J. VOLLMER.

REVERSING GEAR FOR MULTIPLE CYLINDER COMBUSTION ENGINES.

APPLICATION FILED FEB. 21, 1911.

1,042,989.

Patented Oct. 29, 1912

4 SHEETS—SHEET 1.

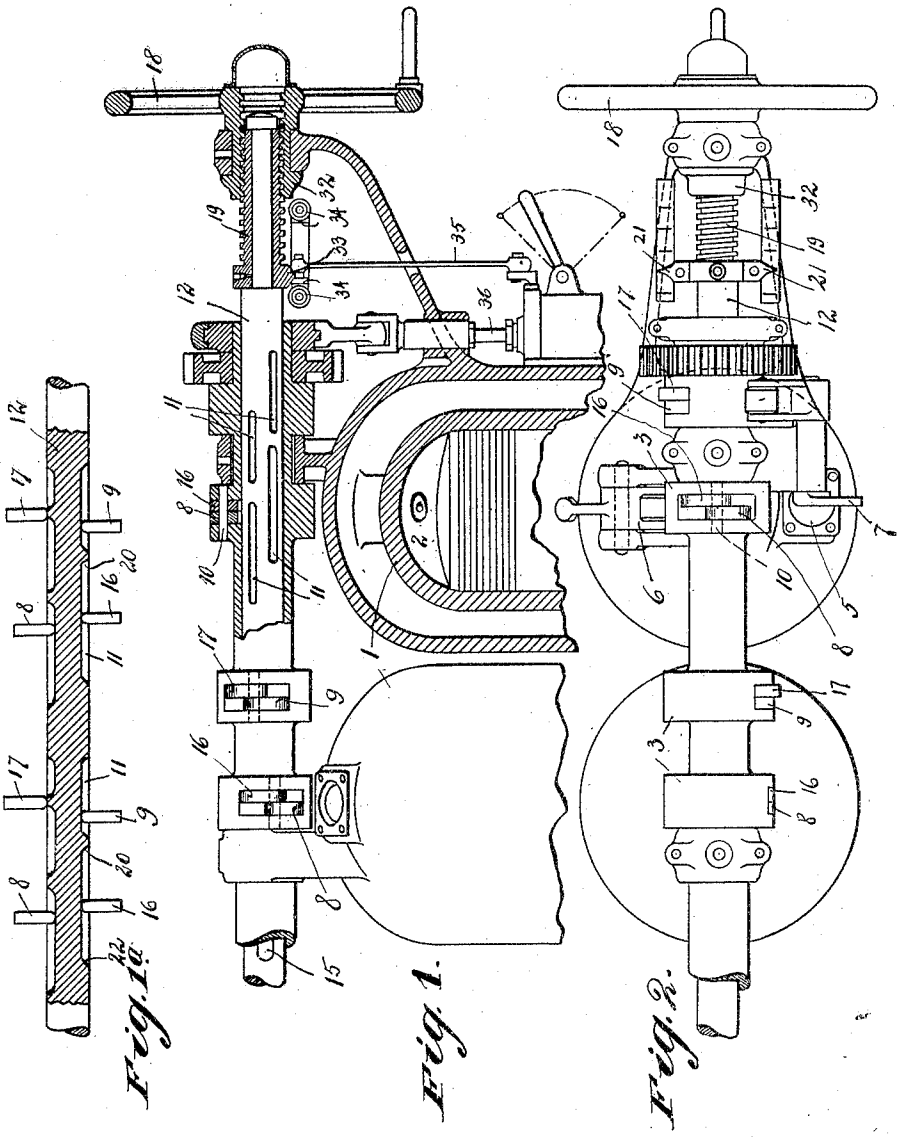

Fig. 1a.

Fig. 1.

Fig. 2.

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Fig. 3.

