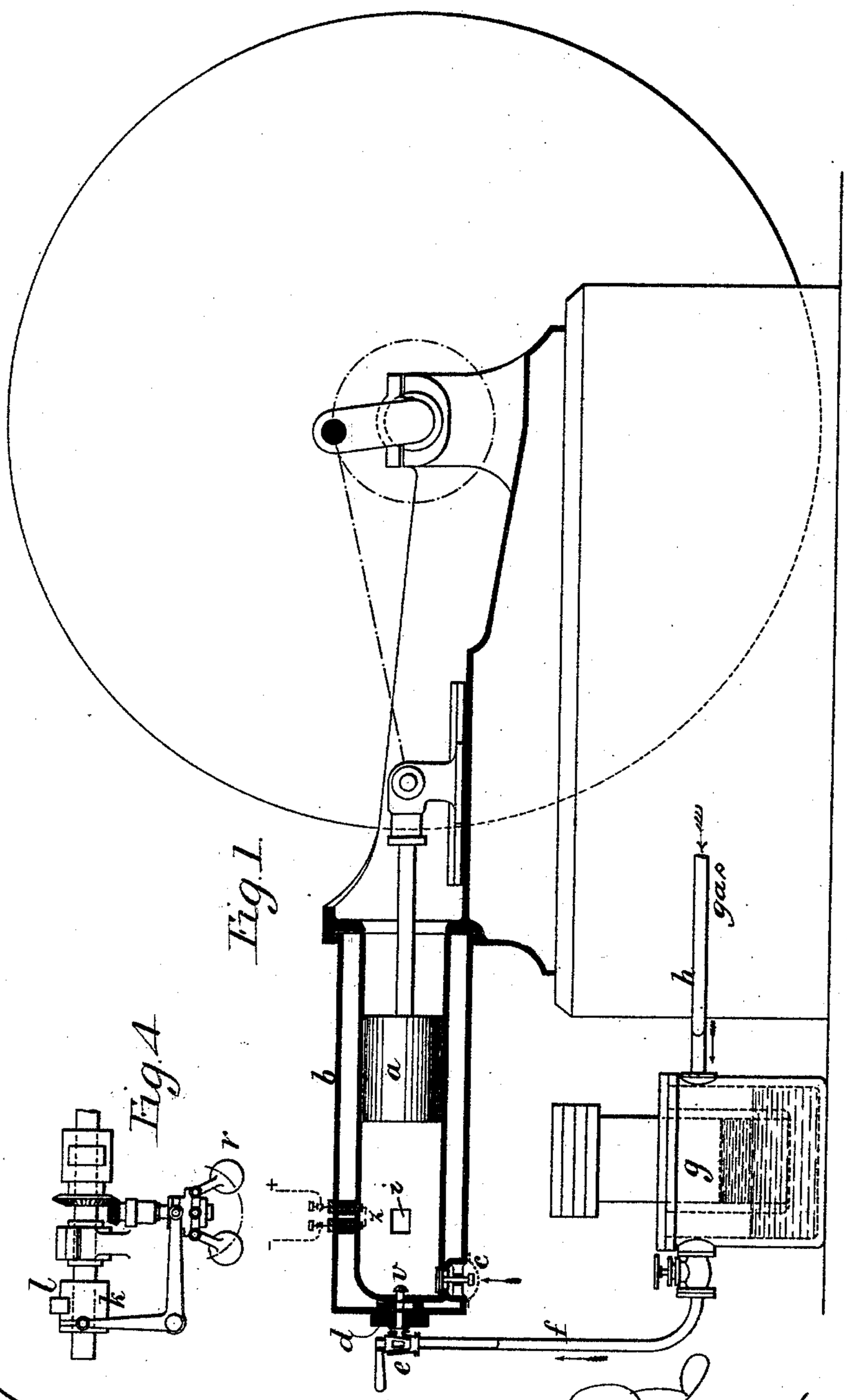
(No Model.) 2 Sheets—Sheet 1.

