

No. 778,375.

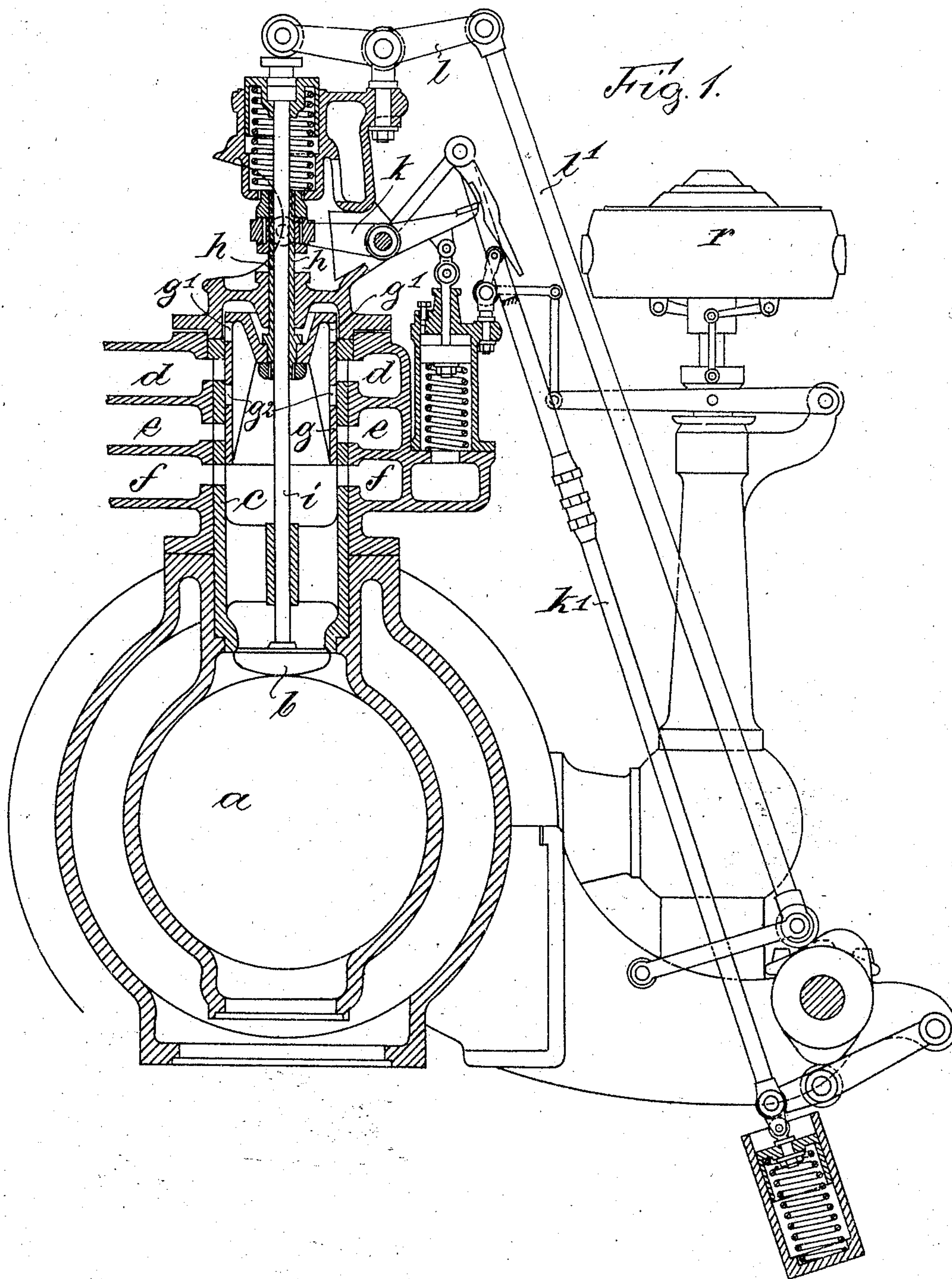
PATENTED DEC. 27, 1904.

K. REINHARDT.

SPEED REGULATOR FOR EXPLOSIVE ENGINES.

APPLICATION FILED NOV. 25, 1903.

2 SHEETS—SHEET 1.



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2 SHEETS—SHEET 2.

