

No. 882,221.

PATENTED MAR. 17, 1908.

T. VEITCH.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED DEC. 5, 1906. RENEWED AUG. 24, 1907.

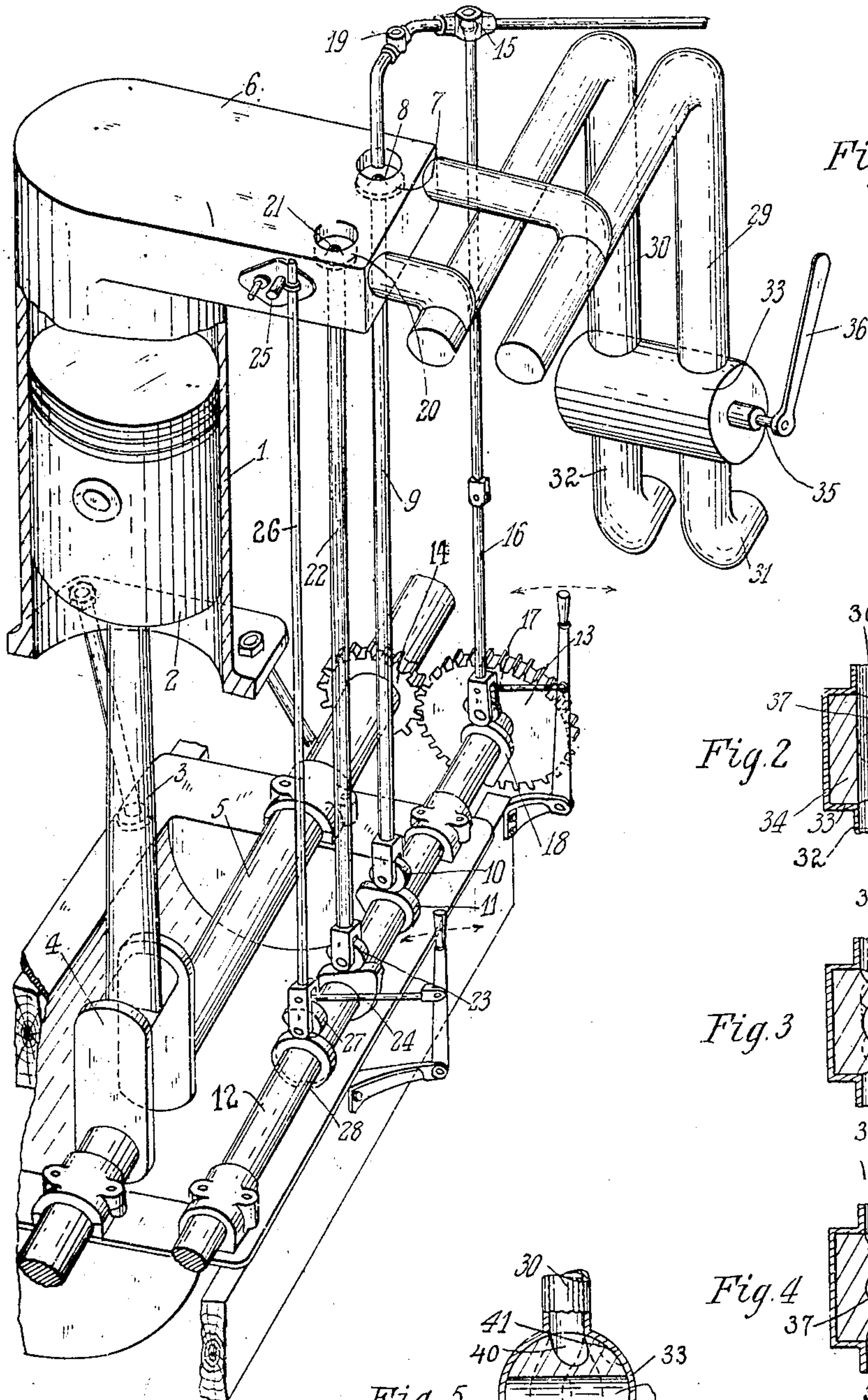


Fig. 1

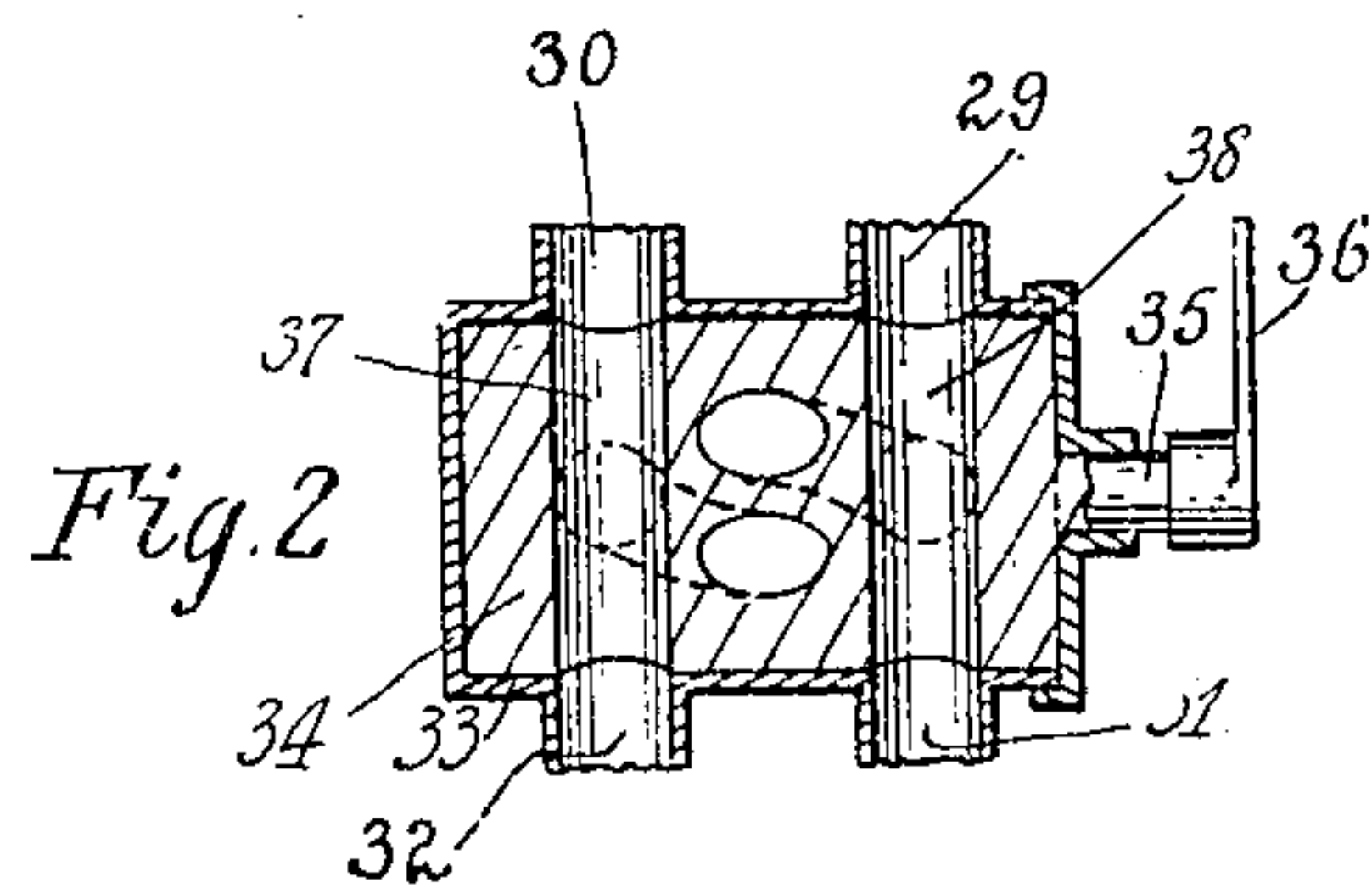


Fig. 2

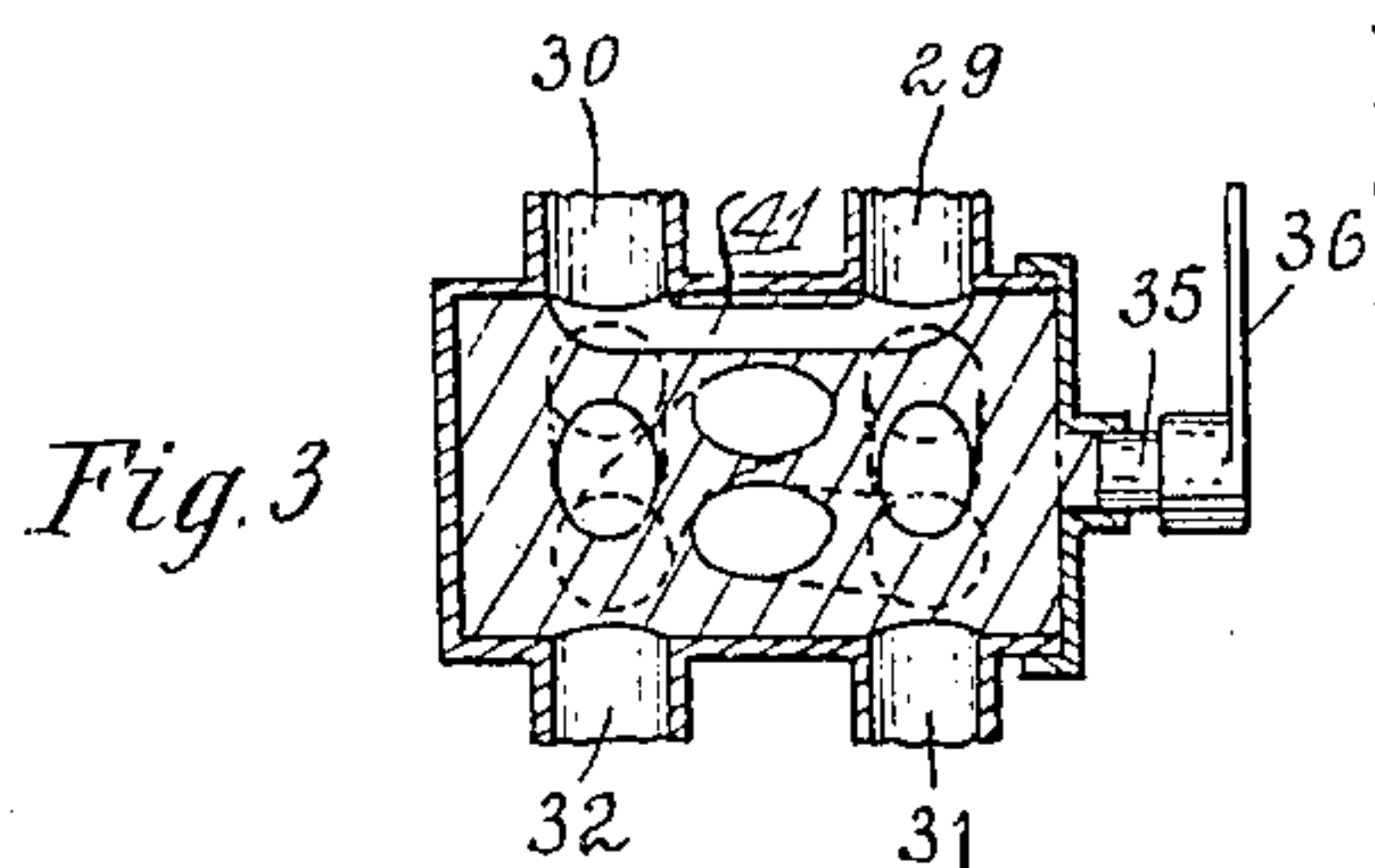


Fig. 3

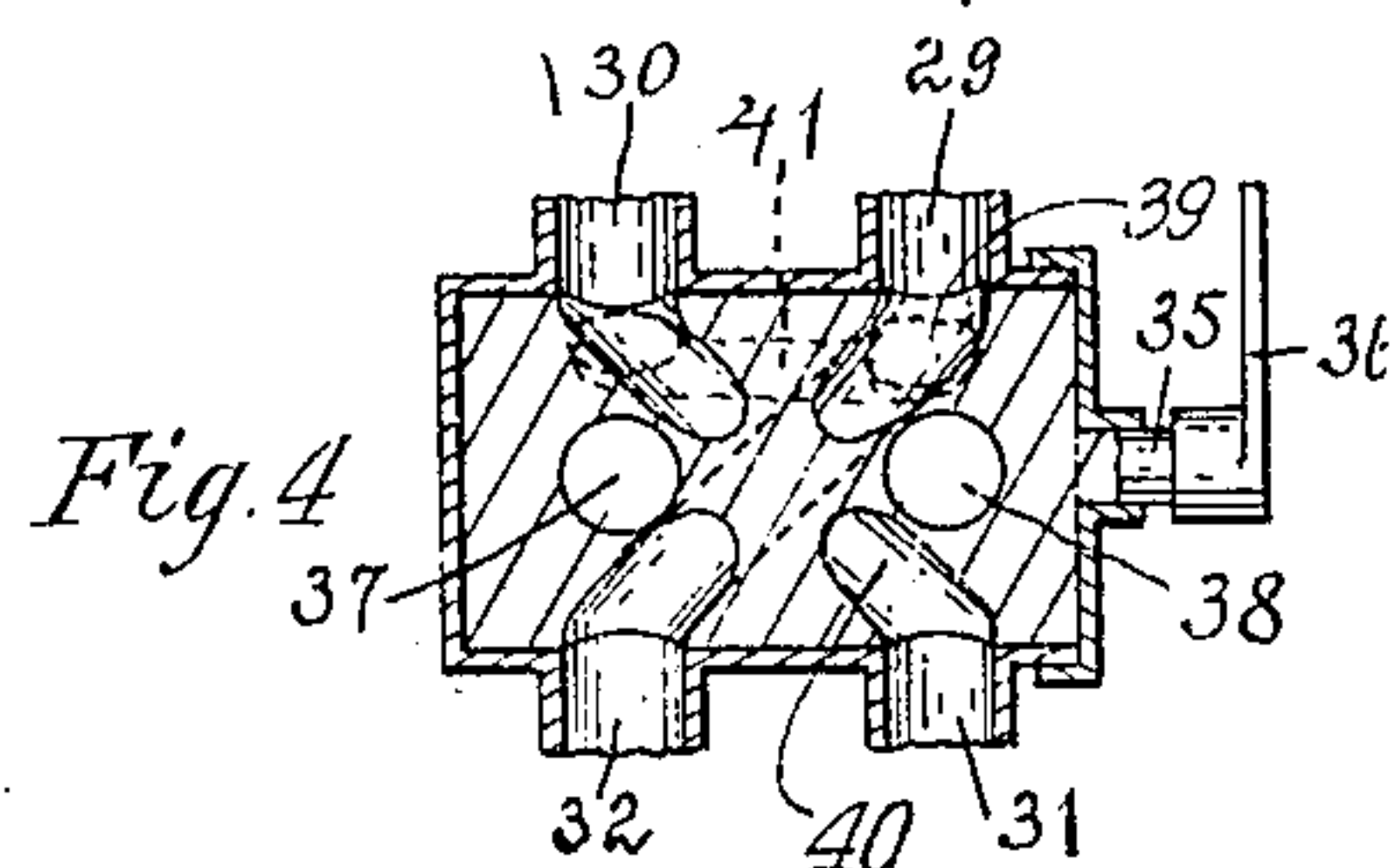


Fig. 4

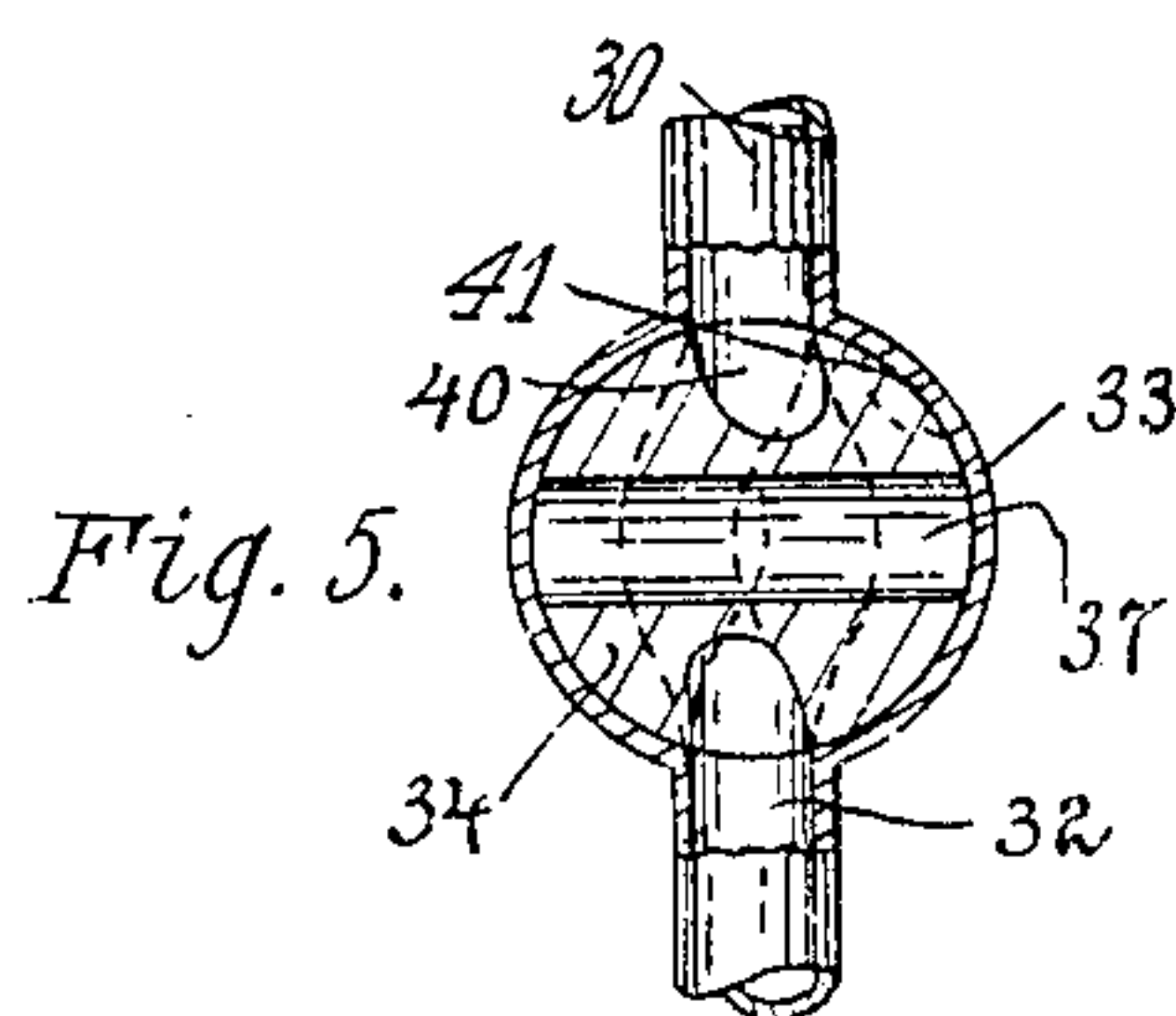


Fig. 5

WITNESSES

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# UNITED STATES PATENT OFFICE.

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## INTERNAL-COMBUSTION ENGINE.

