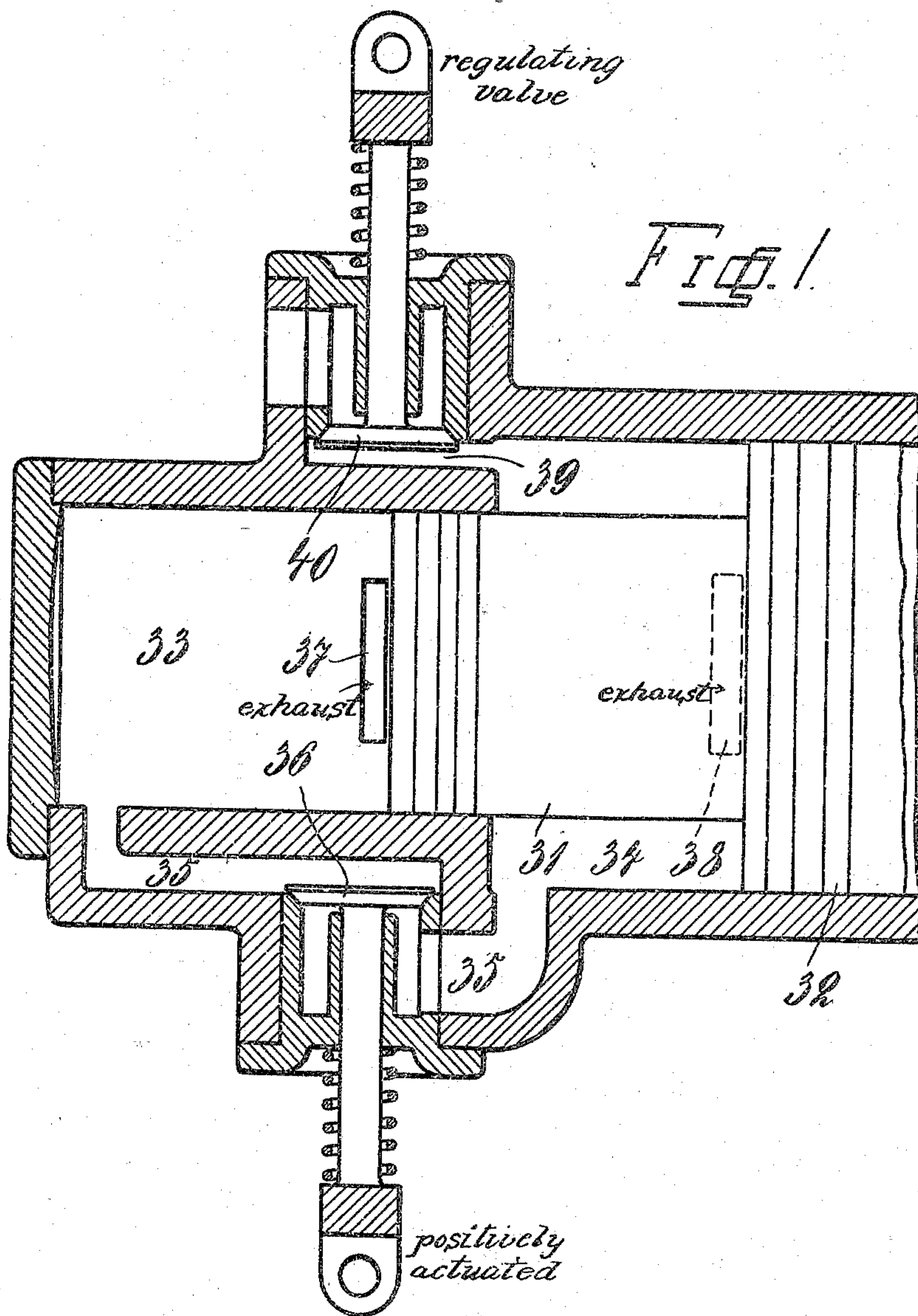


C. A. & O. W. HULT.
INTERNAL COMBUSTION MOTOR.
APPLICATION FILED FEB. 26, 1906.

957,965.

Patented May 17, 1910.
2 SHEETS—SHEET 1.