Fig. 2

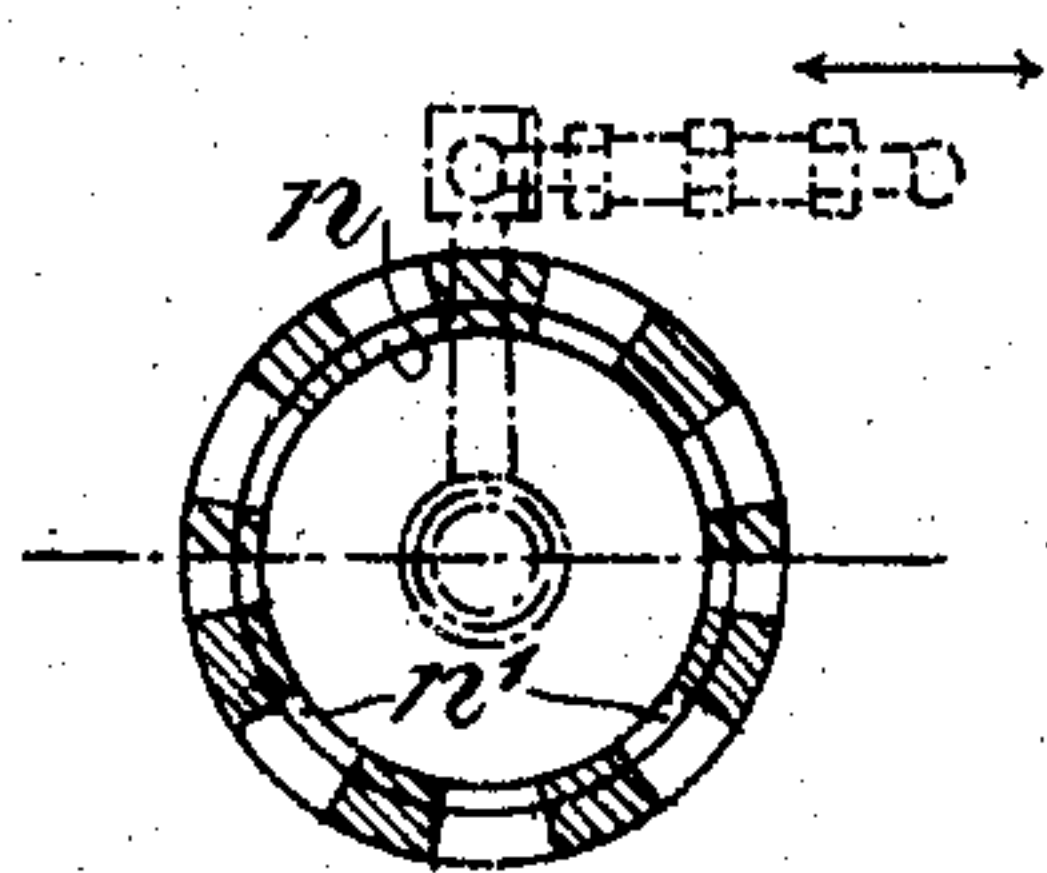
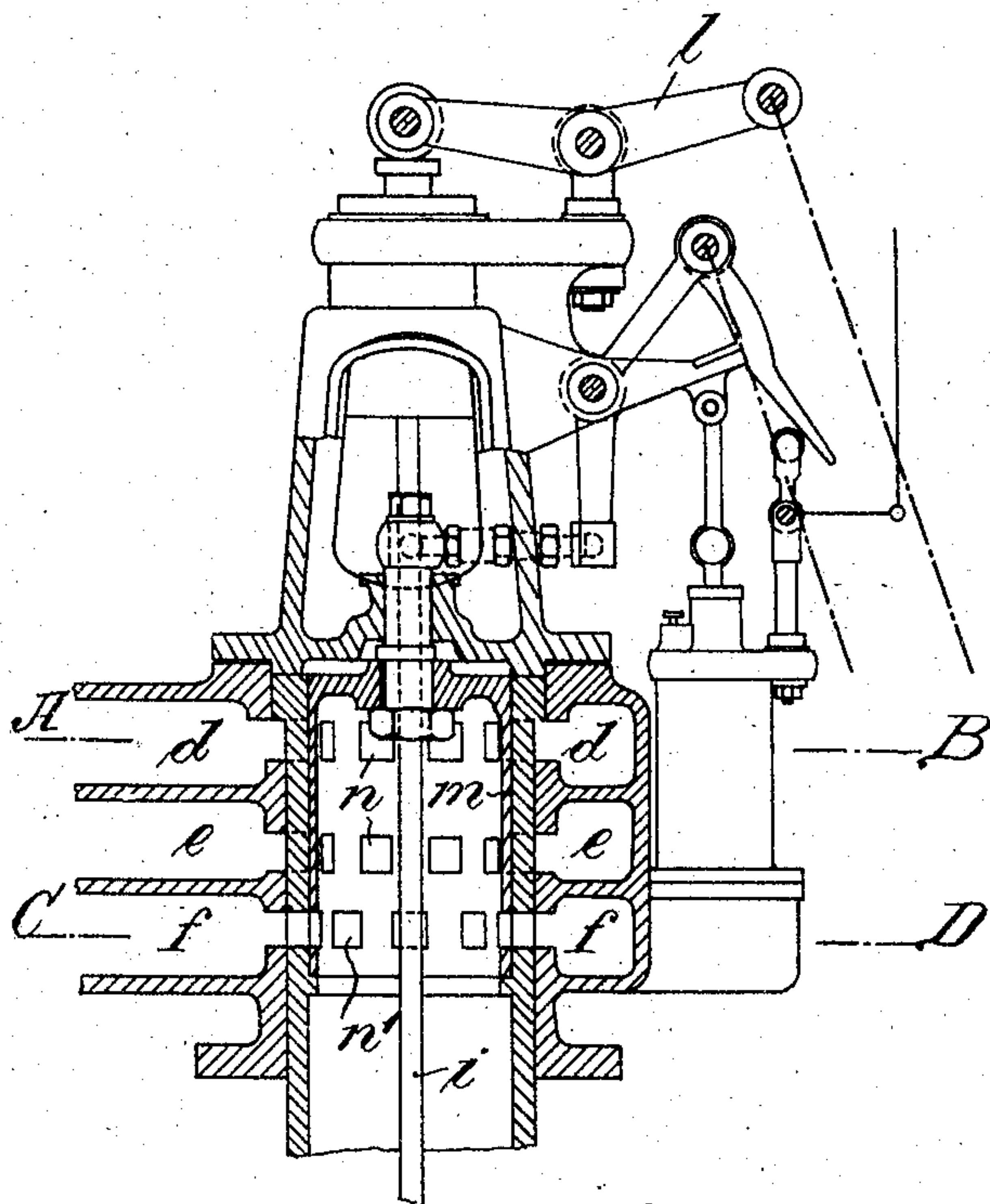