No. 882,221.

Specification of Letters Patent.

Patented March 17, 1908.

Application filed December 5, 1906, Serial No. 346,409. Renewed August 24, 1907. Serial No. 390,043.

*To all whom it may concern:*

Be it known that I, THOMAS VEITCH, a citizen of the United States, and resident of the city of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

One of the desirable features in high-speed engines is a simple and efficient mechanism for reversing the engine in as a short as possible space of time. Numerous experiments have been made in solving this problem, most of which were defined to retaining the unidirectional rotation of the driving elements, while providing devices for reversing the rotation of the driven elements, requiring, of course, rather complicated mechanical arrangements, which in the moment of operation were subjected to a tremendous strain, causing them not infrequently to get out of order and, therefore, seriously to interfere with the reliable working of the entire engine.

It is the object of the present invention to utilize a device, otherwise well known in the art as such, in an improved and modified form, which seems to represent the most simple solution of a problem, which hitherto has been thought to be one of the most complicated ones. This solution consists in the application to said use in a gas engine of the combustion type, of a multiple-way valve, capable of suitably connecting the usual combustion chamber take-in and exhaust either to the mixing chamber or to the open air and thereby reversing the function and operation of the said take-in and exhaust. In addition to this feature, the new multiple-way valve is also provided with a passage or by-pass, capable of directly interconnecting the take-in to the exhaust of the combustion chamber and causing thereby a cessation of the explosions and, consequently, a gradual slowing down of the engine, which effect may be made use of in restarting the engine and reversing its operation by still further operating the multiple-valve, so that connections with the inlet and outlet are reversed, as well as the direction of rotation of the entire engine.

