No. 815,802. PATENTED MAR. 20, 1906.

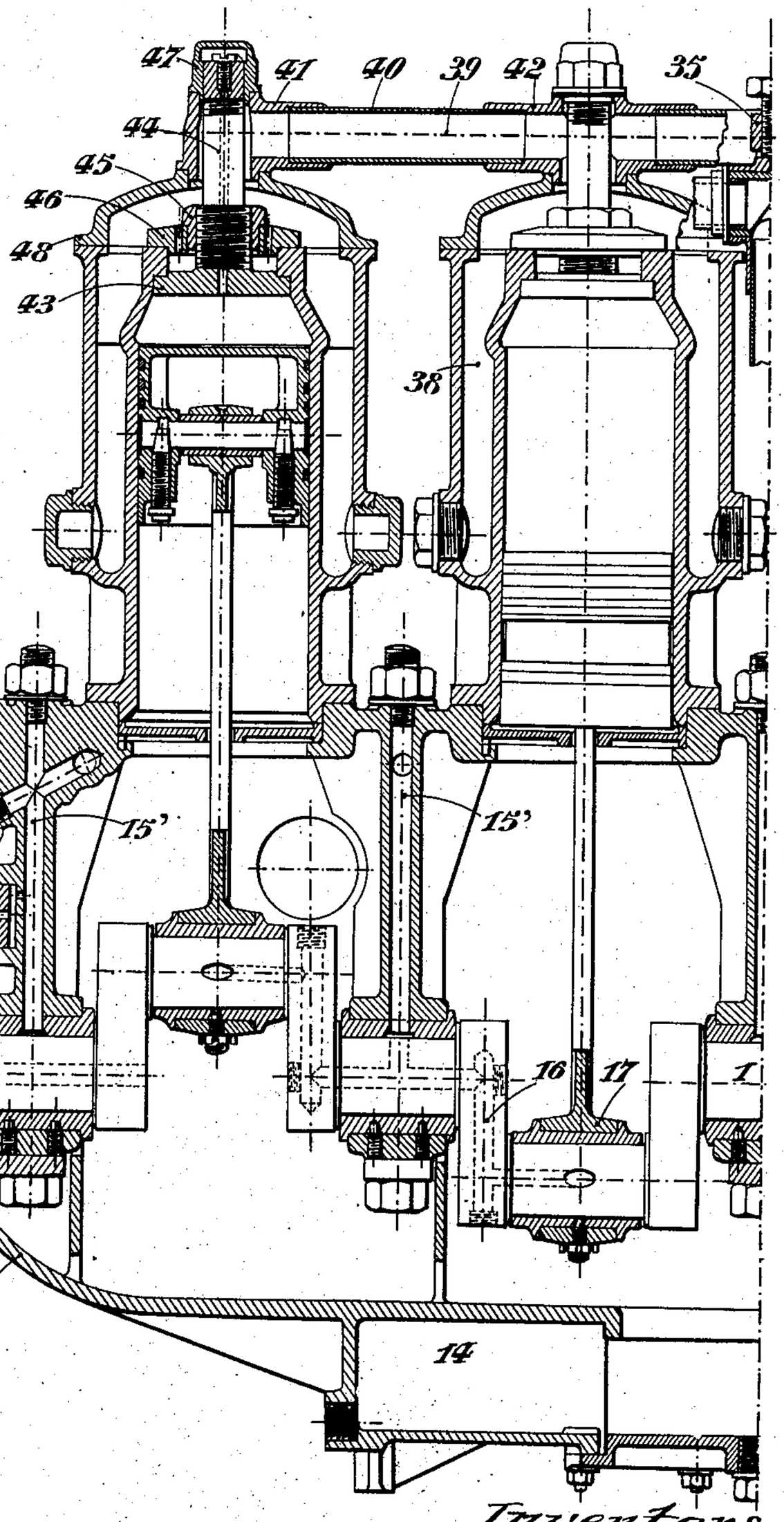
A. DE DION & G. BOUTON.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED MAR. 15, 1905.

5 SHEETS—SHEET 1

Fig. 1.



