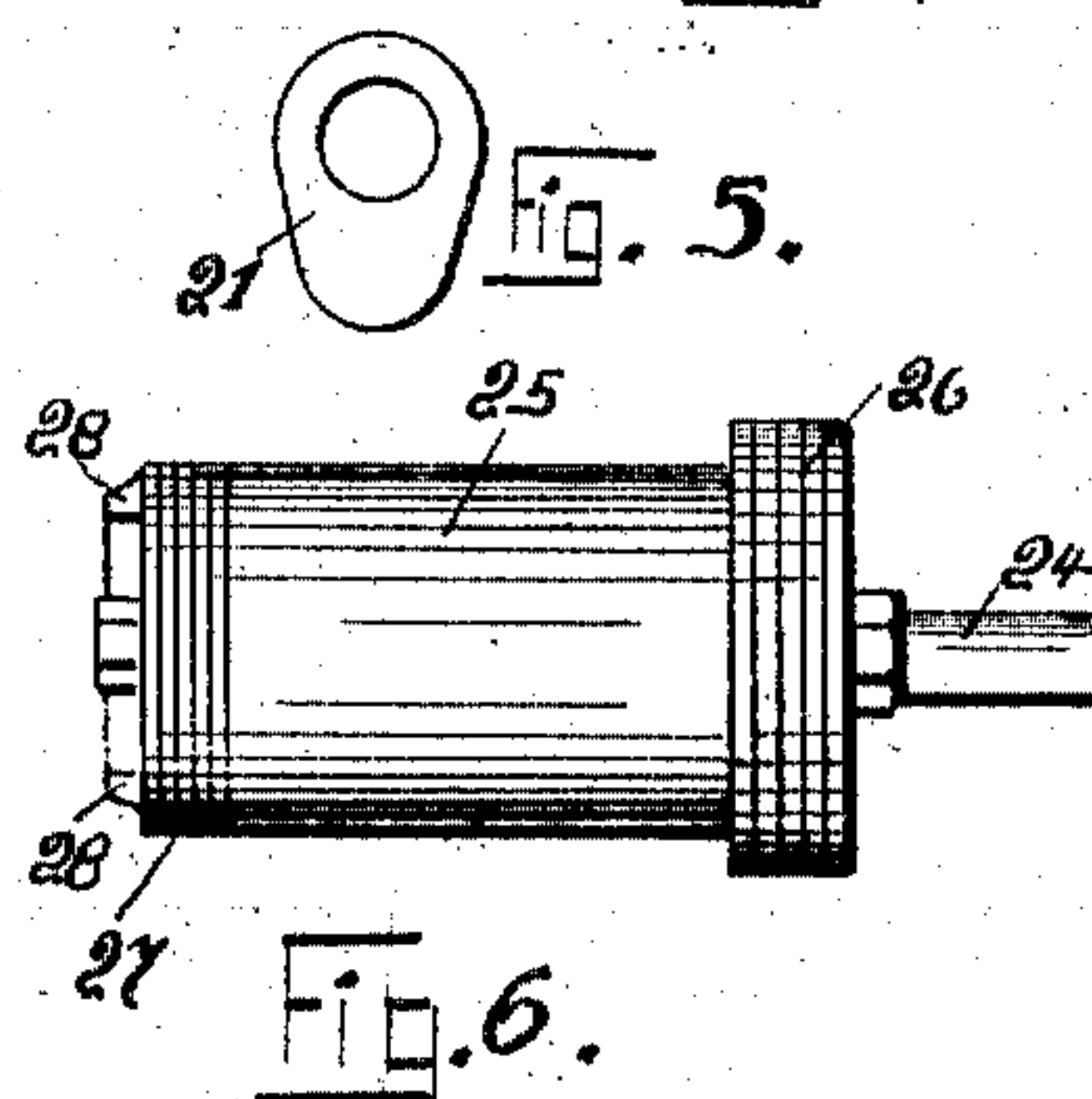