Fig. 3

Fig. 4

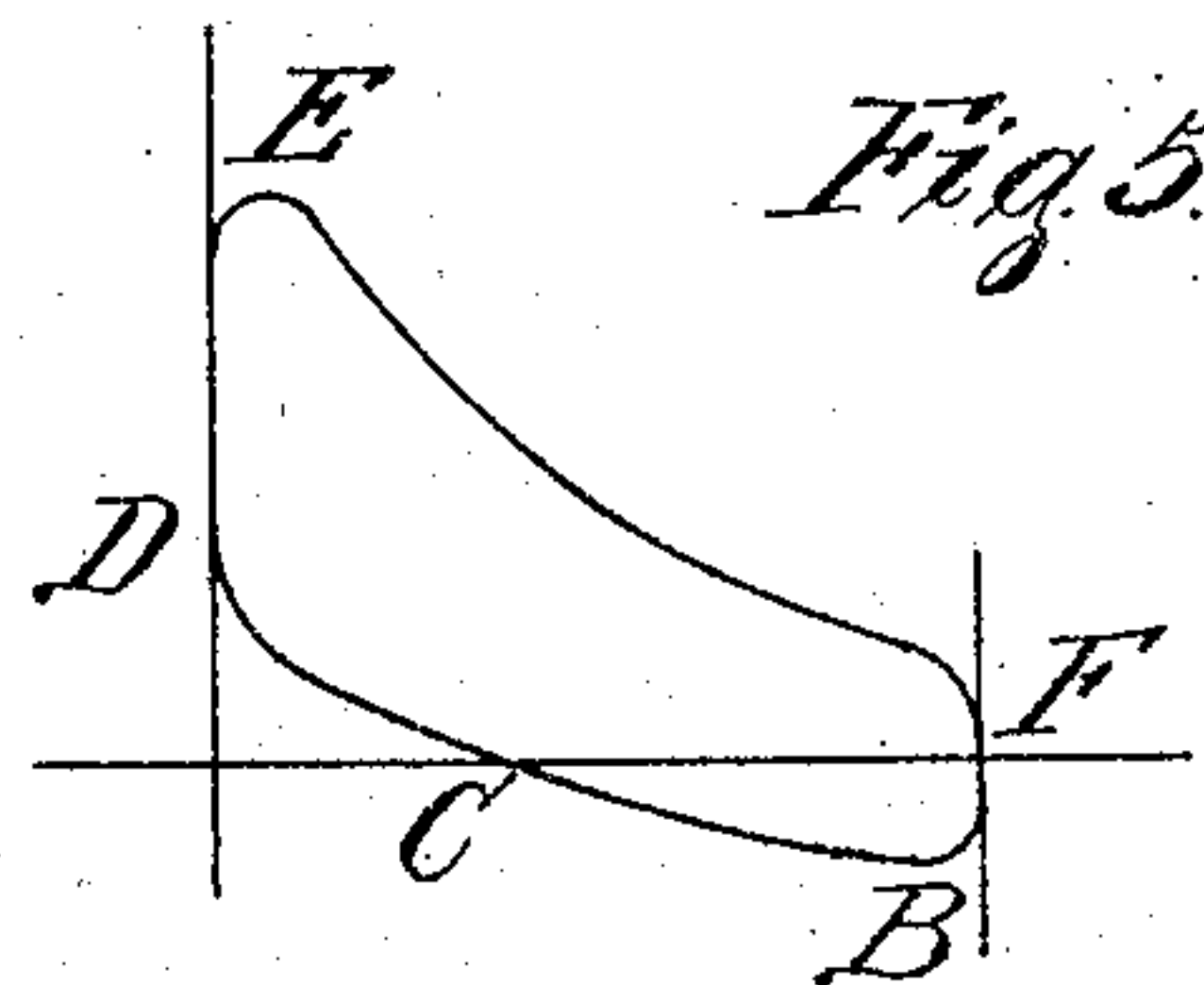