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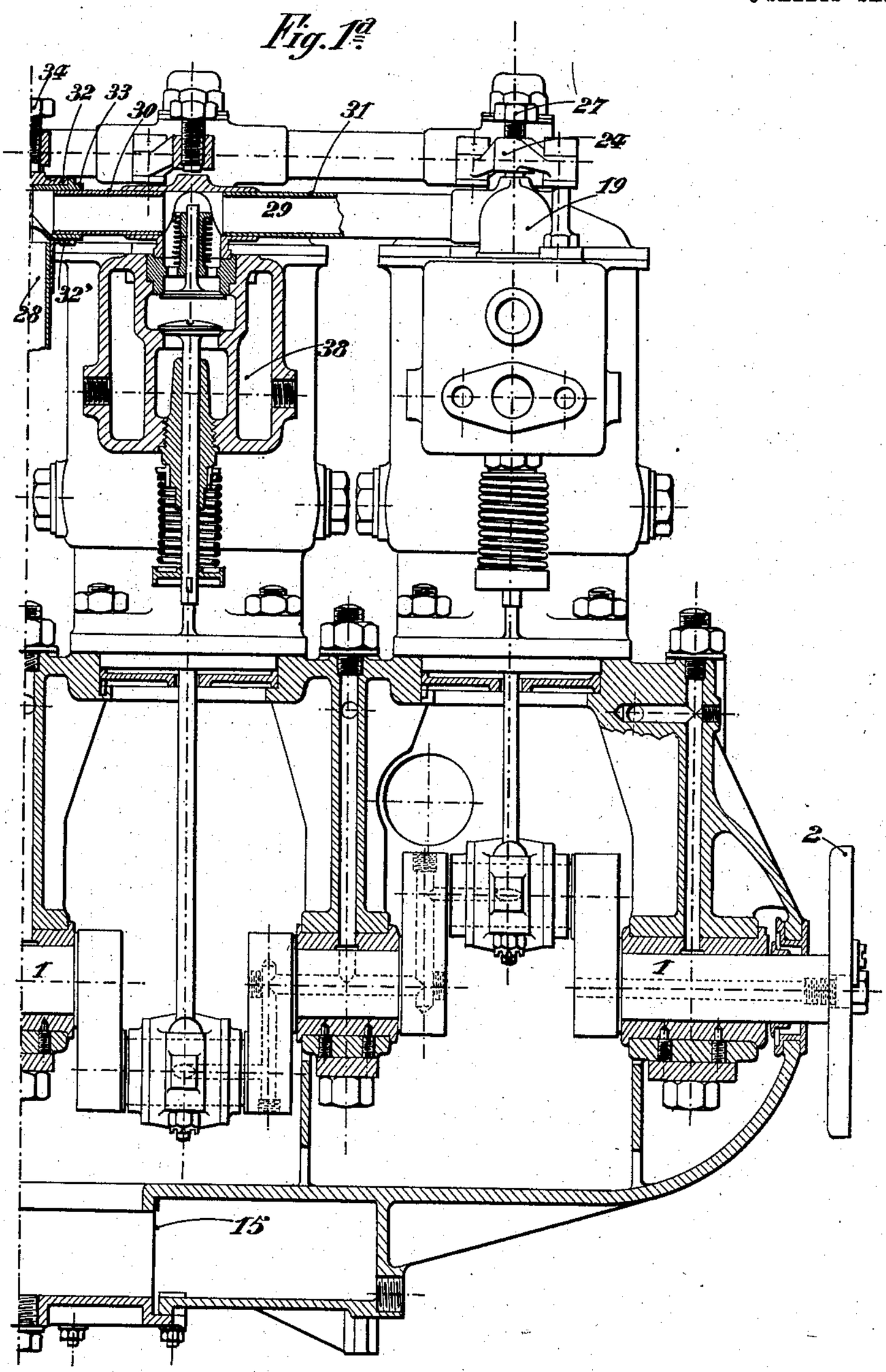
5 SHEETS—SHEET 2.