It is obvious, of course, that in order to reverse the direction of rotation of the engine,

it is necessary to advance or reset the spark-plug in the proper direction.

The new device is applicable to power-engines of any suitable type, in which case the inlet and outlet take the place of the take-in and exhaust of an explosive engine.

The illustrations, shown in the accompanying drawings, are representative of one form of the present invention, and Figure 1 illustrates a perspective side view of the entire engine, having embodied therein the new multiple-valve, while Figs. 2, 3 and 4 illustrate vertical cross-sections of the valve in different positions, and Fig. 5 a vertical cross-section in a plane at right angles to the plane of the sections shown in Figs. 2, 3 and 4.

The perspective elevation, shown in the drawing, indicates at 1 the usual cylinder of an engine of the four-cycle combustion type, supported on a suitable base.

2 is the piston connected by means of a piston-rod 3 to the crank 4 of the driving shaft 5.

6 is the combustion-chamber, having an inlet or take-in 7, capable of being closed by a valve 8, which is operated by means of the valve-rod 9 and the roller 10 from the valve-cam 11, keyed to the valve-shaft 12, driven by means of intermeshing gears 13 and 14 from the driving shaft 5.

An air-valve 15, operated by means of the valve-rod 16 and the roller 17 from the valve-cam 18 on the shaft 12, is located in an air-pipe, connecting an air tank or container to the combustion chamber. The check valve 19 prevents the return of the compressed mixture of gas and air from the combustion chamber.

An outlet or exhaust 20 of the combustion chamber 6 is connected by means of suitable pipes to a muffler or the open air. It is capable of being closed by a valve 21, operated through a valve-rod 22 and a roller 23 from a valve-cam 24. An igniting device or spark plug 25 is operated by a connecting rod 26 and roller 27 from a cam 28 on the shaft 12.

The take-in 7 and the exhaust 20 are connected to pipes 29 and 30, the continuation of these pipes are shown at 31 and 32, and the connection between the pipes is brought about by a multiple-valve mechanism. This



mechanism comprises a casing 33, containing a valve-body 34, rotatable on a shaft 35 by means of a lever 36. The valve-body 34 is provided with a set of passages or paths, capable of interchangeably connecting the pipes, leading to the combustion chamber, to the mixing chamber and the open air, respectively, either by straight or by cross-connection, or by interconnection. For this purpose the valve-body 34 contains a set of two passages leading in a straight line at right angles to the axis of the valve-body, so that passage 37 may directly and in a straight line connect pipe 30 to pipe 32, and passage 38 may connect pipe 29 to pipe 31. A second set of cross-connections is capable of making the following connections:—By means of passage 39, a connection between the pipe 29 and 32, and by means of the passage 40, a connection between the pipes 30 and 31. A by-pass or passage 41 finally is capable of interconnecting pipes 29 and 30 directly.

In the operation of engines constructed according to the present invention, it should not be lost sight of that the compressed air device, represented by the air-valve 15 and a container of compressed air, not shown in the drawing, will be efficient in two different ways. In the first way, as a selfstarting device for the engine, in which case it is obvious that in an engine of the four cylinder type, only one of the cylinders of the engine will be in condition to receive a charge of compressed air passing into the combustion chamber by opening a hand operated valve, leading to the compressed air container. This will start the engine, and as compressed air is supplied to each of the other cylinders until an ignition takes place in their combustion-chambers, the engine will finally be brought to its full operation.

The second function of the compressed air supply is, to act as a substitute for missed explosions, in which case it takes the place of the explosive mixture after ignition and causes an additional impulse to the operating piston. It is obvious, of course, that the pressure on the tank side of the check valve 19 must always be greater than the one on the combustion-chamber side of this valve. As this valve is constructed to open toward the combustion chamber, air can be admitted only when the valve 15 has been opened through the operation of the valve-cam 18, while at any other period of the cycle of rotation this valve will be closed.