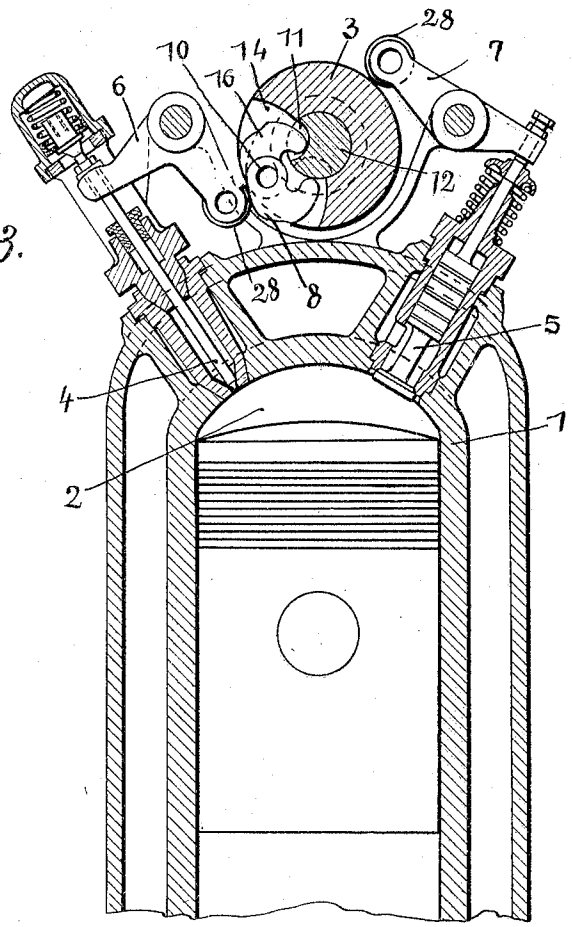
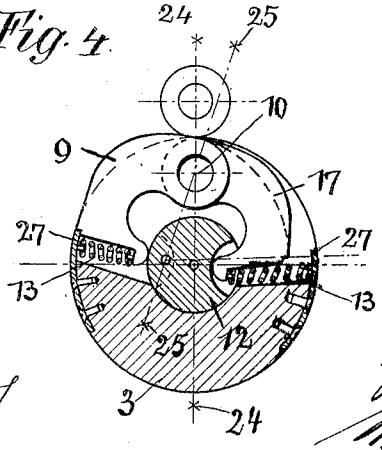


Fig. 4.



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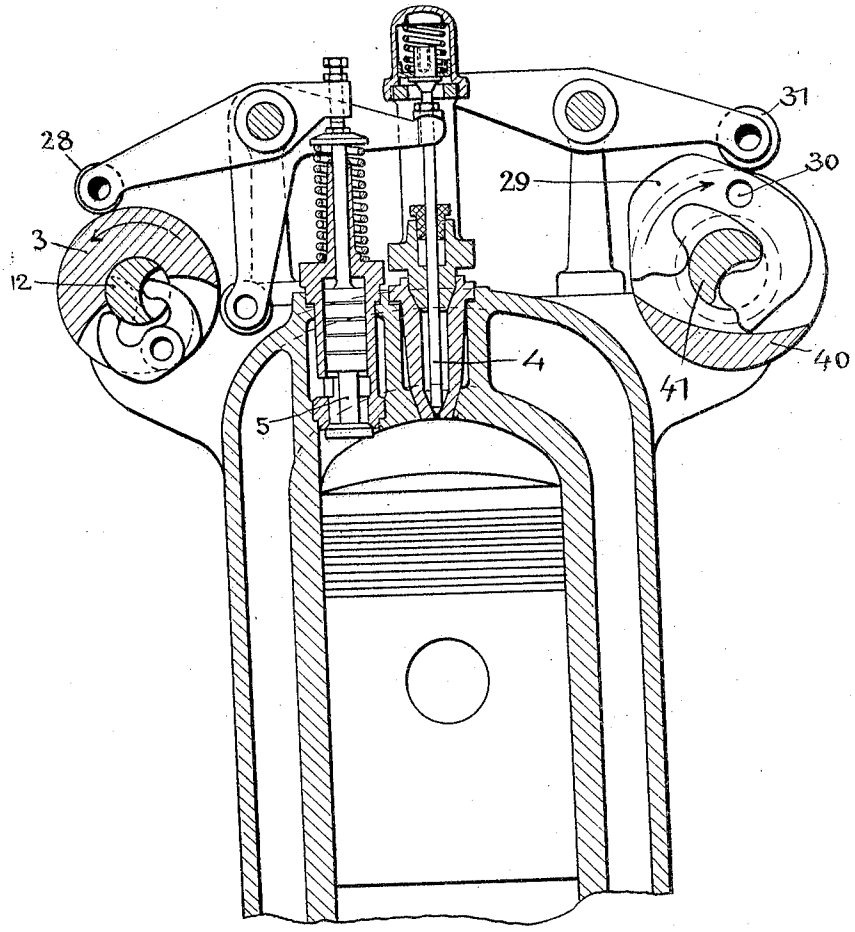

