are viewed is indicated by the small arrows placed adjacent to the letters denoting the plane of section.

I operate the valves, which may be of ordinary construction, by means of a single eccentric 1 for each valve 2. These eccentrics, of which there are usually three in the case of a three-cylinder engine, are keyed to a secondary shaft 3, which is arranged laterally with reference to the crank-shaft 4 and parallel thereto. The secondary shaft is geared to the crank-shaft, so as to have the same angular velocity as the latter. The connecting-gear consists, preferably, of two driving-eccentrics 5 and 5′, mounted on the crank-shaft with their centers at right angles and connected by rods 6 and 6′ to two corresponding cranks 7 and 7′ at right angles on the secondary shaft. The driving-eccentrics are not keyed directly to the crank-shaft, but are formed on a block 8, mounted on the crank-shaft, but capable of rotation to a limited extent relatively to the crank-shaft. It will be seen, therefore, that while the secondary shaft is so geared to the crank-shaft as to have the same angular velocity as the latter the rotation of the block 8 relatively to the crank-shaft 4 will result in an alteration of the angular position of the secondary shaft relatively to the crank-shaft. The amount of rotation of the block relatively to the crank-shaft corresponds with that necessary to move the eccentrics 1 angularly relatively to the cranks from, say, full gear ahead to full gear astern. The extreme positions of the block correspond with these positions of the gear, and consequently intermediate positions of the block correspond to intermediate or "linked up" positions of the gear. It will be seen that, assuming the engines to be rotating full speed ahead, it is only necessary to rotate the block 8 relatively to the crank-shaft from one limit to the other in order to reverse the engines or to partially rotate it to an intermediate position to "link up."

The rotation of the block relatively to the crank-shaft is produced by fluid-pressure in the following way: The block 8 is formed as a hollow cylinder fitting the crank-shaft, on the outside of which cylinder the two driving-eccentrics 5 and 5′ are formed. The crank-shaft has two abutments 9 and 9′ diametrically opposite each other, which extend radially to the internal periphery of the block, and the block has two corresponding diametral abutments 10 and 10′ extending from its internal periphery to the surface of the crank-shaft. The shape of two of the abutments is approximately that of a truncated sector of a circle, the angles of the sectors being such that the block may rotate relatively to the crank-shaft through the angle before mentioned, the shaft-abutments serving as stops to limit the motion. Each pair of the radially-opposite faces of the shaft-abutments are provided with ports 11 and 12, which communicate with two passages or two sets of passages 11′ and 12′ in the crank-shaft, the ports in the radially-opposite faces communicating with the same passage or set of passages. The passages 11′ and 12′ are connected to a hydraulic cylinder 13, and the cylinder and passages are filled with a suitable liquid. The connections are such that the direction of motion of a piston 14 in the cylinder de-

termines on which side of the crank-shaft abutments pressure is exerted. In this way the block can be moved from one position to the other. The crank-shaft 4 is prolonged and enters through glands 15 a casing 16, which communicates with the hydraulic cylinder 13, the arrangement being such that the two sets of passages 11′ and 12′ communicate with opposite ends of the cylinder. A non-return valve 17, capable of being independently operated by a screwed spindle 18, is fitted to one of the passages or sets of passages and intermediate positions of the block are obtained by closing this valve after introducing sufficient liquid under pressure to move the block to the desired position. I find it convenient to have one central passage 11′ concentric with the crank-shaft for the one pair of ports 11 and two passages 12′, one on each side of the central one, for the other pair of ports. The connections between these passages 11′ and 12′ and the cylinder 13 are clearly shown in Fig. II, from which it will be seen that there are, branching from the hydraulic cylinder, two wing-casings, in which passages 11″ and 12″ are formed. The wing-casings are provided with glands, through which the end of the crank-shaft, reduced in diameter, passes, and openings 19 in the periphery of the shaft put the passages 12′ and the wing-passage 12″ in communication. The end of the shaft has a cap 20, secured in position by bolts, and the central passage 11′ communicates with the wing-passage 11″ through an opening 21 in the cap. The opening 21 is controlled by the independently-operated non-return valve 17. The wing-passages 11″ and 12″ are led into the hydraulic cylinder at opposite ends thereof, as shown in Fig. IV.

Referring now to the detailed construction of the block 8, it will be seen from an inspection of Figs. II and III that it is formed by the two driving-eccentrics 5 and 5′, which carry the abutments 10 and 10′, a split side piece 22, a side piece 23, having a central part 23′ screwing into the central part of 23 and adjustable axially relatively thereto, and a thin flexible side piece 24, interposed between the eccentrics and the side piece 23. These several parts are bolted together at their peripheries. The side pieces 22 and 24 have internally-projecting annular spigots which fit, as shown in Fig. II, in annular recesses 25, formed in the collar 26 of the crank-shaft, from which the abutments 9 and 9′ are carried. The annular spigots do not reach to the bottom of the recesses 25 and the intervening space is fitted with an elastic packing. The pressure in an axial direction required to make the joint is obtained by screwing in the central part 23′ of the side piece 23, with the result that the central portion of the flexible side piece is forced in relatively to the split side piece 22. The central part 23′ is locked in position by set-screws 27. Leakage between the abutments and the internal surfaces of the block is prevented by the use of leathers 28 and 28′, attached to the faces of the abutments, which act somewhat after the manner of cup leathers in a hydraulic press. The block 8 is located near the forward crank-shaft bearing 34.

The piston of the hydraulic cylinder is operated either by hand by means of a hand-wheel 29 or by power by means of the crank 30. In either case the rotation of the screw 31 in the hollow piston-rod 23, which is prevented from turning by the piece 33, produces the desired axial movement of the piston.