The use of the multiple-way valve in reversing the direction of rotation of the engine must be preceded by first cutting out the ignition device and closing the hand operated valve of the compressed air container, the lever 36 is then set so as to bring the by-pass 41 in operation, whereby the

explosive mixture, drawn in through the acting take-in 7, is simply communicated through and passed off by the by-pass 41 to the acting exhaust 20, and led again into the combustion-chamber. When now the spark plug operating cam and the compressed-air valve operating cam is properly advanced, the valve 34 is further turned, so as to cross-connect the pipes 29 and 32 and the pipes 30 and 31, as shown in Fig. 4, the hand operated air-valve leading to the air tank is opened again, the operation of the engine is thereby resumed, but its direction of rotation will be reversed, so that the take-in 7 becomes now the acting outlet or exhaust, while the exhaust 20 becomes the acting take-in, the operation of the valve 15 remains the same, as well as the operation of the igniting device 25.

What is claimed as new and useful and desired to be secured by Letters Patent of the United States, is—

1. The combination in an explosive engine, with a combustion-chamber, of a take-in and an exhaust, and means containing a single valve having more than one pair of passages and adapted to reverse the function and operation of said take-in and exhaust.

2. The combination in an explosive engine, with a combustion-chamber, of a take-in and an exhaust, means containing a single valve having more than one pair of passages and adapted to reverse the function and operation of said take-in and exhaust, and means capable of operating said reversing means.

3. The combination in an explosive engine, with a combustion-chamber, of a take-in and an exhaust, means adapted to reverse the function and operation of said take-in and exhaust, means capable of operating said reversing means, and means fit to interconnect said take-in and exhaust.

4. The combination in an explosive engine, with a combustion-chamber, of a take-in and an exhaust, means adapted to reverse the function and operation of said take-in and exhaust, means fit to interconnect said take-in and exhaust, and means capable of operating said reversing means and said interconnecting means.

5. The combination with a plurality of ducts or pipes, of a valve in the same, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, and passages suitable to interconnect said ducts.

6. The combination in a power-engine, with a chest or chamber, of a plurality of ducts or pipes, a valve in said ducts, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, and passages suitable to interconnect said ducts.



straight-connect said ducts, passages suitable to cross-connect said ducts, and a passage suitable to interconnect said ducts.

16. The combination in a power-engine, with a chest or chamber, of a plurality of ducts or pipes, a rotatable valve in said 70 ducts, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, and a passage suitable to interconnect said ducts.

17. The combination in an explosive en- 75  
gine, with a combustion-chamber, of a plu-  
rality of ducts or pipes, a rotatable valve in  
said ducts, passages in said valve suitable to  
straight-connect said ducts, passages suit-  
able to cross-connects said ducts, and a pas- 80  
sage suitable to interconnect said ducts.

18. The combination with a plurality of ducts or pipes, of a rotatable valve in the same, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, a passage suitable to interconnect said ducts, and means adapted to rotate said valve.

19. The combination in a power-engine, with a chest or chamber, of a plurality of 90 ducts or pipes, a rotatable valve in said ducts, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, a passage suitable to interconnect said ducts, and 95 means adapted to rotate said valve.

20. The combination in an explosive engine, with a combustion-chamber, of a plurality of ducts or pipes, a rotatable valve in said ducts, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, a passage suitable to interconnect said ducts, and means adapted to rotate said valve.

21. The combination in a power-engine, 105  
with a chest or chamber, of an inlet and an  
outlet, a plurality of ducts or pipes, a rota-  
table valve in said ducts, passages in said  
valve suitable to straight-connect said ducts,  
passages suitable to cross-connect said ducts, 110  
and a passage suitable to interconnect said  
ducts.

22. The combination in an explosive engine, with a combustion-chamber, of a take-in and an exhaust, a plurality of ducts or pipes, a rotatable valve in said ducts, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, and a passage suitable to interconnect said ducts.

23. The combination in a power-engine, with a chest or chamber, of an inlet and an outlet, a plurality of ducts or pipes, a rotatable valve in said ducts, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, a passage suitable to interconnect said ducts, and means adapted to rotate said valve.



24. The combination in an explosive engine, with a combustion-chamber, of a take-in and an exhaust, a plurality of ducts or pipes, a rotatable valve in said ducts, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, a passage suitable to interconnect said ducts, and means adapted to rotate said valve.

