

M. BERLIET.
INTERNAL COMBUSTION MOTOR.
APPLICATION FILED AUG. 16, 1907.

904,671.

Patented Nov. 24, 1908.

2 SHEETS—SHEET 1.

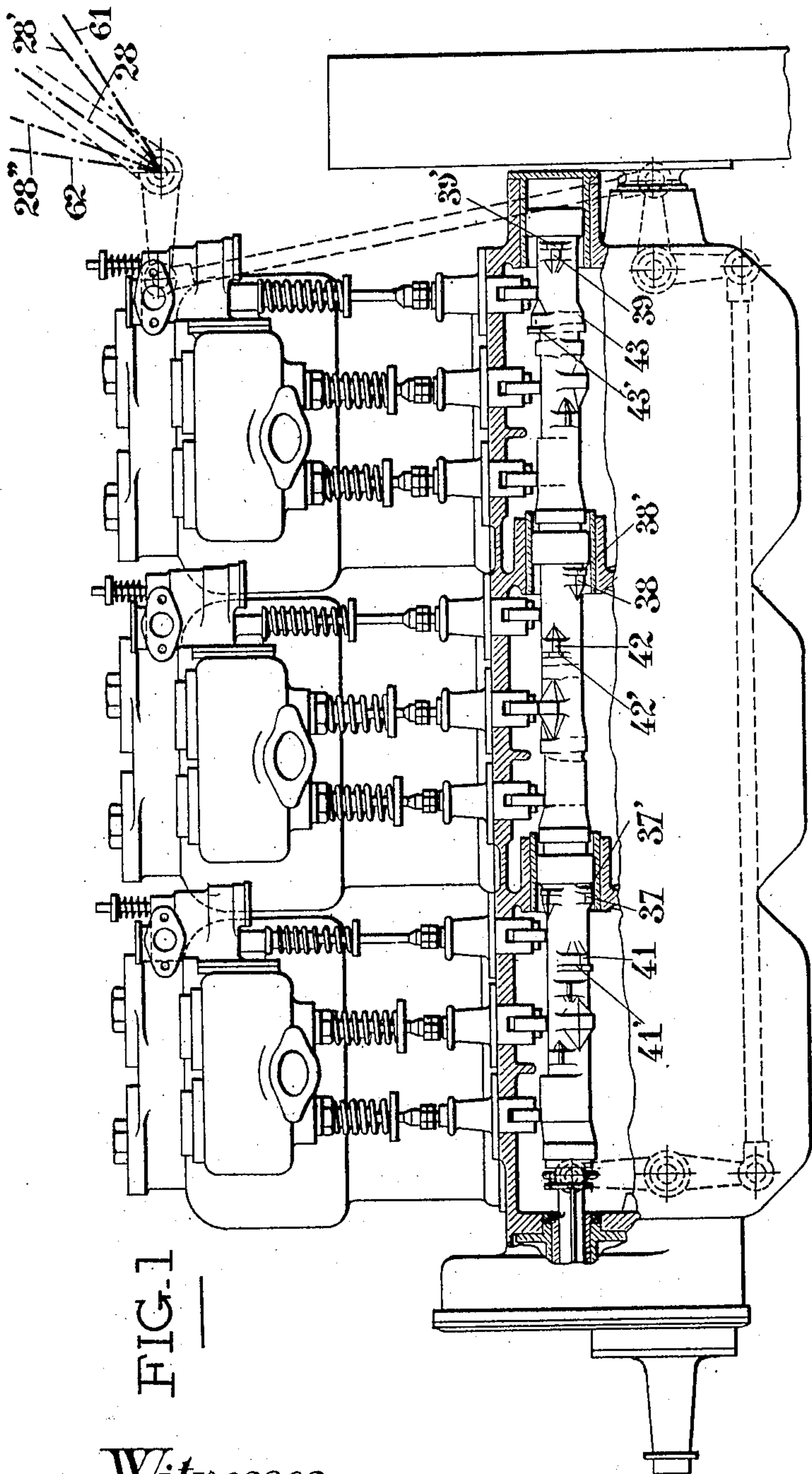


FIG. 1