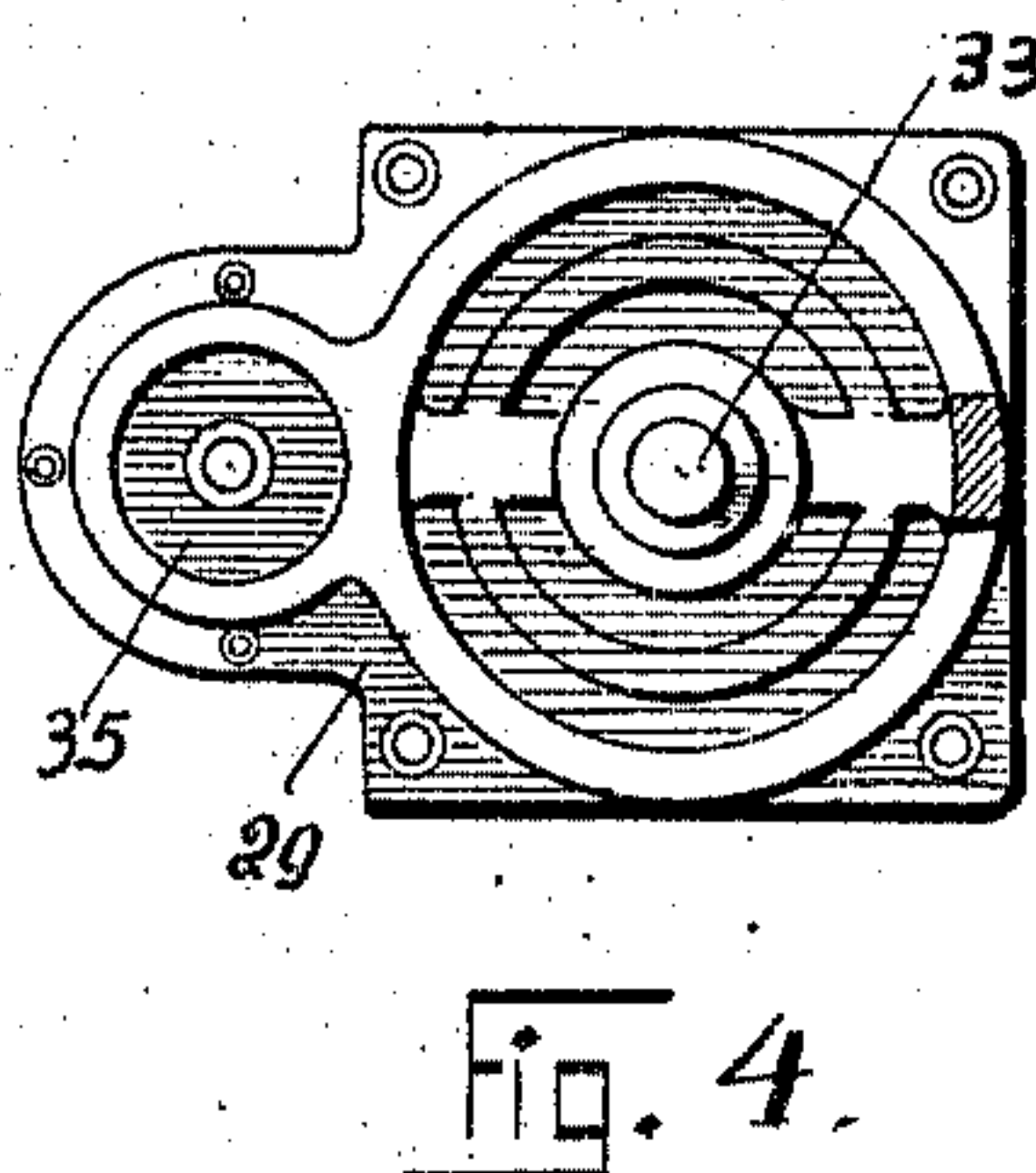
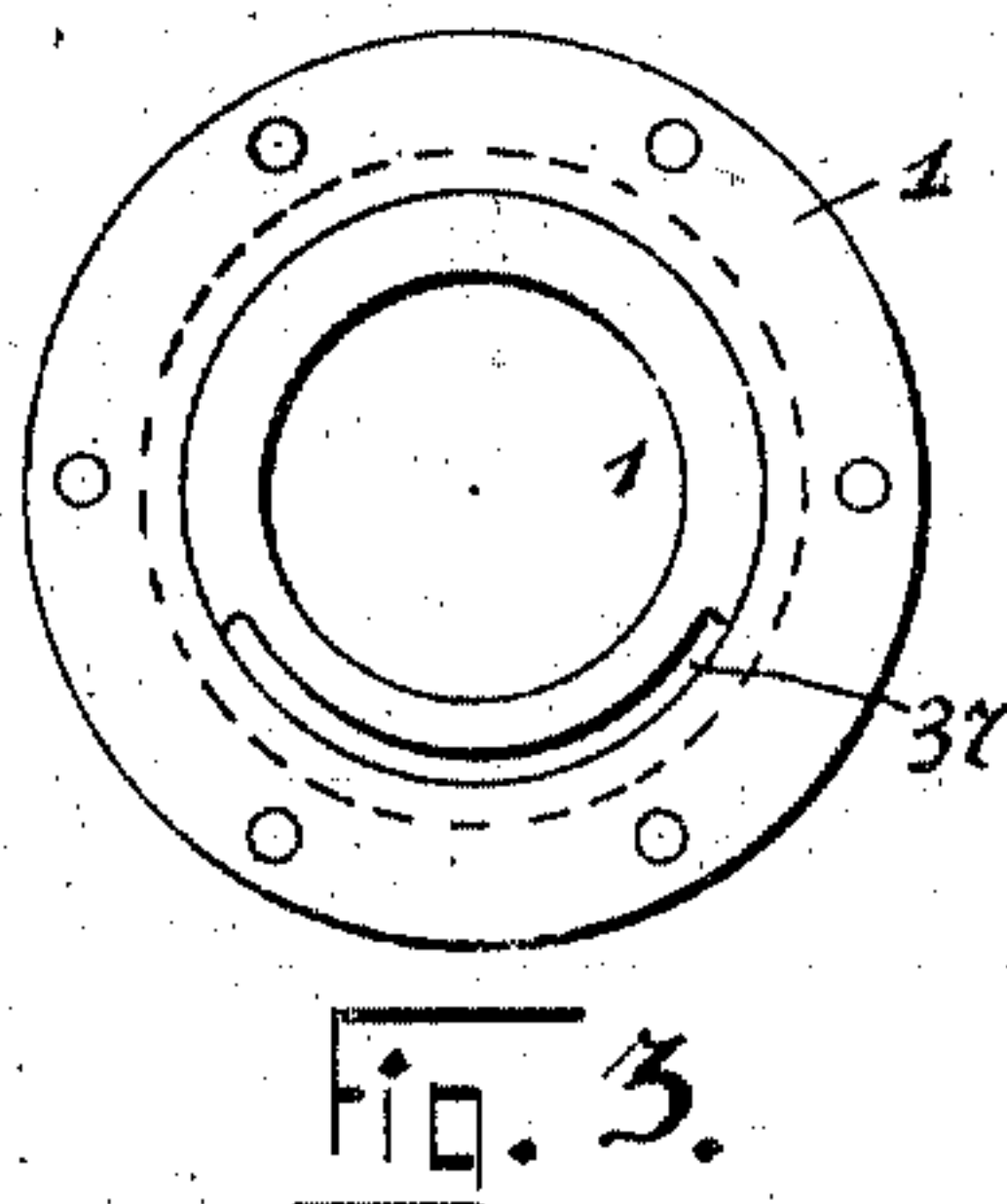