Fig. 5.

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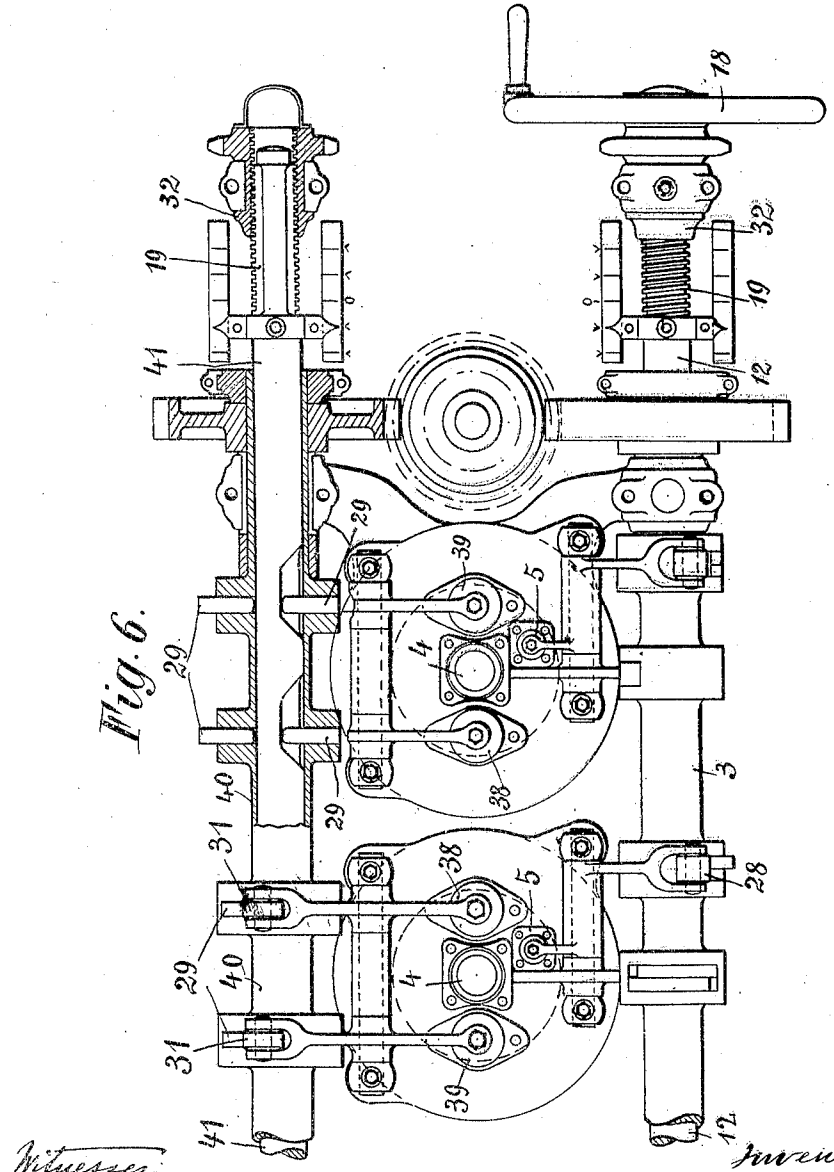

Fig. 6.