Witnesses

Juan Germain
Guillaume Pioche

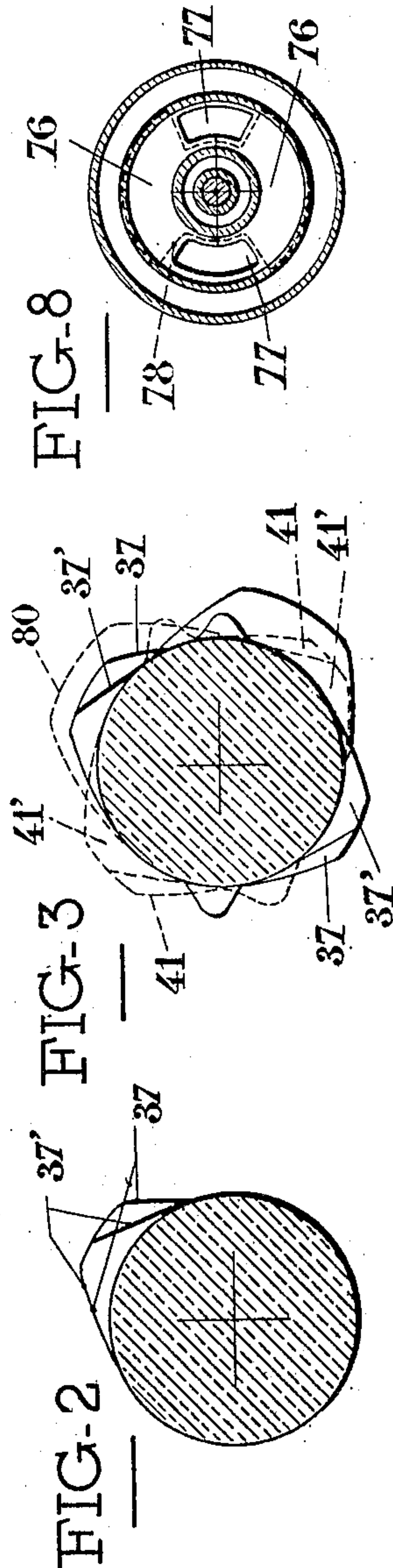


FIG. 2

FIG. 3

FIG. 8

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2 SHEETS—SHEET 2.