H. SCHUMM.

GAS OR OIL MOTOR ENGINE.

No. 497,689. Patented May 16, 1893.



Witnesses:—
J. A. Rutherford
J. H. Daly.

Inventor:
Hermann Schumm.
By James L. Norris.
Attorney

(No Model.) 2 Sheets—Sheet 2.

H. SCHUMM.

GAS OR OIL MOTOR ENGINE.

No. 497,689. Patented May 16, 1893.

Fig. 3.

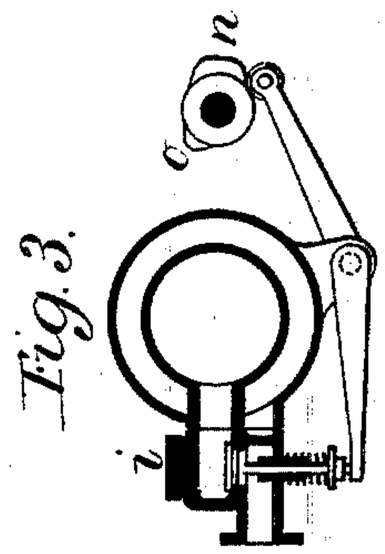


Fig. 6.

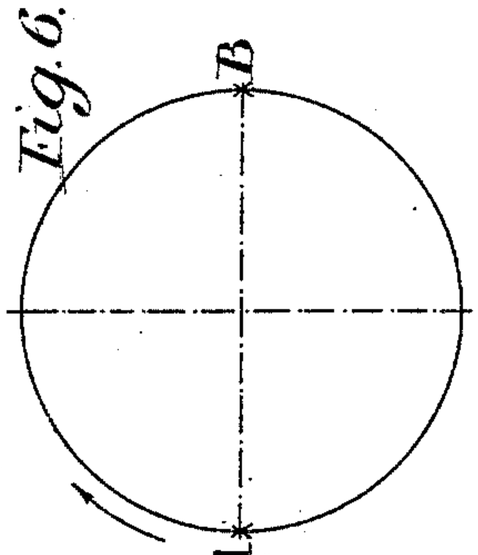


Fig. 5.

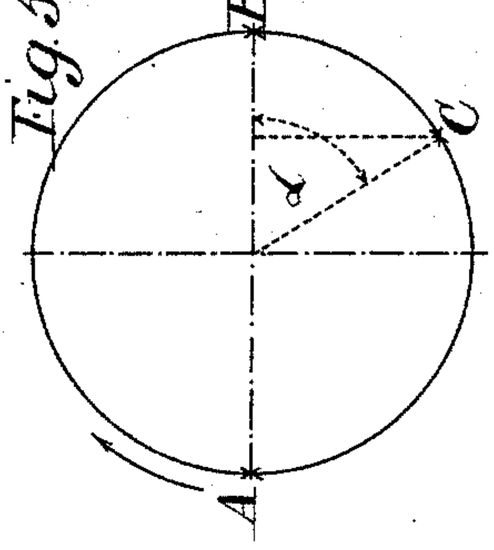


Fig. 2.