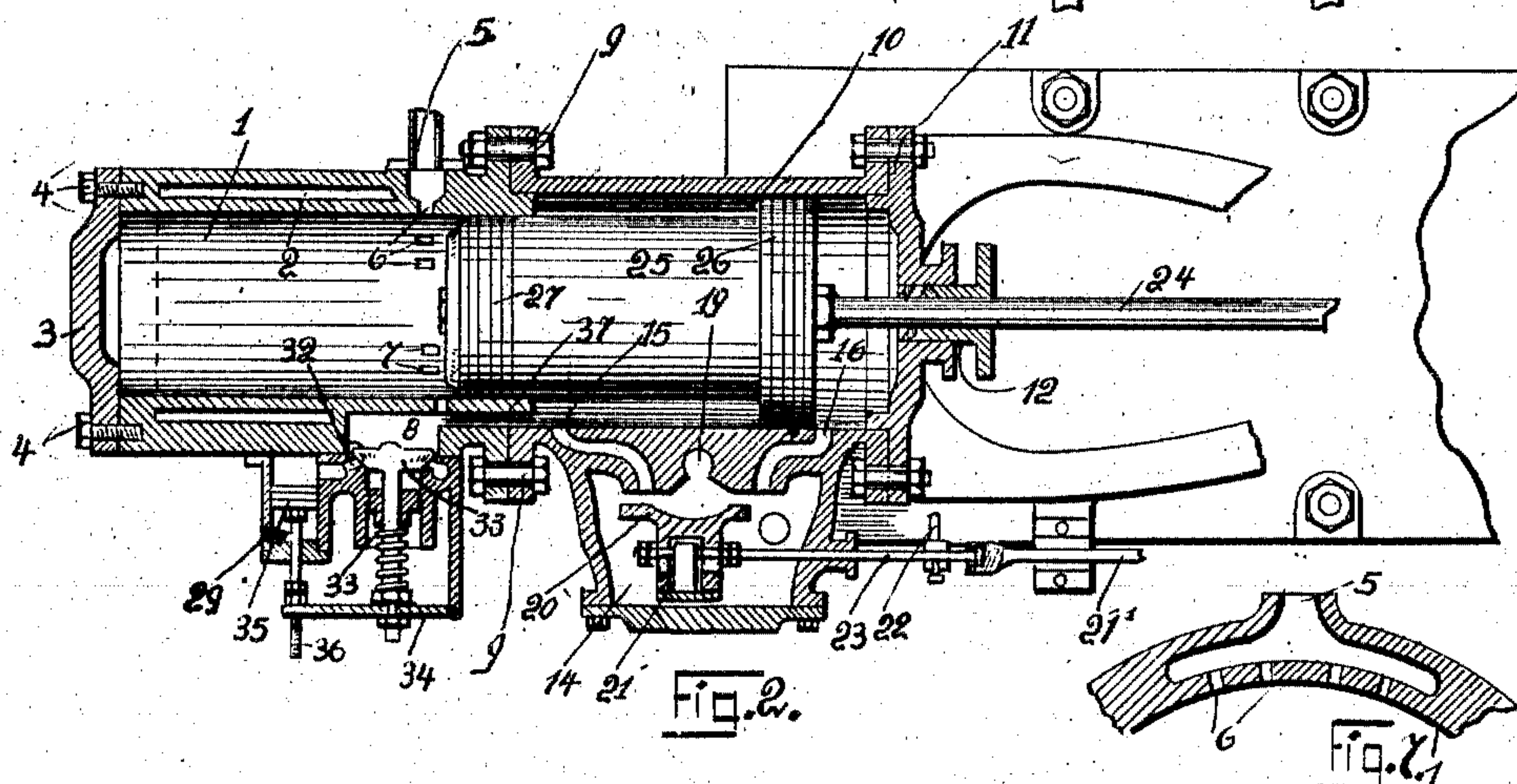