FIG. 4

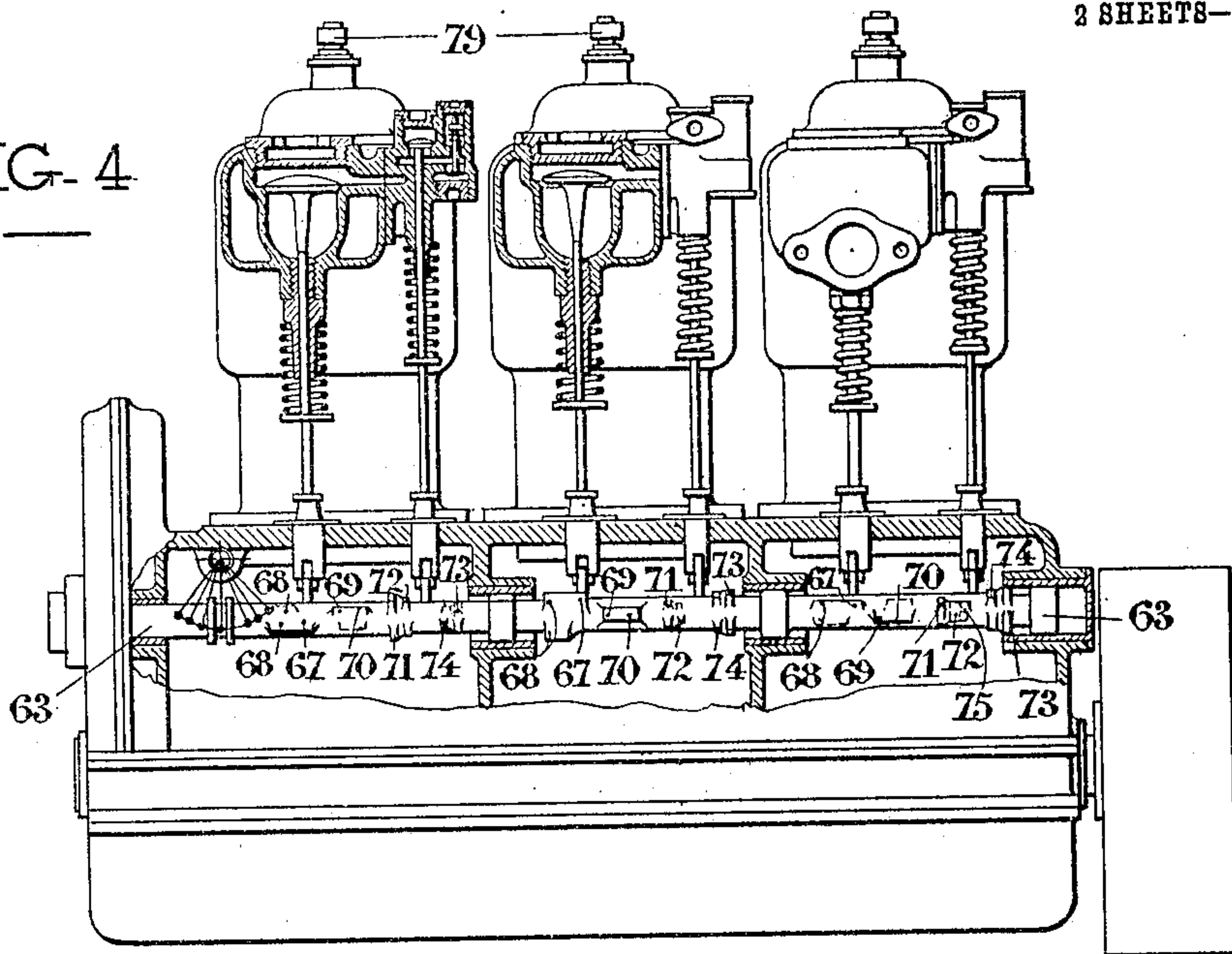


FIG. 7

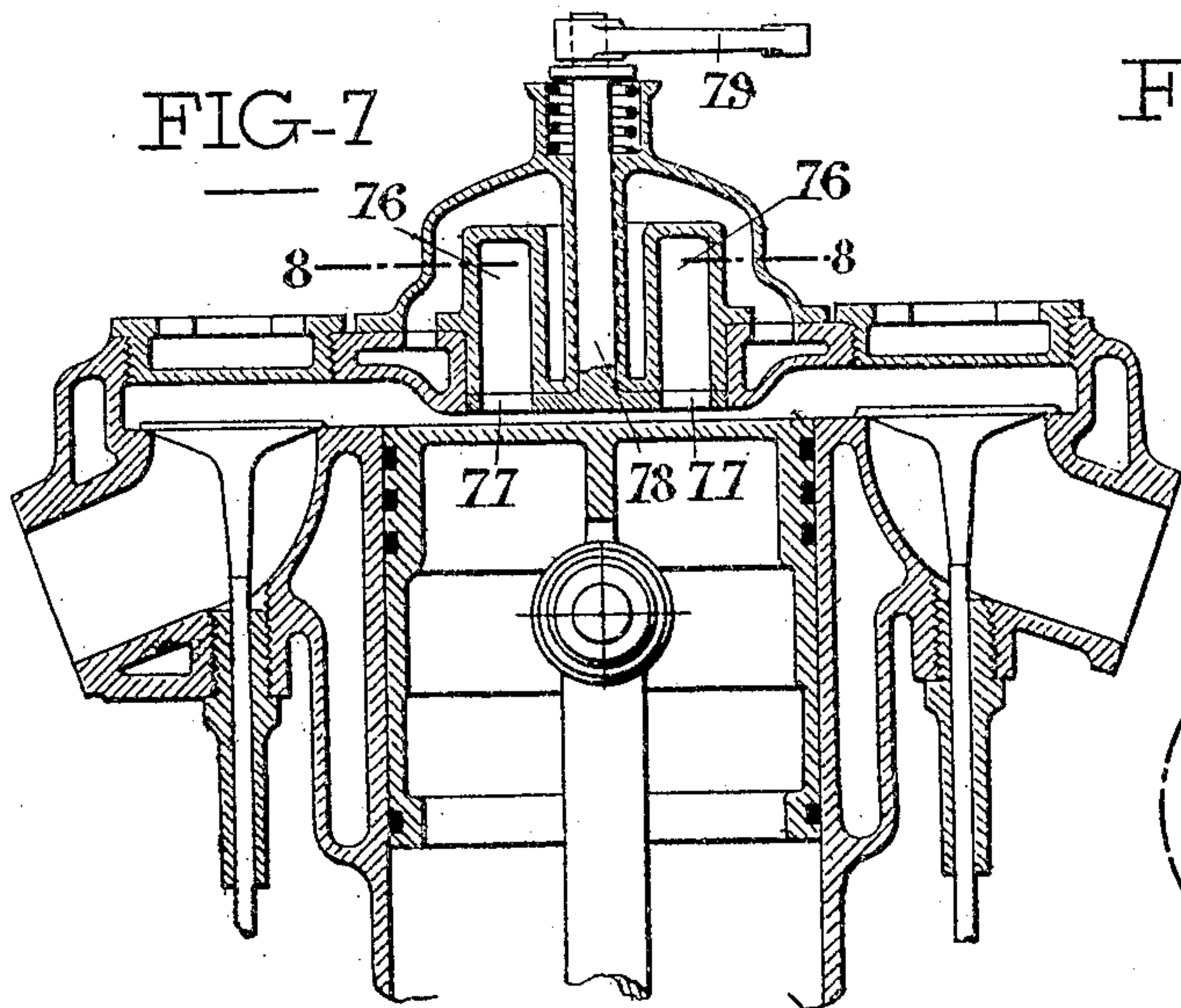