Fig. 1a



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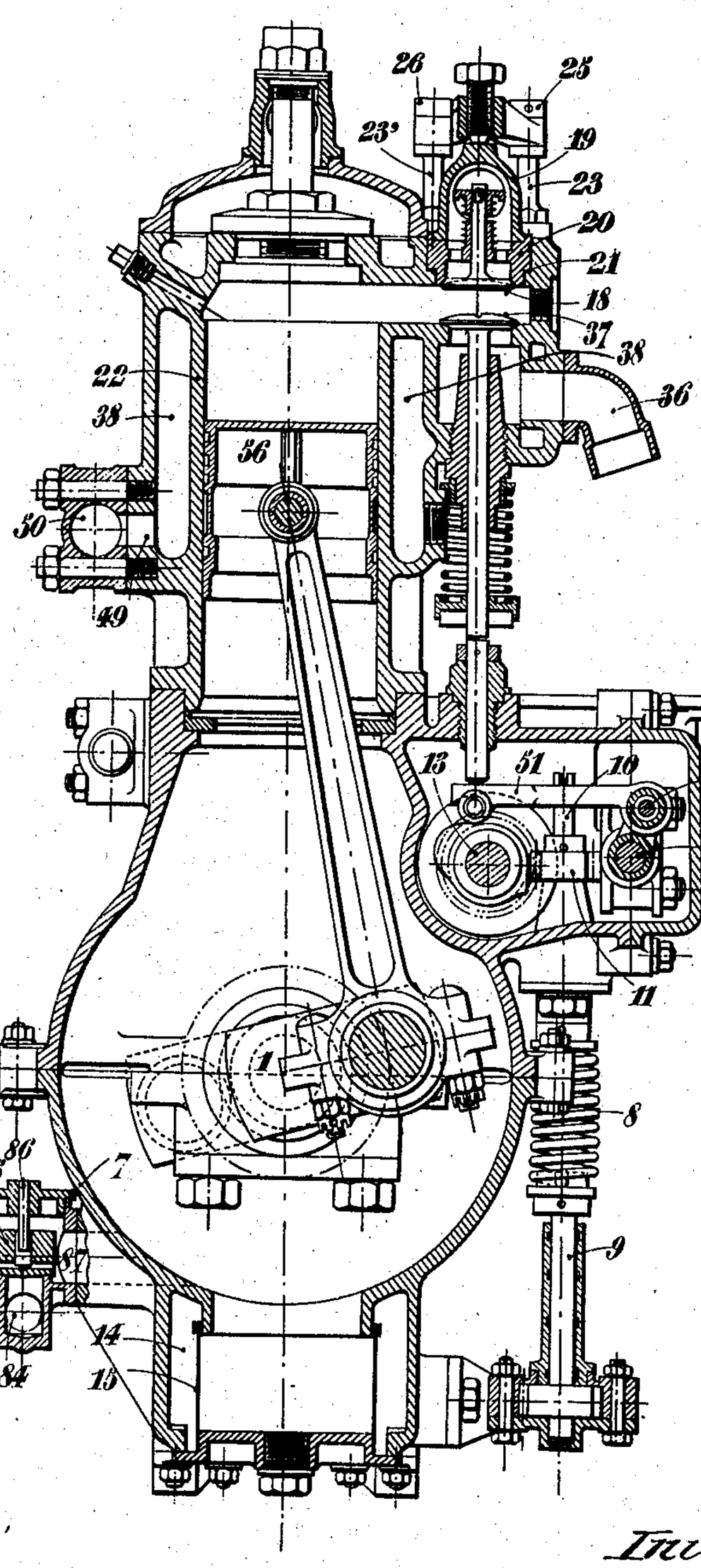
5 SHEETS—SHEET 3

Fig. 2.



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5 SHEETS—SHEET 4.

Fig. 3.