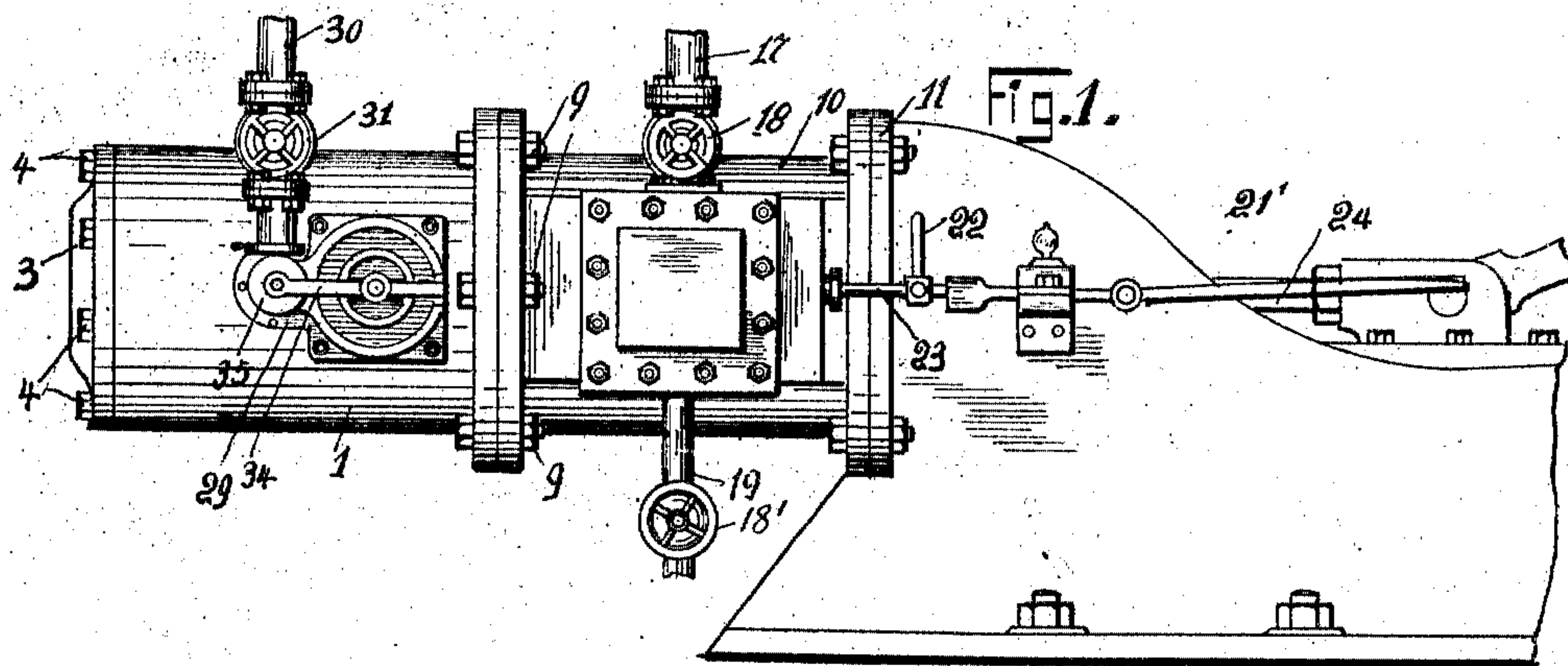