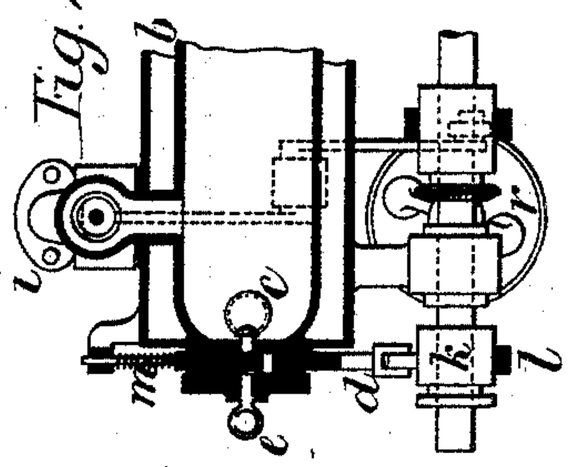
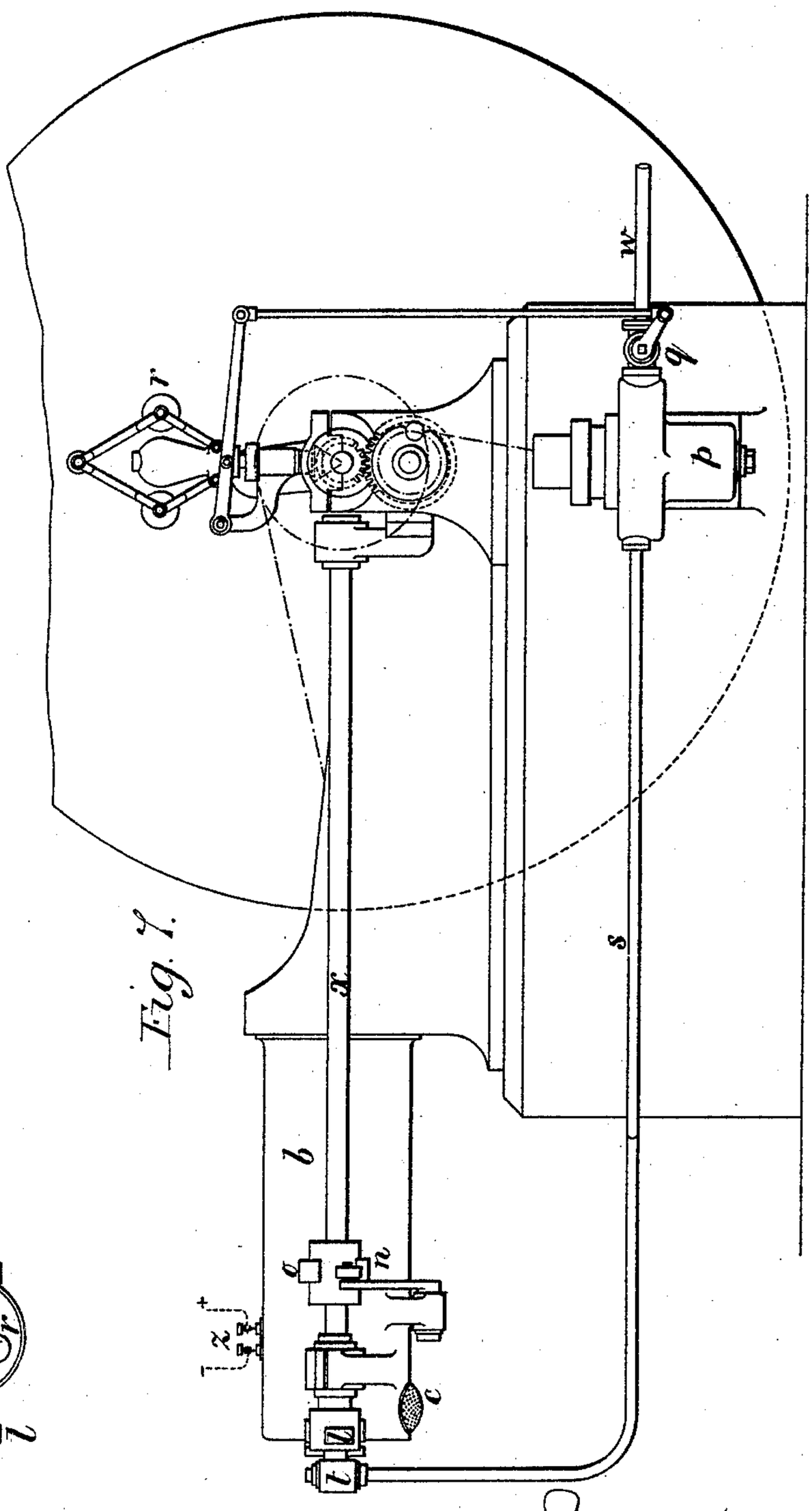


Fig. 1.