WITNESSES:

W. P. Burke
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INVENTORS.

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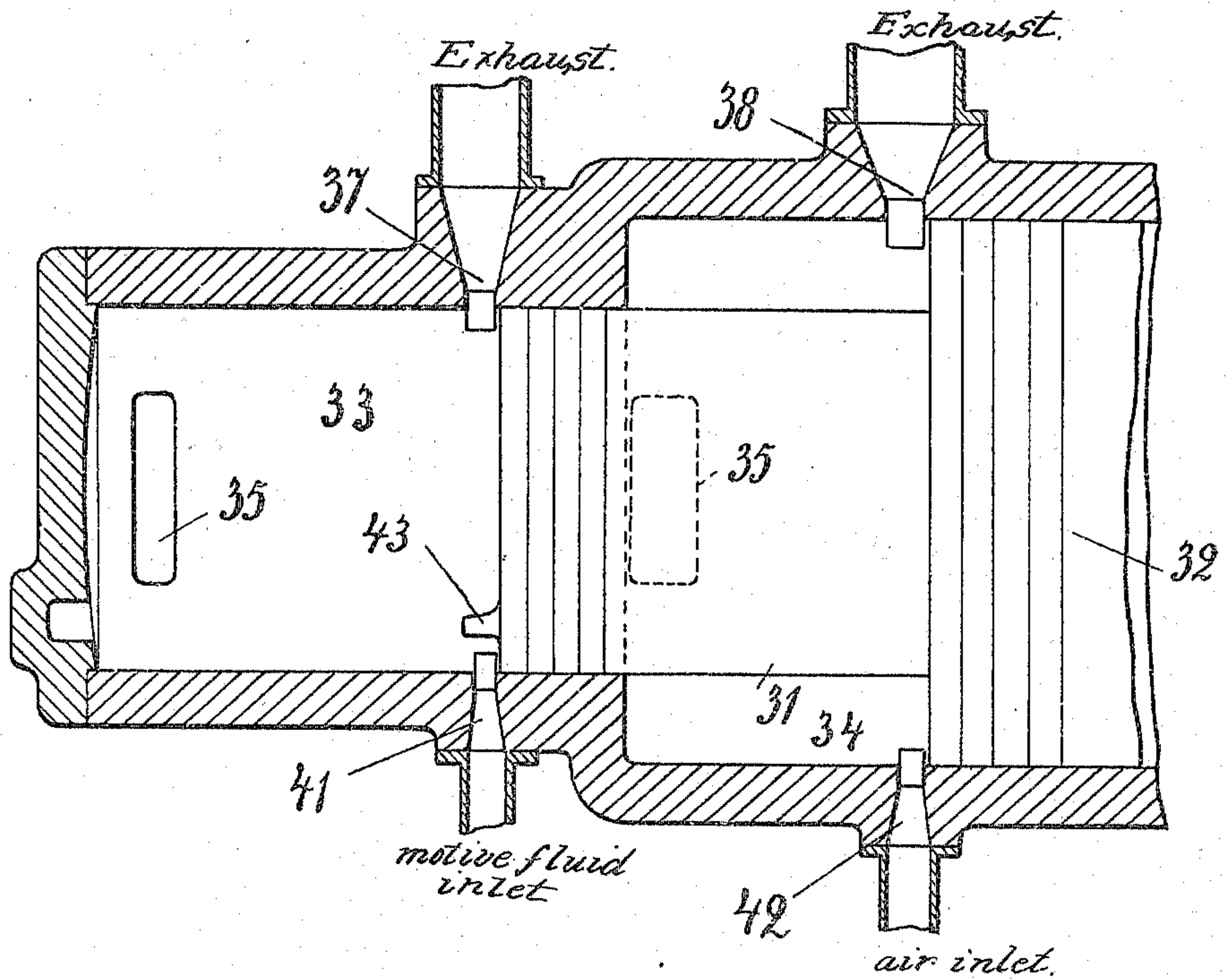
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2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

CARL ALRIK HULT AND OSCAR WALFRID HULT, OF STOCKHOLM, SWEDEN.

INTERNAL-COMBUSTION MOTOR.

957,965.

Specification of Letters Patent.

Patented May 17, 1910.

Application filed February 26, 1906. Serial No. 303,090.

To all whom it may concern:

Be it known that we, CARL ALRIK HULT and OSCAR WALFRID HULT, subjects of the King of Sweden, and residents of 1 Inedalgatan, Stockholm, in the Kingdom of Sweden, engineers, have invented certain new and useful Improvements in Internal-Combustion Motors, of which the following is a specification, reference being made to the accompanying drawings.

The present invention relates to such internal combustion motors as consist of two cylinders (or groups of cylinders), in the one of which (the primary cylinder) the motive fluid is ignited, while in the other (the secondary cylinder) is compressed air (or another fluid), intended to be heated by the burning gas from the first-mentioned cylinder, and of a valve controlled passage between the two cylinders. According to this invention the valve in the passage between the cylinders is so arranged, that it is kept closed during the compression stroke of the working pistons in the cylinders, in consequence of which the compression in the secondary cylinder can be driven to a higher degree than the compression in the primary cylinder, the valve being opened again at the commencement of the stroke in the opposite direction, so that the compressed fluids then come into contact with each other. Hereby is gained the well known advantage that the motor can work with a high initial pressure (and consequently with a high average pressure), and at the same time the inconveniences, for instance ignition of the motive fluid before the right moment, which are usually connected to such working are avoided. Another advantage gained by this invention is that the ignition of the motive fluid in the primary cylinder can be reliably brought about in consequence of the air, which is highly compressed in the secondary cylinder, coming into contact with the fluid in the primary cylinder.