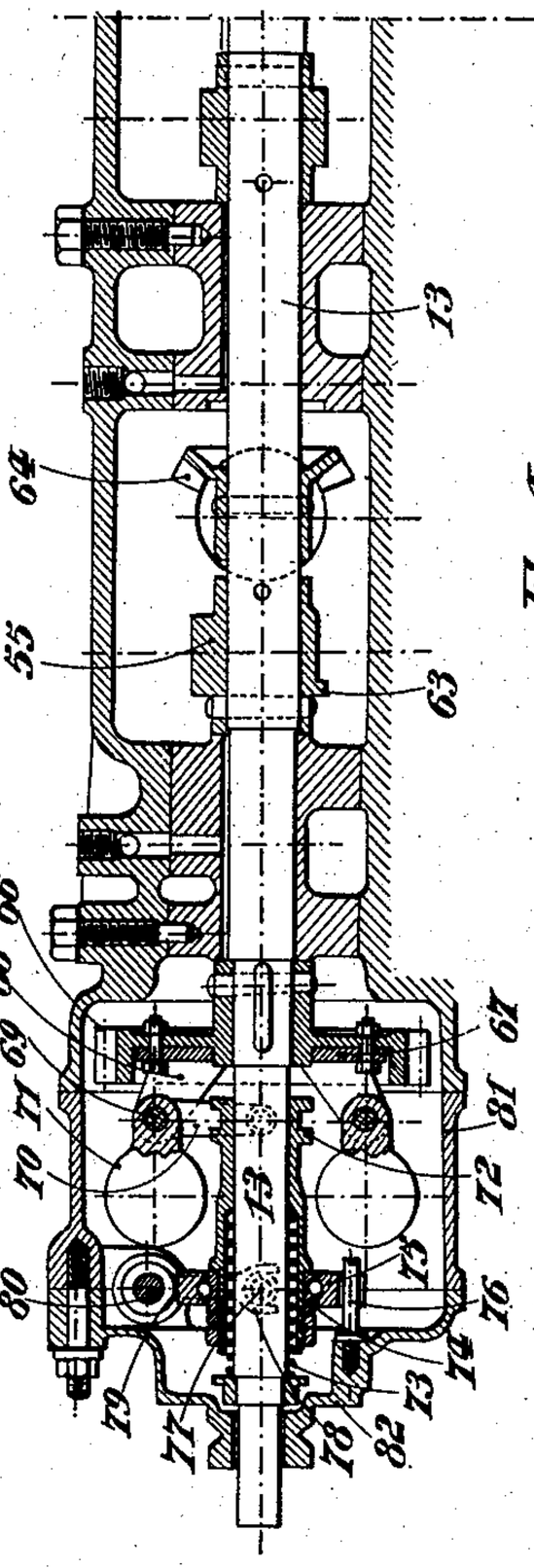
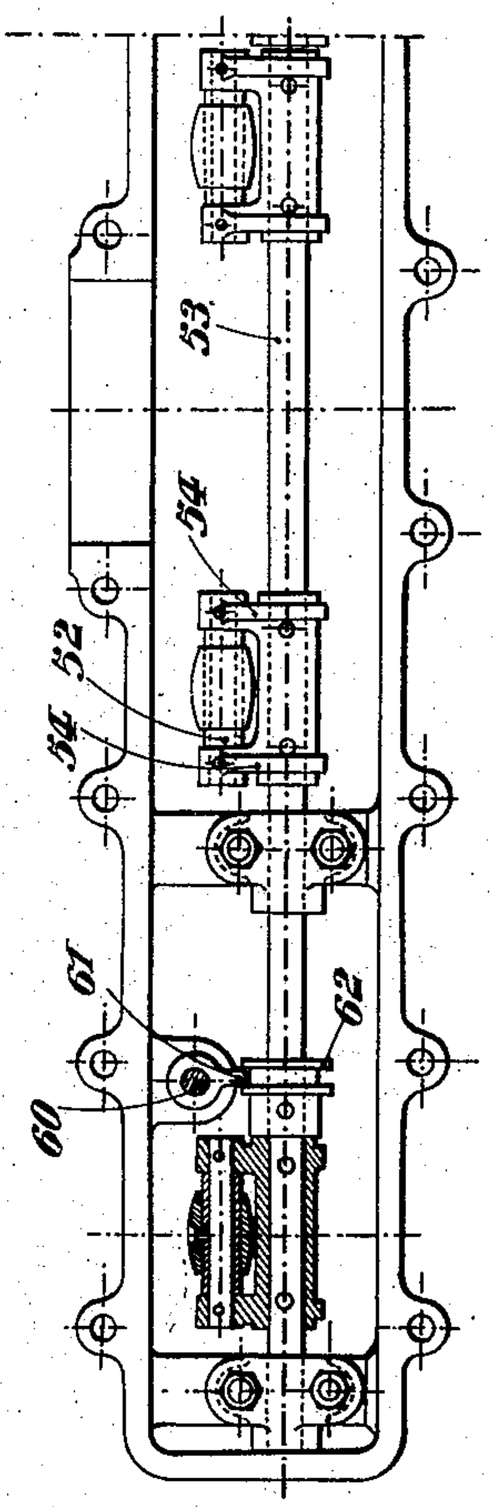


Fig. 4.



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5 SHEETS—SHEET 5.

Fig. 3.