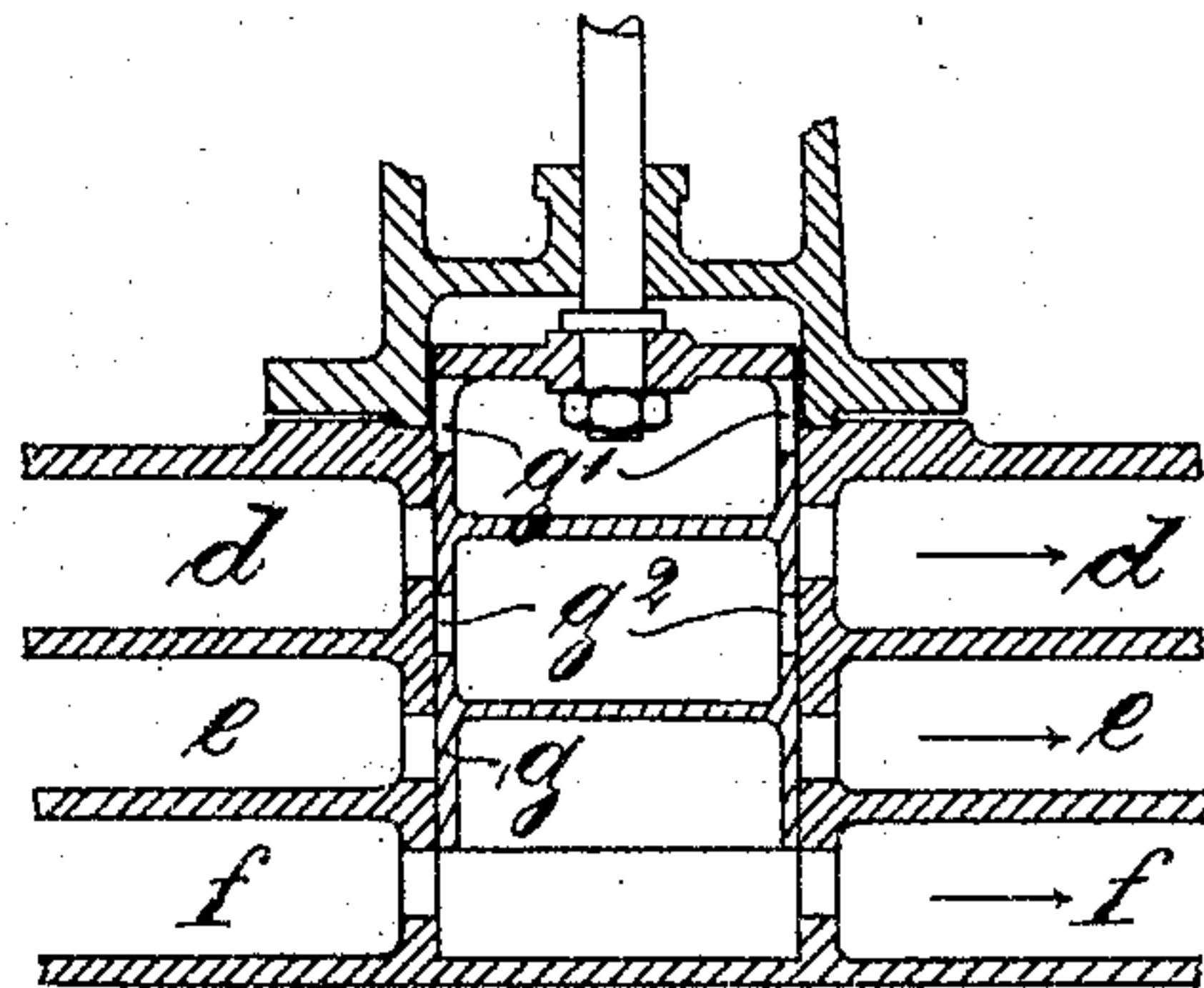