25. The combination with a casing, of sets of ports in said casing, a valve-body in said casing, passages in said valve-body and adapted to connect ports of opposite sets, passages adapted to cross-connect ports of opposite sets, and a passage adapted to interconnect ports of the same set.

26. The combination with a casing, of sets of ports in said casing, a valve-body in said casing, passages in said valve-body and adapted to connect ports of opposite sets, passages adapted to cross-connect ports of opposite sets, a passage adapted to interconnect ports of the same set, and means adapted to operate said valve-body.

27. The combination with a casing, of sets of ports in said casing, a rotatable valve-body in said casing, passages in said valve-body and adapted to connect ports of opposite sets, passages adapted to cross-connect ports of opposite sets, and a passage adapted to interconnect ports of the same set.

28. The combination with a casing, of sets of ports in said casing, a rotatable valve-body in said casing, passages in said valve-body and adapted to connect ports of opposite sets, passages adapted to cross-connect ports of opposite sets, a passage adapted to interconnect ports of the same set, and means adapted to rotate said valve-body.

29. The combination in an explosive engine, with a combustion-chamber, of a valve suited to supply compressed air to said combustion-chamber, a take-in and an exhaust, valves for said take-in and exhaust, means capable of operating said valves, and means containing a single valve having more than one pair of passages and adapted to reverse the function and operation of said take-in and exhaust.

30. The combination in an explosive engine, with a combustion-chamber, of a valve suited to supply compressed air to said combustion-chamber, a take-in and an exhaust, valves for said take-in and exhaust, means capable of operating said valves, means containing a single valve having more than one pair of passages and adapted to reverse the function and operation of said take-in and exhaust, and means suitable of operating said reversing means.

31. The combination in an explosive engine, with a combustion-chamber, of a valve suited to supply compressed air to said combustion-chamber, a take-in and an exhaust,

valves for said take-in and exhaust, means capable of operating said valves, means adapted to reverse the function and operation of said take-in and exhaust, means suitable of operating said reversing means, and means fit to interconnect said take-in and exhaust.

32. The combination in an explosive engine, with a combustion-chamber, of a valve suited to supply compressed air to said combustion-chamber, a take-in and an exhaust, valves for said take-in and exhaust, means capable of operating said valves, means adapted to reverse the function and operation of said take-in and exhaust, means fit to interconnect said take-in and exhaust, and means capable of operating said reversing means and said interconnecting means.

33. The combination in an explosive engine, with a combustion-chamber, of a valve suited to supply compressed air to said combustion-chamber, a take-in and an exhaust, valves for said take-in and exhaust, a plurality of ducts or pipes, a valve in said ducts, valves for said take-in and exhaust, means capable of operating said air-valve and said valves for said take-in and exhaust, means capable of operating said valve in said ducts, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, and a passage suitable to interconnect said ducts.

34. The combination in an explosive engine, with a combustion-chamber, of a valve suited to supply compressed air to said combustion-chamber, a take-in and an exhaust, valves for said take-in and exhaust, means capable of operating said take-in-, exhaust- and supply-valve, a plurality of ducts or pipes connected to said take-in and exhaust, a rotatable valve in said ducts, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, and a passage suitable to interconnect said ducts.

35. The combination in an explosive engine, with a combustion-chamber, of a valve suited to supply compressed air to said combustion-chamber, a take-in and an exhaust, valves for said take-in and exhaust, means capable of operating said take-in-, exhaust- and supply-valve, a plurality of ducts or pipes connected to said take-in and exhaust, a rotatable valve in said ducts, means in said rotatable valve adapted to reverse the function and operation of said take-in and exhaust, and means adapted to rotate said valve.

36. The combination in an explosive engine, with a combustion-chamber, of a valve suited to supply compressed air to said combustion chamber, a take-in and an exhaust, valves for said take-in and exhaust, means capable of operating said take-in-, exhaust-



and supply-valve, a plurality of ducts or pipes connected to said take-in and exhaust, a rotatable valve in said ducts, passages in said valve suitable to straight-connect said ducts, passages suitable to cross-connect said ducts, a passage suitable to interconnect said ducts, and means adapted to rotate said valve.

Signed at New York, in the county of New York, and State of New York, this 23rd day 10 of November, A. D. 1906.

THOMAS VEITCH.

Witnesses:

C. R. RADCLIFFE,  
MARVIN F. WOOD.