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UNITED STATES PATENT OFFICE.

JOSEPH VOLLMER, OF BERLIN, GERMANY.

REVERSING-GEAR FOR MULTIPLE-CYLINDER COMBUSTION-ENGINES.

1,042,989. Specification of Letters Patent. Patented Oct. 29, 1912.

Application filed February 21, 1911. Serial No. 609,877.

To all whom it may concern:

Be it known that I, JOSEPH VOLLMER, subject of the German Emperor, residing at 1 Prinz Louis Ferdinand street, Berlin, Germany, have invented certain new and useful Improvements in Reversing-Gear for Multiple-Cylinder Combustion-Engines, of which the following is a specification.

The present invention relates to a reversing gear for two cycle or four cycle combustion engines, particularly for marine purposes.

The object of the present invention is to allow of performing all operations necessary for maneuvering a vessel the same as with a steam engine by simply a controlling wheel and a lever being operated.

The reversing gears for combustion engines hitherto known are in consequence of the displaceable cam shafts, the several cam shafts, several controlling levers for one valve and the like, particularly with multiple cylinder engines, of a generally complicated design and the operation of several elements for reversing the engine is required.

Contrary to such design, the present invention allows of positively controlling any number of valves both for ahead or astern motion of the engine and in a very simple manner by the arrangement that cams pivotally arranged within recesses in the cam shaft can be moved separately out of such recesses in the cam shaft and into the range of the rollers on the valve gears, while all other cams not in operation, remain sunk within the cam shaft. This moving out of the cam operative at the moment is effected, contrary to the hitherto known types of pivoted controlling rods within the hollow cam shafts by axial displacement of the cam controlling rod arranged within the hollow cam shaft, thus by an axial-thrust cam-gear (Reuleaux). This renders the gear independent of the diameter of the controlling rod, so that the various requirements for the operation of the controlling elements can be met with by suitably dimensioning the thrust cams and the lost motion.

In the accompanying drawing the reversing gear according to the present invention is exemplified in two constructional forms.

Figure 1 is a longitudinal section through the reversing gear of a two cycle combustion engine. Fig. 1ª diagrammatically illustrates the operation of the cams 8, 16, and 9, 17 by the spindle 12. Fig. 2 is a plan view of the same. Fig. 3 is a transverse section through the cylinder and the reversing gear according to Fig. 1. Fig. 4 is a transverse section through the cam shaft on an enlarged scale. Fig. 5 is a transverse section through the head of a cylinder and the reversing gear of a four cycle combustion engine. Fig. 6 is a plan view of the reversing gear and cylinder of the four cycle combustion engine according to Fig. 5.

I shall first describe the reversing gear according to Figs. 1 to 4 for a two cycle combustion engine: In the combustion chamber 2 of the engine cylinder 1 open the fuel intake valve 4 Fig. 3 and a compressed air valve 5 Figs. 2 and 3. These two valves are controlled from a cam shaft 3 by means of cams, rollers and levers 6 and 7 Figs. 2 and 3. The cams 8 and 9 are pivoted to pins 10 to be capable of swinging at right angles to the cam shaft, in such a manner, that the cam surfaces can be turned from their normal position into corresponding recesses 14 in the cam shaft and therewith out of the range of the lever rollers 28. The cams 9 and 17 at the right hand are so arranged that during the rotation of the shaft 3 they will come into contact with the roller 28 carried by the right hand end of the angular lever 7. Such turning of these pivoted cams is effected by the axial displacement of a cam controlling rod 12 arranged within the bore of the cam shaft and provided with thrust-cam recesses 11. The cam opposite to such a recess is held in its innermost position by means of springs 13 or the like, while the cam is moved outward into operative position up to the stop 27, Fig. 4, that is, into the range of the lever roller, by the said cam being raised by the axial thrust cam when the cam controlling rod is displaced. The cam controlling rod 12 is preferably made in form of a cylindrical spindle fitting into the bore of the hollow cam shaft and having suitable recesses 11 milled into its body, longitudinal keys 15 or the like being provided to prevent a rotation with relation to the cam shaft. While the cams 8 serve to operate the fuel intake valve 4 only during the ahead motion of the engine, cams 9 are intended to start the engine ahead by means of compressed air. The reversing of the engine, however, necessitates, that the astern cams are of a shape symmetrical to that of the