The action of the apparatus is as follows: Assuming that the engine has been running ahead, the direction indicated by the arrow in Fig. III, that the block has accordingly been driven in this direction in consequence of the crank-abutments 9 and 9′ being in contact, respectively, with the block-abutments 10 and 10′, and that the engine has now to be reversed, the piston 14, which under the conditions assumed will be at the end of its outstroke, is now caused to make its instroke, with the result that the liquid on the right of the piston, Fig IV, is forced through the wing-passage 11″ past the non-return valve into the passage 11′ and, entering the interior of the block through the ports 11, exerts pressure between the abutments 9 and 10 and 9′ and 10′, separting them and forcing the fluid between the abutments 9 and 10′ and 9′ and 10 to return to the cylinder through the ports 12 and passages 12′ and 12″. The motion of the piston is continued till the abutments 9 and 10′ and 9′ and 10 are in contact. The block will now have moved relatively to the crank-shaft through an angle of one hundred and eighty degrees minus twice the angle of advance, and as this motion will have been communicated to the secondary shaft it is evident that if the eccentric 1 was in the correct ahead position before the movement it will now be in correct position for a stern. To reverse the engines back to the ahead position, the piston is given a movement opposite to that just described, the non-return valve being rendered inoperative by screwing in the spindle 18.

When it is desired to locate the eccentrics in an intermediate position for working the engines expansively for the ahead motion, the spindle 18 is screwed out to free the non-return valve and the liquid is forced through passages 11″ 11′ and the ports 11 till the block is in correct intermediate position. When the engine turns ahead, the liquid is trapped between the abutments 9 and 10 and 9′ and 10′ in consequence of the non-return valve closing, and the driving force is transmitted from the crank-shaft to the block through the interposed liquid. If the engine is required to work expansively when going astern, an independently-operated non-return valve is fitted on both passages.

I have described my invention as applied to a three-cylinder engine; but it is to be understood that it is equally applicable to a sin-

gle-cylinder engine, in which case, of course the single eccentric is mounted on the block 8 and operates the valve directly.

Instead of operating the piston of the hydraulic cylinder as shown in the drawings, it may be coupled directly to the piston of a cylinder operated by steam from a boiler and controlled by a suitable slide-valve, and in some cases the block may be operated directly by steam-pressure.

The leathers 28 are U-shaped in plan, and fit in recesses formed in the three working edges of the abutments 9 and 9′; but they may, of course, be fitted in any other convenient manner. The leathers 28′ are, of course, only fitted on the single working edge of the abutments 10 and 10′.

Having now fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a valve gear, the valve, a shaft and a connection between the shaft and valve comprising a block mounted on the shaft arranged to be adjusted circumferentially about the shaft and carrying an eccentric or eccentrics, the block and the shaft being provided with abutments to permit a limited relative angular movement between the block and the shaft, and means for operating the block by fluid pressure.

2. In a valve gear, the valve or valves, a shaft and a connection between the shaft and valve comprising a block mounted on the shaft arranged to be adjusted circumferentially about the shaft and carrying an eccentric or eccentrics, the block and shaft being provided with abutments to permit a limited relative angular movement between the block and shaft, and means for operating the block including the cylinder and piston with operating means therefor and the ports leading therefrom to the block through the shaft and the abutments thereof, substantially as described.

3. In combination in a valve gear, a valve or valves, a shaft and a connection between the shaft and valve comprising a block mounted on the shaft to be adjusted circumferentially about the same and carrying eccentrics, said block and shaft having abutments, the passage 11′ through the shaft having ports 11 leading to the recesses between the abutments and the passages 12′, 12′, leading to the opposite recesses, means for forcing the fluid through the passages and the non-return valve controlling the passage 11′ with means for operating the said valve, substantially as described.

4. In combination in a valve gear, the valve or valves, the shaft and the connection between the same and the shaft comprising the block carrying an eccentric or eccentrics and arranged to be adjusted about the shaft circumferentially and held by fluid pressure and an independently operated non return valve for maintaining the block in intermediate position.

5. In combination in a valve gear, the valve or valves, a crank shaft, a block mounted thereon and capable of limited angular movement relative thereto, a secondary shaft, carrying the eccentrics to operate the valves, and driven by means of cranks at right angles, by eccentrics mounted on the block; and means for operating the block by fluid pressure.

6. In combination, a valve gear, the valve or valves, the shaft, the block thereon carrying an eccentric or eccentrics, means for adjusting the position of the block in its angular relation to the shaft by fluid pressure and the packing joint between the block and crank shaft comprising the flexible side piece 24 and the central part 23′ of the side piece 23, the said flexible piece 24 being held at its outer edge to the block together with the said piece 23 and the central portion 23′ being screwed into the side piece 23 and forcing the inner edge of the flexible piece against the crank shaft substantially as described.

7. In combination in a valve gear, the shaft, the valve, the connections between the shaft and valve comprising the block on the shaft having abutments to contact with abutments on the shaft and means for supplying fluid pressure between the abutments consisting of the hydraulic cylinder and piston, the wing casings extending from the cylinder and having channels through the same, the bearings at the upper ends of the wing casings, the said shaft having an extension journaled in said bearings and having ports extending through the same and communicating with the passages in the wing casing and a non return valve with a controlling device therefor adapted to regulate the fluid pressure between the abutments, substantially as described.

8. In combination, the valve, the crank shaft having laterally extending abutments, the block having inwardly extending abutments between the shaft abutments and fitted to the shaft forming radial recesses about the shaft, fluid pressure means and the conduits therefrom to the recesses between the abutments, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN DEAM.

Witnesses:
H. S. SANKEY,
THOS. HAYES.