Witnesses:—
J. A. Rutherford.
J. H. Daly.

Inventor:—
Hermann Schumm
By James L. Norris.
Attorney.

UNITED STATES PATENT OFFICE.

HERMANN SCHUMM, OF COLOGNE-DEUTZ, GERMANY, ASSIGNOR TO THE GAS-MOTOREN-FABRIK-DEUTZ, OF SAME PLACE.

GAS OR OIL MOTOR ENGINE.

SPECIFICATION forming part of Letters Patent No. 497,689, dated May 16, 1893.

Application filed June 12, 1891. Serial No. 396,019. (No model.)

To all whom it may concern:

Be it known that I, HERMANN SCHUMM, a citizen of Switzerland, residing at Cologne-Deutz, in the Empire of Germany, have invented new and useful Improvements in Gas or Oil Motor Engines, of which the following is a specification.

This invention relates to gas engines of the type illustrated in Letters Patent No. 432,260, wherein a charge of air is drawn in through an air inlet valve during the suction stroke and during the following compression stroke part of the air drawn in is driven out of the cylinder during the first part of such stroke, the remainder of the charge being then compressed during the completion of the stroke, while a quantity of fluid is introduced to form a combustible charge which is ignited. In the prior construction alluded to the air inlet valve is carried by the reciprocating piston and the discharge valve is operated by a complicated arrangement of devices interposed between the cylinder and a shaft arranged at right angles to the axis of the cylinder and serving also to operate an oil pump by which a charge of oil is forced first into a chamber and then by compressed air into the cylinder. This arrangement is complicated and expensive and requires an air compressing pump in addition to an oil pump, to force said charge of oil from said chamber into the cylinder.

The object of my invention is to reduce the cost of this type of engines by materially simplifying their construction and mode of operation, which is accomplished by arranging the air inlet valve on the cylinder, instead of in the reciprocating piston, and by dispensing with the air compressing pump, and arranging a single counter shaft substantially parallel with the axis of the cylinder in contradistinction to arranging the shaft at right angles to the axis of the cylinder, whereby three cams can be mounted on the single counter shaft and thus materially simplify the devices necessary to operate the discharge valve and the slide which controls the flow of combustible gas or explosive mixture from a store under pressure to the cylinder during the compression stroke of the piston, in which respect my invention differs from the prior engine where a charge of oil is forced by an oil pump into a chamber from whence such charge is forced by compressed air into the cylinder at the end of the compression stroke, as hereinbefore alluded to.

The object of my invention is accomplished by the specific features of construction and arrangement hereinafter described and claimed, reference being made to the accompanying drawings, in which—

Figure 1 shows a longitudinal section; Fig. 2 a part sectional plan; Fig. 3 a cross section; Fig. 4 a detail of the regulating device. Figs. 5 and 6 show diagrams of the action, and Fig. 7, is a side elevation of an engine showing a modification of the invention.

The piston *a* in working in the cylinder *b* leaves at the end of its instroke a charging space with which communicate the self-acting air valve *c*, the discharge valve *i* the igniting device Z as also the gas supply passage *v*. This passage which is closed in the cylinder by a finely perforated rose, is opened by a slide *d* when the cam *l* on the sleeve *k* actuated by the governor *r* acts upon it in opposition to the spring *m*, which brings the slide back into its original position when released by the cam.

The arrangement shown at Figs. 2 and 4 for causing the governor *r* to act upon the sleeve *k* for controlling the speed of the engine, is the well known one in which, on the normal speed being exceeded the governor moves the sleeve on the countershaft *x* revolving at half the speed of the engine shaft, so as to prevent the cam from acting on the slide and thus preventing the admission of combustible gas or oil during one or more strokes.