No. 821,373.

PATENTED MAY 22, 1906.

H. B. NICODEMUS.
GAS AND STEAM ENGINE.
APPLICATION FILED OCT. 27, 1904.



Witnesses:

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UNITED STATES PATENT OFFICE.

HENRY B. NICODEMUS, OF ALLEGHENY, PENNSYLVANIA.

GAS AND STEAM ENGINE.

No. 821,373.

Specification of Letters Patent.

Patented May 22, 1906.

Application filed October 27, 1904. Serial No. 230,237.

To all whom it may concern:

Be it known that I, HENRY B. NICODEMUS, a citizen of the United States of America, residing at Allegheny, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Gas and Steam Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to certain new and useful improvements in gas and steam engines, and has for its object the provision of novel means whereby these engines may be combined so that either one may be operated independently of the other.

A further object of this invention is the provision of novel means whereby it will not be necessary to detach or separate any part of the engine when it is desired to use either one, and to this end I have constructed the engine in as compact a form as possible to maintain a safe, strong, and durable construction.

With the above and other objects in view the invention finally consists in the novel construction, combination, and arrangement of parts to be hereinafter more fully described, and specifically pointed out in the claims.

In describing the invention in detail reference is had to the accompanying drawings, forming a part of this application, and wherein like numerals of reference indicate like parts throughout the several views, in which—

Figure 1 is a side elevation of my improved gas-engine, a portion of the same being broken away. Fig. 2 is a horizontal sectional view of the same. Fig. 3 is an end view of the gas-engine cylinder. Fig. 4 is an enlarged bottom plan view of the casing containing the gas-inlet and governor. Fig. 5 is a detail view of a cam employed in connection with the steam-valve. Fig. 6 is a side elevation of the piston employed in my improved engine. Fig. 7 is a detail sectional view of a portion of the gas-engine cylinder.

In the accompanying drawings the engine, as illustrated, is in position to be operated as a gas-engine, and as such it will be first described.