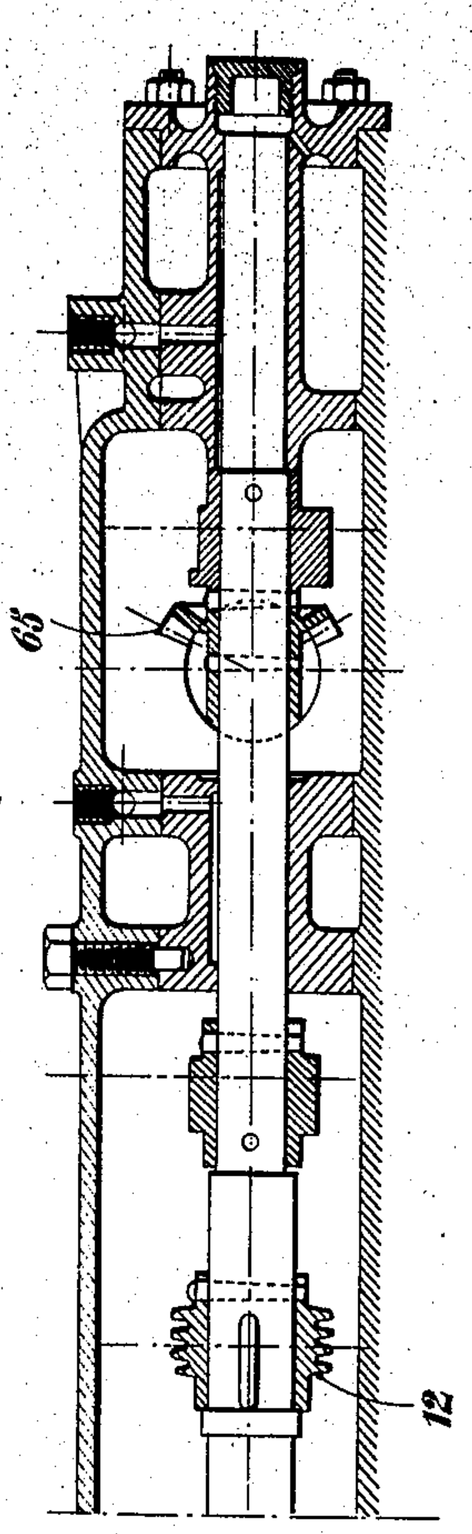

Fig. 3.

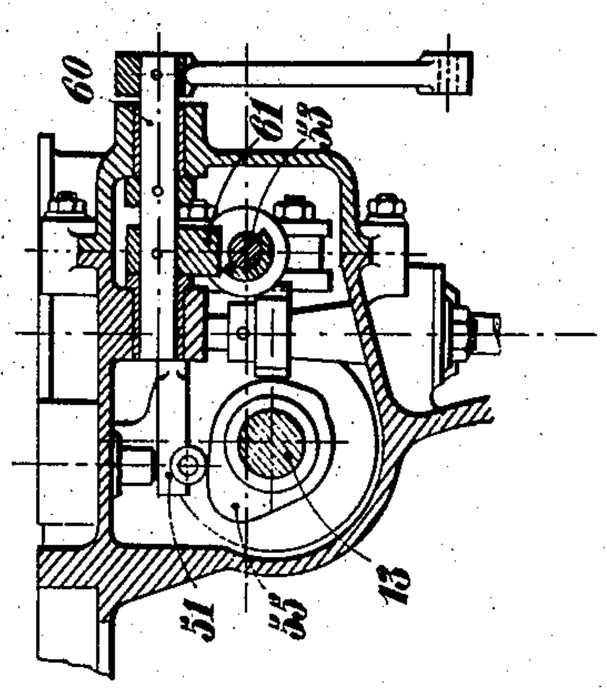

Fig. 4.

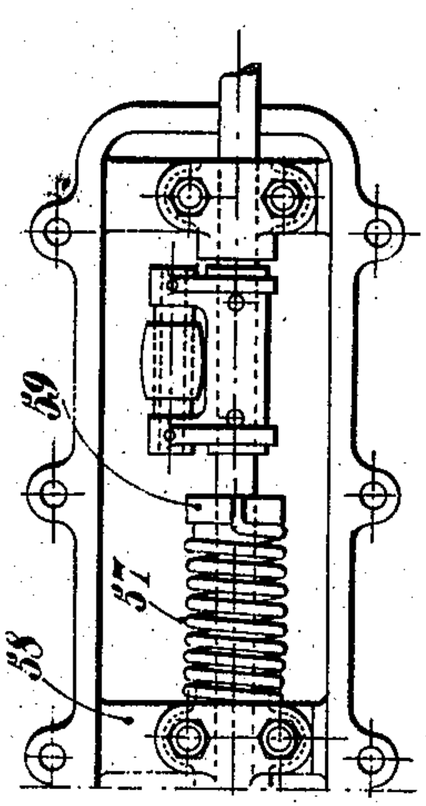

Fig. 4.a

Witnesses.

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Georges Bouton
By James L. Norris
Atty.

UNITED STATES PATENT OFFICE.

ALBERT DE DION AND GEORGES BOUTON, OF PUTEAUX, FRANCE.

INTERNAL-COMBUSTION ENGINE.

No. 815,802. Specification of Letters Patent. Patented March 20, 1906.

Application filed March 15, 1905. Serial No. 250,320.