Fig. 5

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UNITED STATES PATENT OFFICE.

KARL REINHARDT, OF DORTMUND, GERMANY.

SPEED-REGULATOR FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 778,375, dated December 27, 1904.

Application filed November 25, 1903. Serial No. 182,656.

To all whom it may concern:

Be it known that I, KARL REINHARDT, a subject of the King of Prussia, German Emperor, and a resident of Dortmund, in the Province of Westphalia, German Empire, have invented certain new and useful Improvements in Speed-Regulators for Explosive-Engines, of which the following is an exact specification.

My invention relates to improvements in gas-engines, and has for its purpose to provide means for regulating the engine without changing the gas and air mixture and without changing the compression. I attain this purpose by the construction illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section of a gas-engine constructed according to my present invention. Fig. 2 shows a modification of the principal parts. Fig. 3 is in its upper half a section on line A B, in its lower half a section on line C D, of Fig. 2. Fig. 4 shows a modification in which the principal parts shown in Fig. 1 are not situated above the cylinder of the gas-engine, but are inserted in the gas and air conduits. Fig. 5 shows an indicator-diagram of the engine.

It has been found out by trials that the most advantageous utilization of the gas for the indicated positive horse-power per hour is attained in case the filling of the engine is regulated, but the mixture of gas and air remains the same. In engines which are regulated in this manner the consumption of gas remains nearly constant for different loads of the engine. It will be understood that the indicated positive horse-powers are represented by the surface C D E F of the diagram Fig. 5. If the load of the engine is diminished, the surface B C F is to be subtracted from the positive diagram-surface. The consumption of gas for the really indicated horse-power will consequently be greater. In order to avoid this augmented consumption of gas per indicated horse-power for smaller loads, it is therefore necessary to have the cylinder always equally filled and to work with equal compression and without under pressure during the suction. Hitherto it has been tried to attain this in four-cycle engines by admitting at the beginning of the suction-stroke only atmos-

pheric air and afterward at a point of time influenced by the governor admitting also the gas. In these engines it was, however, very difficult to attain during the simultaneous flowing in of gas and air always a good and homogeneous mixture and in case of a small load a good ignition, because in the moment in which the gas was admitted the column of gas which was in rest must begin to move (the column of air has, however, a certain acceleration) and because the proportion of the sections of the opening through which the air and gas has to pass during the opening of the gas-valve is always changed. The chief purpose of the present invention consists in doing away with these disadvantages in the formation of the mixture in case of an always perfect filling of the cylinder.