The gas-engine cylinder 1 is formed with a water-jacket 2, and the one end of the cylinder is provided with a head 3, which is secured upon said cylinder by bolts 4. Near

the opposite end of the cylinder is formed an exhaust-port 5, this port communicating with the interior of the cylinder by a plurality of smaller ports 6, which are in communication with the exhaust-port, as clearly shown in Fig. 7 of the drawings. Diametrically opposite these ports are formed a plurality of inlet-ports 7, which communicate with the main inlet-port 8.

To the end of the gas-engine cylinder 1 is secured by bolts and nuts 9 the steam-engine cylinder 10, this cylinder being provided with a head 11, that carries a suitable stuffing-box 12. Formed integral with the steam-engine cylinder 10 is the steam-chest, from the chamber 14 of which lead ports 15 and 16, communicating with the steam-engine cylinder.

The reference-numeral 17 designates the steam-inlet pipe, which is provided with a valve 18.

The reference-numeral 19 designates the steam-exhaust, and this exhaust is controlled by the slide-valve 20, which is operated by the link 21', connected to the crank-shaft of the engine. The position of this slide-valve is governed by a cam 21, rotatably mounted within said slide-valve and controlled by a lever 22, carried by the rod 23, that connects said slide-valve with the link 21.

The reference-numeral 24 designates the piston-rod, to which is secured the piston 25, this piston being of a diameter equivalent to the diameter of the gas-engine cylinder 1, and said piston is provided with a head 26, that is of a diameter equivalent to the steam-cylinder 10. The forward end of the piston is provided with the packing-rings 27 and the deflectors 28 28.

To the side of the gas-engine cylinder is secured a casing 29, and in this casing is mounted a governor and a gas-inlet valve.

The reference-numeral 30 designates the gas-inlet pipe, which is provided with a valve 31.

The casing 29 is provided with an annular gas-inlet port 32, this port being controlled by a spring-pressed valve 33, that is connected to a pivoted lever 34.

The reference-numeral 35 designates a valve which controls the gas-inlet to the annular port 32, and this valve is connected by a rod 36 to the pivoted lever 34.

It will be observed from Figs. 2 and 3 of the drawings that the steam-engine cylinder

10 is in communication with the gas-inlet port 8 by an arc-shaped passage or by path 37.

As heretofore stated, the drawings illustrate the engine in condition to be operated by gas, and the operation of said engine is as follows: Assuming the piston to be in the position shown in Fig. 2 of the drawings, the gas-shut-off valve 31 in gas-inlet pipe 30 is opened, admitting gas to the chamber in casing 29. The fly-wheel (not shown) of the engine is turned by hand, whereby to move the piston 25 and head 26 on the outstroke toward the head 3 of the gas-cylinder. This movement creates a suction in the steam-engine cylinder back of the piston-head 26 sufficient to unseat valve 33 and allow the gas to pass from chamber in casing 29 through port 32 into chamber 8, through passage-way 37, through passage 15 into the steam-chest, and from thence through passage 16 into the steam-cylinder 10. On the return or in stroke of the piston the gas is forced out of the steam-cylinder 10 through ports 16, 15, and 37 and passes into the gas-cylinder through port 7 and is compressed in said gas-cylinder on the succeeding outstroke of the piston 25 and head 26, being ignited when compressed in the usual manner to again force the piston on its instroke, and the engine is started, the exploding gases escaping through the exhaust 5. It is to be understood that in this operation of the engine the exhaust 19 is closed in any desirable manner, as by a valve 18', which may be located therein at any suitable point. Should the explosions become too frequent, due to an excess amount of gas being admitted to the gas-engine cylinder, the valve 33 will, due to the frequent explosions, be moved away from its seat farther than required, and through connection of the stem of this valve with the lever 34 the valve 35 will be moved so as to partially close the port leading from the chamber in casing 29 to the port 32, and thus shut off the flow of gas sufficiently to reduce the explosions and bring the engine to its normal running condition. The gas is thoroughly mixed with air at the intake of the gas into the cylinder, air being readily permitted to enter through the spider-like end of the casing in which the valve 33 is mounted, as clearly shown in Fig. 4 of the drawings.