To all whom it may concern:

Be it known that we, ALBERT DE DION, gentleman, and GEORGES BOUTON, engineer, citizens of the French Republic, residing at Puteaux, Department of Seine, France, (and having post-office address 36 Quai National, in the said city,) have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

This invention has for its object to provide various improvements in the construction of multiple-cylinder internal-combustion engines, and more especially those having four cylinders and working on the four-stroke cycle, the purpose of the said improvements being to facilitate the putting together and taking apart of the various working parts of the engine and also to facilitate the fitting in of reserve parts.

In the accompanying drawings, Figures 1, 1ª when taken together illustrate a longitudinal vertical section of a four-cylinder motor provided with improvements in accordance with this invention. Fig. 2 is a vertical transverse section through the axis of one of the cylinders. In this figure the direction of rotation of the motor is clockwise. Figs. 3, 3ª when taken together illustrate a longitudinal section showing the arrangement of the governor and of the valve-operating cams. Figs. 4, 4ª when taken together illustrate a side elevation, partly in longitudinal section, showing the arrangement for operating the regulating-lever and the compression-reducing mechanism; and Fig. 5 is a transverse sectional view.

Fig. 1 shows the manner in which the four cranks of the driving-shaft are set relatively to one another. This arrangement of the cranks has been adopted because it secures a better balance of the moving parts; but the cranks may be set in any other angular position relatively to each other. At one end the crank-shaft 1 terminates in a disk 2, to which the fly-wheel is bolted in the usual way. To the other end of the crank-shaft the starting-crank may be secured. The plumber-blocks (one at each end of the driving-shaft and one between each two adjacent cranks) are for plain journals; but in order to counteract injurious longitudinal thrusts on the crank-shaft the end which carries the starting-crank handle is provided with ball-bearings acting like a thrust-block. These ball-bearings may be constructed in the usual manner, one part of the race thereof being secured to the crank-shaft by a nut 4 and the other part being fixed to a box 5, made in one with a cover 6, bolted to the casing 7 of the motor.

The lubrication of the various bearings is insured by a circulation-pump, which may, for instance, be a toothed gearing-pump (the operating mechanism of which is illustrated in Fig. 2) and comprises a helical spring 8, connecting the spindle 9 of one of the pinions of the pump with a vertical spindle 10, carrying a worm-wheel 11, gearing with a worm 12, keyed on the cam-shaft 13. The oil drawn from the lower part 14 of the casing, which forms a reservoir, passes through a filtering-partition 15 and is conducted to the pump by a longitudinal passage, which supplies the oil to the various bearings through passages, such as 15′, Fig. 1. The crank-shaft and crank are provided with internal channels 16, conducting the oil to the enlarged ends 17 of the connecting-rods.

In order that the lubrication of the motor may take place at constant pressure, whether the oil be limpid or viscous or hot or cold, the canal 84, Fig. 2, through which the oil passes on leaving the pump, is fitted with a loaded or reducing valve 85, guided by the stem 86. When the pressure exceeds a pretermined amount, the said valve is lifted and the oil flows back into the casing through the opening 87. In this motor the exhaust-valves are mechanically controlled, while the inlet-valves work automatically. The admission of gas into each cylinder is effected by a valve 18, Fig. 2, of ordinary construction; but mounted in a special manner. Each such valve is surmounted by a hood 19, the lower part of which engages with a circular recess provided in the valve-seat 20, which is situated in a recess in the cylinder-casting, a gasket 21 being provided between the said recess and the valve-seat 20. The hood may of course bear on the top of the valve-seat and be kept in place by the recess in the casting. The upper part of the cylinder proper, 22, is machined, so as to form a plane, which greatly simplifies the tooling. To maintain the hood 19 in position, two small pillars 23 23′ are arranged on opposite sides thereof the feet of these pillars being in a line at, say, an angle of forty-five degrees with the longitudinal line of the motor and being screwed into the body of the cylinder-casting. The said pillars are connected together at their upper ends by a cross-bar 24, one end

of which has an eye through which passes the upper end of the pillar 23 and is held in place by a nut 25 and split pin, while the other end of the said cross-bar is forked and engages with the pillar 23′ below a head 26, provided thereon. The middle portion of the cross-bar 24 carries a screw 27.

In order to secure the hood 19 in position after having put it in place, the cross-bar 24 is turned round the pillar 23 until the forked end of the cross-bar engages under the head 26 of the pillar 23′. The screw 27 s then screwed down to press the hood 19 and valve-seat 20 firmly down in their places. The removal of the hood is rapidly effected by slightly loosening the screw 27 and then turning round the cross-bar 24.