In the drawings, *a* is the cylinder of the gas-engine.

b is the inlet-valve.

c is the casing situated above the inlet-valve. Around this casing *c* three annular channels *d*, *e*, and *f* are situated, the channel *d* being connected to the gas-conduit and channels *e* and *f* being connected to the atmospheric air. The latter connection must be effected separately, so that the air-streams do not influence one another.

In the casing *c* a valve-piston *g* is situated. This valve-piston is fixed to a pipe *h*, situated around the valve-spindle *i* of the valve *b*. The pipe *h* is moved by means of a lever *k*, whereas the valve-spindle *i* is moved by means of a lever *l*. The mechanism for moving the levers *k* and *l* may be of any convenient construction and does not form part of this invention. In Fig. 1 the levers *k* and *l* are shown as being actuated by the governor *r* by the intermediacy of the connecting-rods *k'* and *l'*. In the hollow valve-piston *g* openings *g'* and *g''* are provided, which are adapted to connect the interior of the casing *c* with the channels *d* and *e*. In the position shown in the drawings the channels *d* and *e* are closed and the channel *f* is opened. By the downward movement of the valve-piston *g* the channel *f* will be closed and the channels *d* and *e* will be opened. The effect of this construction is as follows: The inlet-valve *b* must

be actuated so that it opens always at the beginning of the suction-stroke and closes at the end of the same. Already before the beginning of the suction-stroke—that is to say,
 5 at the end of the exhaust-stroke—the valve-piston *g* is moved to the position shown in the drawings, in which position the air-channel *f* is opened and the channels *d* and *e* are closed. In consequence hereof atmospheric
 10 air will flow into the cylinder. After a certain while the valve-piston *g* moves suddenly downward, thereby closing the channel *f* and opening the channels *d* and *e*. The moment at which the valve-piston *g* moves downward
 15 is adjusted by the governor *r* of the engine in that way that in case the number of revolutions of the engine diminishes the downward movement of the valve-piston takes place earlier, so that a greater quantity of the
 20 gas and air mixture flows into the cylinder. It will be understood that by this construction always a homogeneous mixture of gas and air flows into the cylinder and that this mixture is not changed at all, as is the case
 25 in engines in which the gas-valve is slowly opened. The channels *d* and *e* may remain open until after the closing of the inlet-valve *b*. During the expansion or exhaust stroke of the engine the valve-piston is moved back
 30 to the position shown in the drawings.

In the modification shown in Fig. 2 the valve-piston situated in the casing *c* is not moved upward and downward; but this valve-piston *m* is provided with several openings *n*
 35 and *n'*, the openings *n* being adapted to connect the casing *c* with the channels *d* and *e*, the openings *n'* being situated so as to be capable of connecting the channel *f* with the interior of the casing *c*. The openings *n* and
 40 *n'* are situated so that either the channels *d* and *e* or the channel *f* is opened by turning the piston *m*. The turning of the piston *m* may be effected in any convenient way; but

it will be understood that the mechanism for turning this piston must be influenced by the
 45 governor of the engine.

Instead of arranging the piston-valve for opening and closing the channels *d* *e* *f* directly above the cylinder *a* of the engine this piston-valve may be inserted in the conduits
 50 leading to the cylinder, as shown, for instance, in Fig. 4 of the drawings.

By the construction described it is attained that the mixture of gas and air flowing into the cylinder remains always the same and
 55 that the negative indicated effect is avoided. The construction has the further advantage over the regulating devices for four-cycle engines hitherto constructed that in consequence of no under pressure existing during the suc-
 60 tion-stroke the springs loading the valve may have only a small tension and that by the compression being always equal the working of the engine will be uniform and regular, even in case the engine runs with small load
 65 or without load.

Having thus fully described the nature of my invention, what I desire to secure by Letters Patent of the United States is—

In an explosive-engine, the combination of
 70 the cylinder and inlet-valve, of a gas-conduit and two air-conduits, a valve controlling the same, operating means therefor constructed to move said valve on the charging stroke to
 75 first open one air-conduit, then to close that conduit and open the other air-conduit and the gas-conduit, substantially as described and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two sub-
 80 scribing witnesses.

KARL REINHARDT.

Witnesses:

WILLIAM ESSENWEIN,
 PETER LIEBER.