ahead cams with regard to the radius of the cam shaft 3 drawn through the point which at the moment when the respective piston occupies its inner dead center position registers with the controlling parts, to wit, the rollers 28 and the levers 6 which radius I shall call the dead center line of the circle of control. The use of pivoted cams allows of an easy arrangement of the symmetrically placed astern cams 16, 17 by each astern cam being given the same fulcrum with its corresponding ahead cam and its being operated by the cam controlling rod 12 in such a manner, that either both cams are out of operation or only one of them projects beyond the cam shaft. The ahead and astern cams corresponding to each other may either be arranged close to each other and acting alternately on the same roller or axially separated from each other and operating on separate roller levers. For bringing the engine from rest to the full ahead speed, the axially not displaceable controlling wheel is turned to the right, whereupon the screw socket 19, having a single or double thread will draw the cam controlling rod 12 toward outside. Indices 21 attached to the screw socket indicate on a dial the respective positions of the rod 12. When the engine has been started ahead with compressed air, a further turn of the controlling wheel 18 to the right will by withdrawing the rod 12 cut off the compressed air. The ahead cams for compressed air 9 of all cylinders return into the recesses 11 of the rod 12, whereupon the full parts 22 of the rod 12 will turn out the ahead fuel intake cams 8 and the engine will be run in the ordinary manner with fuel. At the same time the index 21 will have been moved to the position "Fuel ahead". The engine is stopped by simply turning the controlling wheel back to the zero position of index 21. For reversing the engine, the same operations are gone through but in the opposite direction with regard to the zero position of the index 21, by the controlling wheel being turned to the left and the index being moved first to the position "Compressed air astern" and further on to the position "Fuel astern". A direct reversing say from astern to ahead is effected by moving the index from the position "Fuel astern" via the positions "Compressed air astern" and "Zero" to the position "Compressed air ahead", by turning the wheel to the right, the counter air having a braking effect on the piston until the engine is reversed. Then the index 21 is adjusted to the position "Fuel ahead", whereupon the engine will run in the normal manner. As during the passage of the index over the position "Compressed air astern", the latter will be of no avail for the reversing operation provision may be made to admit the compressed air by hand through an intermediate valve in the compressed air supply pipe into the cylinder, when the respective compressed air cams, adjusted by the cam controlling rod, operate the compressed air valves. For reversing the engine from ahead to astern the wheel 18 is operated in the opposite sense. For avoiding injurious ignitions during the compressed air periods and for safely stopping the engine, the fuel supply of the fuel pump must be cut off in due time before the engine is adjusted over the compressed air positions. This may be obtained as shown in Fig. 1, during the axial displacement of the controlling rod and the long travel by means of a cam 33 fitted to the screw socket 19, which cam 33 will participate in the displacement of the rod 12 and in its two terminal positions operate rollers 34, thereby cutting out the fuel supply in known manner by means of rods 35. Besides the fuel intake valve and the compressed air valve each cylinder of the two cycle combustion engine may be provided with a scavenging air valve, by which the entrance of the scavenging air, compressed either in the crank case, a special air pump or a rotary blower, is controlled. The cam for operating this valve may also be pivoted in the cam shaft in the same manner as the other cams.