The gaseous fuel for working the motor is supplied by a pipe 28, running from the carbureter and opening into a horizontal pipe 29, extending along the length of the motor and consisting of four lengths of tube, such as 30 and 31, with their ends received in tubular projections on the inlet-valve hoods, the end hoods for this purpose being provided with one tubular projection, while the intermediate hoods are each provided with two tubular projections opposite each other. The connection of the pipe 28 with the two tubes 30 is effected by means of two half-collars 32 32′, the latter carrying a socket-tube, in which the pipe 28 is fixed. These two half-collars encircle rings 33, fixed to the tubes 30, between which they allow a slight amount of play. The half-collars 32 and 32′ have likewise a slight amount of play in a horizontal plane passing through the axis of the tubes 30, and the tightening of the half-collars on the tubes is effected by means of a screw 34, passing through a stirrup 35, the branches of which bear at their lower part (not shown) on the under side of the lower half-collar 32′. The elasticity of the pipes 30 permits of suitably tightening the half-collars. This arrangement has the advantage of being easily taken apart. Any air that might enter the opening at the junction of the pipes 30 30 is not objectionable, as it would only be additional to that admitted at the variable air-inlet.

The exhaust branches 36, Fig. 2, through which the burned gases escape when the exhaust-valve 37 is lifted open into a collecting-pipe, (not shown,) which conducts them to the silencer. The exhaust-valve gear may be based on the same principle as that of the gear of single or multiple cylinder motors, well known under our names; but the gear illustrated presents the following improvements.

Each exhaust-valve 37 is operated in the usual manner by the lift of a lever or "hammer" 51, the head of which rests on a cam 55, (see Fig. 3,) mounted on the shaft 13, revolving at half the speed of the motor. The pivot of each hammer is movable, each hammer being for this purpose mounted on a pin 52, (see also Fig. 4,) connected by two links 54 to an auxiliary longitudinal shaft 53, so that the speed of the motor can be regulated by partial rotation of the shaft 53, effected either by hand or by the governor. By shifting the shaft 53 in a longitudinal direction the compression-reducing mechanism can be operated. For this purpose the cams 55 have not the same contour throughout their whole width, and, while the motor is running, by shifting the shaft longitudinally the hammer 51 can be brought over any part of the cam's width, and the hammer, and consequently the exhaust-valve 37, be thus caused to have a lift depending on the contour of the part of the cam in operation. For instance, the valve 37 can be kept open during the greater part of the stroke of the piston 56 when it is desired to secure the reduction of compression necessary for starting the motor. This longitudinal movement of the shaft 53 can be effected in a very simple manner, as illustrated in Fig. 4. A helical spring 57, bearing at one end on a partition 58 of the framing inclosing the shaft 53 and at the other end on the ring 59, pinned or otherwise secured to the shaft 53, normally pushes the shaft 53 toward the right end of Fig. 4. When it is desired to use the compression-reducing mechanism, a suitable operating-gear is caused to rotate a small shaft 60, carrying a finger 61, engaging the peripheral groove of a ring 62, fixed to the shaft 53. This movement brings the heads of the hammers 51 opposite the parts 63 of the cams 55, specially formed for the purpose. The spring 57 is also subjected to torsion and tends to rotate the shaft 53 clockwise, Fig. 2. The movement of the cams under the hammers tends to produce rotation in the same direction. The presence of this spring does away with the loss of time ordinarily resulting from play between the driver's handle and levers keyed on the shaft 53.

The cam-shaft 13 has keyed on it bevel-pinions, such as 64 and 65, (or the equivalent, such as worms,) which are so arranged as to actuate transverse shafts (not shown on the drawings) intended to operate the igniter-controlling device, the magneto-electric machine, the circulation-pump, and the like. This arrangement has the advantage that these various auxiliary parts are arranged at the side of the motor instead of at the end of it, as hitherto, when owing to the radiator being at the fore end of the vehicle it constitutes an impediment to access being gained to these various parts.

Our motor is provided with a centrifugal ball-governor. (Shown in Fig. 3.) To the shaft 13 is keyed a pinion 66, gearing with a pinion 83, Fig. 1, driven by another pinion the diameter of which is half the diameter of

the pinion keyed on the driving-shaft 1, and in this way the shaft 13 receives its motion. The pinion 66 is connected, by means of bolts, to a disk 67, carrying, say, eight lugs 68, each pair carrying pins 69, on which are mounted, say, four bell-crank levers 70, carrying each a governor-ball 71. Each bell-crank lever carries a pin engaging in a peripheral groove in the collar 72, capable of sliding on the shaft 13.