The accompanying drawings show as an example a form of this invention.

Figures 1 and 2 show longitudinal sections of two cylinders of a motor carried out according to this invention Fig. 1 being taken at right angles to Fig. 2.

In each of the two cylinders 33 and 34, which are situated in a line with one another and are made in one piece, works a piston 31 and 32 respectively which pistons are of different diameters and are combined so as

to form one piston. On the return stroke of the pistons there takes place in the cylinder 33 (the primary cylinder) a compression of a combustible charge of motive fluid or of air, intended for the formation of such a charge, and simultaneously there takes place a compression of air in the cylinder 34 (the secondary cylinder), which, when this is going on, is kept separated from the cylinder 33 by a valve 36 in a passage 35 extending between the two cylinders. The air in the cylinder 34 is compressed to a pressure which is in a suitable degree higher than the pressure to which the motive fluid or the air in the cylinder 33 is compressed. A passage 39, leading from the back part of the cylinder 34 to the atmosphere, is thus, in the normal working of the motor, kept shut during the return movement of the piston by a valve 40, which is located in the said passage. 37 and 38 designate exhaust openings for the gases which are in the cylinders 33 and 34, when the expansion is finished, while 41 and 42 designate inlet passages which lead from suitable supplies of mixture and air, respectively, under pressure and 43 a deflector on the piston 31. At, or about, the moment when the compressed charge in the cylinder 33 is ignited, the valve 36 is opened, so that the two cylinders 33 and 34 come into communication with each other. In consequence of this, a part of the burning fluid in the cylinder 33 comes into contact with the air compressed in the cylinder 34, which air therefore becomes heated to considerably above the temperature it possesses, when the compression is ended. The caloric energy in the compressed charge in the cylinder 33 is thus divided between the two cylinders and can therefore be converted into kinetic energy (received by the pistons 31 and 32) in a much better way, from an economic point of view, than if the conversion of energy took place in the cylinder 33 alone. Moreover, as the pressure of the air in the cylinder 34 is higher than that of the motive fluid in the cylinder 33, the pressure in both cylinders, after the valve 36 in the passage 35 has been opened, will become higher than if the pressure in the cylinder 34, before the opening of the valve, were equal to the pressure in the cylinder 33, which latter pressure may not be driven above a certain degree, in order that a premature ignition of the motive fluid may not be caused by the com-

pression. Consequently, according to this invention, the motor can work with a higher initial pressure and thus with a higher average pressure than other motors, whereby advantages, well known to persons skilled in the art, are gained, and at the same time inconveniences, for instance premature ignition, caused by such working, are avoided.

The final pressure in the cylinder 34 can be so proportioned relatively to the final pressure in the cylinder 33 that, when the two cylinders are put into communication with each other, through the passage 35, the pressure in the cylinder 33 becomes so high, that the motive fluid in the last mentioned cylinder becomes ignited. The ignition can thus be brought about reliably and at the right moment in a mechanical way, *i. e.* by opening the valve 36, and without the aid of the ordinary means, for instance an ignition tube or electric sparks, which makes it less reliable.

In motors constructed according to this invention the power development can be adjusted by the aid of the valve 40 in the passage 39 leading from the cylinder 34. In the normal working of the motor the valve 40 is kept closed during the whole compression stroke of the working pistons. The lowest degree of power development (with a given proportion of mixture of the fluid in the cylinder 33) is obtained, when the valve 40 is kept open during the whole return stroke of the piston 32, so that no

air is then compressed in the cylinder 34, Degrees of power development lying between the lowest and the normal degrees of power development can be obtained by adjusting (with the assistance of the valve 40) in a suitable degree the compression of air in the cylinder 34, from 0-compression to the compression corresponding to the normal working.

Having now described our invention, what we claim as new and desire to secure by Letters Patent is:

In internal combustion motors the combination of two cylinders having a passage connecting them together, said cylinders being positioned co-axially with respect to one another, one of said cylinders being of greater diameter than the other of said cylinders, one of said cylinders having a motive fluid inlet port, and the other cylinder having an air inlet port and an exhaust port, and a passage leading to the atmosphere, a double piston fitting within said cylinders, a positively actuated valve controlling the passage between the two cylinders, and a governing valve controlling the passage leading to the atmosphere.

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

CARL ALRIK HULT.

OSCAR WALFRID HULT.

Witnesses:

CARL FRIBERG,

HANS B. OHLSSON.