The four cycle combustion engine shown in Figs. 5, 6 has similar devices for the fuel supply and reversing as the hereinbefore described two cycle engine. Besides these there is a mechanically operated admission valve 38 and exhaust valve 39. The valves may all be operated either from one cam controlling rod in a cam shaft or be distributed over several such cam shafts and rods.

I claim:

1. Reversing gear for multiple cylinder combustion engines consisting of a hollow cam shaft, recesses in said cam shaft, in said recesses cams pivoted so as to swivel in a plane at right angles to the axis of the cam shaft, in said hollow cam shaft a cam controlling rod axially displaceable, means for preventing the rotation of said rod in the cam shaft, said cam controlling rod having axial thrust cams adapted to operate said swiveling cams and projecting them from their recesses in the cam shaft into the range of the valve lever rollers and returning them into said recesses.

2. Reversing gear for multiple cylinder combustion engines consisting of a hollow cam shaft, recesses in said cam shaft, in said recesses cams pivoted so as to swivel in a plane at right angles to the axis of the cam shaft, in said hollow cam shaft a cam controlling rod axially displaceable, means for preventing the rotation of said rod in the

cam shaft, said cam controlling rod having axial thrust cams adapted to operate said swiveling cams and projecting them from their recesses in the cam shaft into the range of the valve lever rollers and returning them into said recesses, the ahead and the respective astern cam being formed in one piece and representing a twin cam and operated together by said rod, one of the two cams being turned into the range of the valve lever roller.

3. Reversing gear for multiple cylinder combustion engines, consisting of hollow cam shafts, recesses in each of said cam shafts, in said recesses cams pivoted so as to swivel in a plane at right angles to the axis of the cam shaft, in each of said hollow cam shafts a cam controlling rod axially displaceable, means for preventing the rotation of said rod in the cam shaft, each of said cam controlling rods having axial thrust cams adapted to operate said swiveling cams and projecting them from their recesses in the cam shaft into the range of the valve lever rollers and returning them into said recesses, the ahead and the respective astern cam being formed in one piece and representing a twin cam and operated together by said rod, one of the two cams being turned into the range of the valve lever roller, the cam shafts of a four cycle engine being coupled so as to be independent of each other with regard to their axial displacement.

4. Reversing gear for multiple cylinder combustion engines consisting of a hollow cam shaft, recesses in said cam shaft, in said recesses cams pivoted so as to swivel in a plane at right angles to the axis of the cam shaft, in said hollow cam shaft a cam controlling rod axially displaceable, means for preventing the rotation of said rod in the cam shaft, said cam controlling rod having axial thrust cams adapted to operate said swiveling cams and projecting them from their recesses in the cam shaft into the range of the valve lever rollers and returning them into said recesses, the ahead and the respective astern cam being formed in one piece and representing a twin cam and operated together by said rod, one of the two cams being turned into the range of the valve lever roller, the two controlling rods of a four cycle engine, moving in two cam shafts, axially displaced by rotatable screw sockets, a gear coupling between said screw sockets, a hand wheel on one socket operating this socket and by the gear coupling also the other socket, an index arrangement indicating the respective positions of the rod.

5. Reversing gear for multiple cylinder combustion engines consisting of a hollow cam shaft, recesses in said cam shaft, in said recesses cams pivoted so as to swivel in a plane at right angles to the axis of the cam shaft, in said hollow cam shaft a cam controlling rod axially displaceable, means for preventing the rotation of said rod in the cam shaft, said cam controlling rod having axial thrust cams adapted to operate said swiveling cams and projecting them from their recesses in the cam shaft into the range of the valve lever rollers and returning them into said recesses, said axial thrust cam gears having a certain play, adapted to delay the admission of the fuel from the fuel pump into the fuel intake valve until the intake cam has been moved into the range of its respective rollers for the ahead and astern motions respectively, and to entirely shut off such supply during the compressed air periods for either ahead or astern motions, the rest and idle run of the engine and means for controlling the fuel supply.

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

JOSEPH VOLLMER.

Witnesses:

HENRY HASPER,

WOLDEMAR HAUPT.