When used as a steam-engine, the cam 21 is rotated, which is accomplished by lever 22 and rod 23, so as to move valve 20 against the valve-seat in the steam-chest, which in the position shown in Fig. 2 of the drawings would cause the valve 20 to close port 15. The gas-controlling valve 31 having previously been closed and steam-controlling valve 18 now being opened, the steam admitted to the steam-chest would pass through port 16 into the steam-cylinder behind the piston-head 26 and cause the piston 25 and piston-head 26 to be propelled outwardly; but

the movement of the piston 25 and piston-head 26 is not sufficient on this outstroke to cause the head 26 to close port 15. The actuation of the slide-valve 20, due to its connection, through rod 23 and link 21', with the crank-shaft of the engine, shifts said valve so as to allow steam to enter port 15 into the annular space surrounding the piston 25, the steam employed to force the piston outwardly exhausting through port 16 and exhaust 19. This operation is continuous during the time said engine is operated by steam.

The effect of the construction and operation above described is that the more frequent the explosions the more rapidly the engine will run, and the more rapidly the pistons reciprocate the more violent the suction, and consequently the farther the movement of the valve 33. The regulating means prevents the engine from racing by partly closing valve 35 when the predetermined maximum rate of motion has been attained.

Having fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a gas-engine cylinder, of a steam-engine cylinder, said steam-engine cylinder being of a larger diameter than said gas-engine cylinder, a piston operating in said cylinders, and having an enlarged head operating in said steam-cylinder, said gas-cylinder having an inlet and an exhaust port, said steam-cylinder having an inlet and an exhaust port, means for controlling the inlet of said gas, a sliding valve controlling said steam inlet and exhaust ports, and means for moving said sliding valve into and out of operative position, substantially as described.

2. In a combined steam and explosive engine, the combination of an aligned steam-cylinder and gas-cylinder, the steam-cylinder being of greater internal diameter than the gas-cylinder, a piston operating in said cylinders and having an enlarged head at one end operating in the steam-cylinder, a gas-inlet and an exhaust for the gas-cylinder, a valve normally closing the gas-inlet, controlling means connected to said valve for automatically regulating the quantity of gas admitted through the gas-inlet, a port establishing communication between the gas-inlet and the steam-cylinder, and inlet-ports and an exhaust-port for said steam-cylinder, substantially as described.

3. In a combined steam and explosive engine, the combination of an aligned steam-cylinder and gas-cylinder, the steam-cylinder being of greater internal diameter than the gas-cylinder, a piston operating in both of said cylinders, and having an enlarged head operating in the steam-cylinder, inlet and exhaust ports for the gas-cylinder, and independent inlet and exhaust ports for the steam-cylinder, the said steam-cylinder act-

ing in conjunction with the gas-cylinder when the engine is being used as an explosive-engine, substantially as described.

4. In a combined steam and explosive engine, an alined steam and gas cylinder, the steam-cylinder being of larger internal diameter than the gas-cylinder, a piston operating in both of said cylinders and having an enlarged head operating only in the steam-cylinder, both of said cylinders receiving gas and air when the engine is operated as an explosive-engine, and the steam-cylinder being used independently of the gas-cylinder when the engine is operated as a steam-engine.

5. A combined gas and explosive engine embodying an alined steam-cylinder and a gas-cylinder, a piston operating in both of said cylinders, and having a head operating only in the steam-cylinder, both of said cylinders receiving gas and air when the engine is operated as a gas-engine, and the steam-cylinder alone receiving steam when the engine is operated as a steam-cylinder.

6. In a combined steam and explosive engine, the combination of a steam-cylinder, a steam-chest and a slide-valve in said steam-chest, said cylinder having ports leading from the steam-chest to its opposite ends and said steam-chest having inlet and exhaust ports, with means for placing said slide-valve in operative and inoperative positions relatively to the ports in the cylinder, a piston located in the cylinder, a gas-cylinder having an inlet-port and an exhaust-port, a valve governing the inlet-port of the gas-cylinder, a plunger located in the gas-cylinder and connected to the piston in the steam-cylinder, said cylinders being provided with a port leading from the gas-inlet to one of the ports of the steam-cylinder.

In testimony whereof I affix my signature in the presence of two witnesses.

HENRY B. NICODEMUS.

Witnesses:

E. E. POTTER,
K. H. BUTLER.