FIG. 5

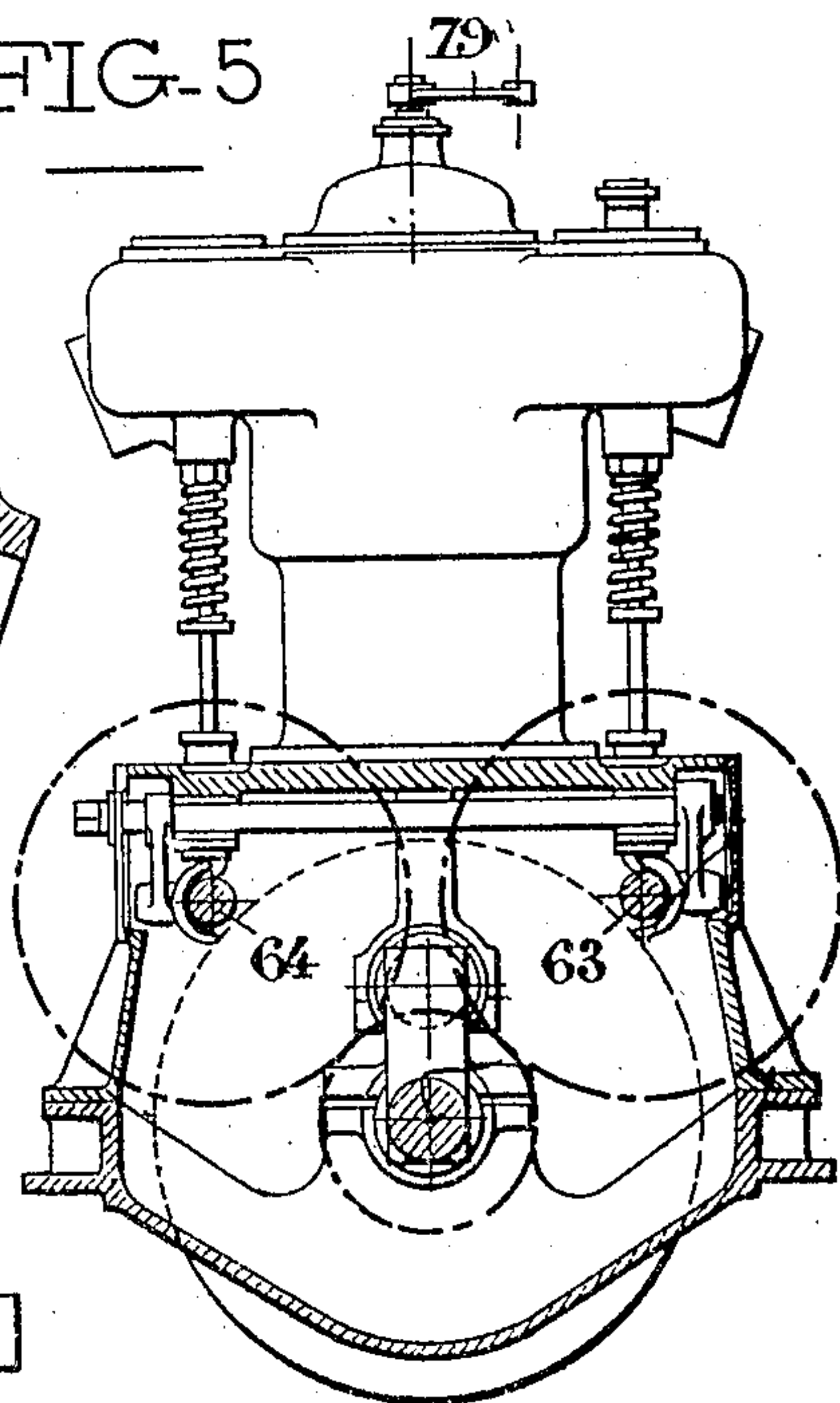
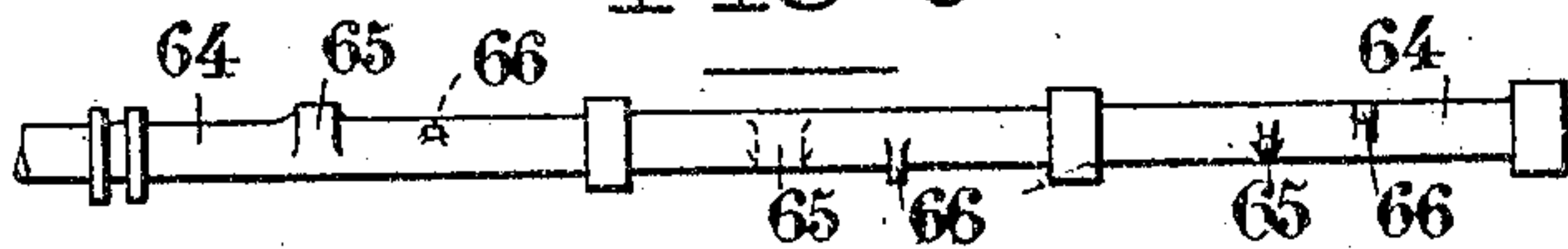


FIG. 6



Witnesses

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UNITED STATES PATENT OFFICE.