A helical spring 73 tends to press the collar 72 in such a direction as to bring the balls 71 nearer the shaft 13. One half 74 of a ball-bearing race is carried by the collar 72 and the other half 75 is prevented from turning by a stud 76, engaging a notch therein, and carries two pins 77, arranged diametrically opposite each other and engaging a fork 78, fixed to the end of a lever 79, oscillating on a spindle 80. When the motor is running, the balls 71 move away from the shaft 13, the spring 73 is compressed, and the shaft 80 undergoes a partial rotation which operates some regulating part of the motor—such, for instance, as the exhaust-valves—through the medium of the shaft 53 and the hammers 51. Instead of controlling the exhaust this governor can be arranged to vary the admission.

The governor is inclosed in a casing consisting of two parts 81 and 82, connected together by studs and attached to the valve-gear casing in a similar manner. If it be desired to do without the governor, the part 81 of the governor-box and the working parts of the governor are omitted and the cover 82 of the governor-box is attached directly to the valve-gear casing, in which case the pinion 66 will of course be an ordinary pinion.

The governor may be so arranged that whenever the speed of the motor decreases below a certain value (four hundred revolutions per minute, for instance) the inward movement of the balls toward the shaft 13, and the consequent movement of the collar 72, actuates the compression-reducing gear, which need not then be operated when the motor is being started. It is also possible either to use the governor to effect only the reduction of the compression at the slow speeds of the motor or to combine this operation with the automatic regulation of the admission or exhaust.

The cooling of the cylinders can be effected in this motor in the usual way by the circulation of water through jackets 38, surrounding the cylinders and valve-chambers, the water supplied to these jackets by openings, such as 49, branching off a main water-supply pipe 50, extending along the motor. The water used in cooling the cylinders leaves the motor through a pipe 39, extending likewise on the whole length of the motor. This pipe 39 is similar to the hereinbefore-described pipe for the supply of gas to the motor, it being constituted by several lengths of tube 40, mounted in hoods provided with a branch or two branches, such as 41 and 42; but the mode of attachment of these hoods is different, the head of each cylinder being provided with a closing-plate 43, (see Fig. 1,) the screw-threaded rod 44 of which is screwed into a nut 45, maintaining a perforated disk 46 in position. At the upper part a box-nut 47 is screwed on the end of the rod 44 and holds the hood (41 or 42) down on the jacket-cover 48, which is thus held firmly on the cylinder-body.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, we declare that what we claim is—

1. A multiple-cylinder internal-combustion engine, comprising the combination with a plurality of cylinders, each provided with a suction-valve, of a hood inclosing said valve, a pair of pillars arranged in operative relation with respect to each of said hoods, a cross-bar mounted upon each pair of pillars and engaging each of the hoods, means for securing the cross-bar in position, conduits for establishing communication between the hoods, and a common supply-pipe for said conduits.

2. A multiple-cylinder internal-combustion engine, comprising the combination with a plurality of cylinders, each provided with a suction-valve, of a hood inclosing each of said valves, certain of said hoods provided with a pair of tubular extensions and the other of said hoods provided with a single tubular extension, a pair of pillars arranged in operative relation with respect to each of said hoods, a cross-bar mounted upon each pair of pillars and engaging each of the hoods, means for securing the cross-bar in position, conduits connected to said tubular extension for establishing communication between the hoods and a common supply-pipe for said conduits.

3. A multiple-cylinder internal-combustion engine, comprising the combination with a plurality of cylinders, each provided with a suction-valve, of a hood inclosing each of said valves, certain of said hoods provided with a pair of tubular extensions and the other of said hoods provided with a single tubular extension, a pair of pillars arranged in operative relation with respect to each of said hoods, a cross-bar mounted upon each pair of pillars and engaging each of the hoods, means for securing the cross-bar in position, conduits connected to said tubular extension for establishing communication between the hoods, a common supply-pipe for said conduits, a pair of half-collars for connecting said supply-pipe to said conduits, a screw securing the half-collars in position, and a stirrup bearing against one of said collars and through which the said screw passes.

4. A multiple-cylinder internal-combus-

tion engine, comprising the combination with a plurality of cylinders, each provided with a suction and an outlet valve, of a hood inclosing each of said suction-valves, a pair of pillars arranged in operative relation with respect to each of said hoods, a cross-bar mounted upon each pair of pillars and engaging each of the hoods, means for securing the cross-bar in position, means for suitably operating the suction-valve, conduits for supplying a cooling medium to each of the said cylinders, conduits for establishing communication between the hoods, and a common supply-pipe for said last-mentioned conduits.

In testimony whereof we have hereunto set our hands in presence of two subscribing witnesses.

ALBERT DE DION.
GEORGES BOUTON

Witnesses:
EMILE KLOTE,
PIERRE LEINE.