MARIUS BERLIET, OF LYON, FRANCE.

INTERNAL-COMBUSTION MOTOR.

No. 904,671.

Specification of Letters Patent.

Patented Nov. 24, 1908.

Application filed August 16, 1907. Serial No. 388,765.

To all whom it may concern:

Be it known that I, MARIUS BERLIET, a citizen of the Republic of France, residing at Lyon, France, have invented a certain new and useful Improvement in Internal-Combustion Motors, of which improvement the following is a specification.

My present invention relates to internal combustion motors of the general class or type which is set forth in an application for Letters Patent of the United States, Ser. No. 325,897, filed by me July 12, 1906, and its object is to improve the operation of the motor of said application and facilitate its construction and location in position.

To this end, my invention, briefly and generally stated, comprises the following features of improvement. 1st. A system of regulation of the admission of compressed air to the cylinder during the whole or part of the stroke of the piston. 2nd. The employment of two cam shafts controlled simultaneously for the working of the air admission valves and the exhaust valves, on the one part, and the admission valves of the explosive mixture on the other part. 3rd. The separation of the explosion chamber into two compartments, permitting the reduction of the waste spaces when the motor works with compressed air, and: 4th. Certain structural or detailed improvements, designed to render the general features above recited conveniently and desirably applicable in practice.

The improvement claimed is hereinafter fully set forth.

In the accompanying drawings: Figure 1, is a side view, in elevation, of a six cylinder motor embodying my invention, and adapted to operate either with hydrocarbon, or simultaneously with hydrocarbon and compressed air, or with compressed air only, in either forward or backward motion, and in which the admission of compressed air can be varied; Fig. 2, a transverse section, on an enlarged scale, showing the cams for complete and partial admission in this type of motor; Fig. 3, a similar section, showing the setting of the cams for exhaust and partial and complete admission in one of the cylinders of the motor shown in Fig. 1; Fig. 4, a side view, in elevation, of a three cylinder motor embodying my invention, in which all the valves are controlled by means of two cam shafts; Fig. 5, an end view of the same; Fig. 6, a detail view of the second

cam shaft which is not shown in Fig. 4; Fig. 7, a vertical section, on an enlarged scale, of the head of one of the cylinders, showing the appliance which permits the reduction of the waste spaces during movement by compressed air; and Fig. 8, a horizontal section on the line 8, 8 of Fig. 7.

The six cylinder motor shown in Fig. 1 is, in its general construction, analogous to the motor set forth in my aforesaid application for Letters Patent of the United States, Ser. No. 325,897, filed July 12, 1906, but, as supplemented by my present invention, it further comprises means for: 1st. The starting of the motor in forward or in backward movement, with three or six cylinders and full admission of compressed air, that is to say, during 134 degrees on the crank. 2nd. The forward or backward movement by compressed air, with partial admission and cut off; in this case, three cylinders work with compressed air and the other three with hydrocarbon. 3rd. The normal forward or backward movement, that is to say, with the six cylinders working with hydrocarbon.

The appliance employed for the partial admission of compressed air consists of admission cams, 37, 38, 39, 41, 43 (Fig. 3) comprising two series of noses; the first—the largest, which correspond to the noses of the cams above described, and give complete admission through 134 degrees—being indicated on the drawing by the reference numerals 37, 38, 39, 41, 42, and 43, and the second, 37', 38', 39', 41', 42', 43', which effect partial admission, being shown on Fig. 1 of different heights, to mark the two phases of movement. To effect complete admission, it suffices to bring the lever 28 to the position 28', for forward motion with compressed air, and to 28'' for backward motion; for partial admission the lever 28 is brought to 61 for backward motion. Fig. 2 shows, on a larger scale, the exact profile of these two parts of the cams.

Fig. 3 shows the profile and the setting of the different cams of the six cylinder motor represented in Fig. 1, the cam 80 serving to control the exhaust for backward motion with hydrocarbon.

The three cylinder motor shown in Figs. 4, 5, and 6, is specially applicable to automobile vehicles and to navigation. This motor, which can be provided with six cylinders, if preferred, is shown with all the

valves controlled, but it can also comprise automatic admission valves, in small motors for example.

In the case in which all the valves are controlled, the cam shafts 63 and 64 are displaced together. The shaft 63 is the shaft of the cams of exhaust and of air admission, and the shaft 64, the shaft of the admission cams of the explosive mixture.

The different phases of operation of this motor are the following: 1st. Forward movement by compressed air with full admission to three cylinders. In this movement, the working cams are the cams 71 for admission and 68 for exhaust. 2nd. Forward movement by compressed air with reduced admission to three cylinders. The working cams are; 72 for admission and 68 for exhaust. 3rd. Forward movement, one cylinder working with compressed air and two cylinders with hydrocarbon. The working cams are: 72 for admission and 68 for the exhaust of the third cylinder working with compressed air, and for the two first cylinders, the cams 65 for admission and 67 for exhaust. 4th. Forward movement by hydrocarbon. The working cams are the cams 65 for admission and 70 for exhaust. 5th. Backward motion by air (three cylinders with full admission, starting). The working cams are the cams 73 for admission and 70 for exhaust. 6th. Backward motion by compressed air with reduced admission to three cylinders. The working cams are the cams 74 for admission and 70 for exhaust. 7th. Backward motion by hydrocarbon. The working cams are the cams 66 for admission and 69 for exhaust.

The compressor serving for the production of compressed air may be either placed on the motor, or worked separately by means of a special motor, as desired, according to the applications of the motor which may be made.

In a hydrocarbon motor, the piston being at the bottom of its stroke, there should remain between it and the cylinder a sufficient volume to permit compression to a desired degree. In a compressed air motor, on the contrary, all supplemental volume becomes injurious space, diminishing the delivery and by so much increasing the expenditure of air.

Figs. 7 and 8 represent the appliance employed to obviate this objection and diminish the consumption of compressed air.

The motor carries, on its upper portion,

the compression chamber 76, communicating with the cylinder by the orifices 77 (Fig. 8); a turning choke plug 78 allows these orifices to be choked at will, by working it from the exterior by the lever 79.

When the motor operates with hydrocarbon, the orifices 77 are open, and the working is normal, the chamber 76 performing its function as in an ordinary motor. When operating with compressed air, the orifices 77 are closed by the choke plug 78; the objectionable space is thus diminished, and consequently, the consumption of air, by the entire volume of the chamber 76, which is then isolated from the cylinder. There then remains no more space which is objectionable or undesirable, than that which is absolutely necessary for the lift of the valves. The lever which controls the cam shafts at the same time works the choke plugs.

I claim as my invention and desire to secure by Letters Patent:

1. In a motor having a plurality of cylinders, the combination with a source of gas supply and a source of compressed air supply, of valves for admitting the air and valves for admitting the gas to the cylinders, valves for exhausting the air and the gas from the cylinders, a cam-shaft having two sets of cams for the air admission valves, one set holding said valves open longer than the other set, a cam-shaft for operating the gas admission valves, and means for moving said shafts longitudinally so as to supply all the cylinders with air, or all with gas, or some with air and some with gas.

2. In a motor having a plurality of cylinders, the combination with a source of gas supply and a source of compressed air supply, of valves for admitting the air and valves for admitting the gas to the cylinders, valves for exhausting the air and the gas from the cylinders, a cam-shaft having two sets of cams for the air admission valves, one set holding said valves open longer than the other set, a set of cams for operating the air exhaust valves and a set for operating the gas exhaust valves, another cam-shaft having a set of cams for operating the gas admission valves, and manually-controlled means for moving said shafts longitudinally to bring the different cams into operative position.

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Witnesses:

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GUILLAUME PIOCHE.