The gas passage in the slide *d* is supplied with combustible gas under pressure through a regulating cock *e* and pipe *f* from an accumulator *g* into which gas is forced from a suitable pump through a pipe *h*, the uniformity of the pressure in the accumulator being insured by any known arrangement, such as a loaded plunger as shown.

The action of the engine will be understood on reference to the diagrams Figs. 5 and 6.

During the movement of the crank from A to B Fig. 5 the piston *a* draws air into the

cylinder through the self acting valve *c;* during the part of the return stroke represented by the arc B C, that is, during the angle *L*, passed through by the crank, which is determined by the degree of expansion required, a cam *o* on the countershaft is made to open the discharge valve *i* Fig. 3, so that a portion of the air and combustion gases contained in the cylinders is driven out. When the crank has arrived at the point C the cam *o* allows the valve *i* to close again, so that during the remainder of the stroke from C to A the remaining charge in the cylinder is compressed. During such compression the cam *l* also moves the slide *d* so as to allow combustible gas to be injected through it into the cylinder. As the pressure in the accumulator *g* can be regulated to any required degree, the proper velocity with which the gas must enter the cylinder for effecting a reliable distribution thereof among the charge of air can be insured. When the piston arrives at the end of its instroke at A Fig. 6, the compressed charge is ignited by any suitable igniting devices Z, and the piston is made to perform its working stroke from A to B. From B to A Fig. 6, the cam *n* Fig. 3 opens the discharge valve *i*, allowing the combustion gases to be expelled; whereupon the above described cycle of operations is repeated.

It will be seen from the foregoing that according to the proportion of the capacity of the charging chamber and of the angle *L* chosen, the degree of expansion of the engine can be increased or decreased, and the explosive force of the charge can be utilized to the fullest possible degree.

No explosion can take place during the charging stroke as the cylinder at that time contains no explosive charge.

The easy starting of the engine can be effected on account of a gas supply under pressure being available. For this purpose the accumulator is directly connected to the cylinder by a pipe provided with a cock through which, at starting, gas is allowed to enter the cylinder so as to form an explosive mixture with the air therein. The crank shaft is then turned so as to bring the piston to the end of its instroke whereupon the ignition of the charge will take place. As soon as the engine is started, the cock *e* on the gas supply to the slide *d* is opened so that after the first working stroke the engine will work in the normal manner, the cock on the separate gas supply being then closed.

Instead of regulating the engine by cutting off the gas supply entirely during one or more strokes, as above described, this may be effected in cases where it is desired to obtain great uniformity of motion, by reducing the explosive action by decreasing the charges of combustible gas admitted to the cylinder. For this purpose the cam *l* is formed with an incline in such a manner that, on an increase of speed, the governor *r* moves the cam so as to bring its decreased sections to act upon the slide *d* and in thus reducing the motion of the latter to effect a greater or less throttling of the gas supply.

When the engine runs without any load, so that a number of strokes are made without any admission of combustible gas, then air will be repeatedly drawn in and compressed until the gas cam *l* is again brought to act upon the slide *d* so as to admit combustible gas to the cylinder, and thus produce an explosive charge again.

Instead of using an accumulator *g* the engine may be arranged to force the gas at the requisite pressure directly into the cylinder by means of a force pump. Fig. 7 shows a side view of an engine with such an arrangement. The crank shaft is made to work a force pump *p* through speed reducing gearing so arranged as to force in the gas supply during the compression stroke through a pipe *s* and check valve *t* into the cylinder. The slide *d* is in this case actuated by a cam *l* which is fixed on the countershaft, so as to cause the slide to be brought into the open position at every compressing stroke, the regulation being effected by connecting the governor *r* with a regulating valve *q* on the gas supply pipe *u*, of the gas pump, so that by throttling such supply when the engine runs too fast the quantity of gas supplied to the cylinder is reduced. The governor can also be so arranged as to entirely close the re lating valve when the engine runs too fast, so as to prevent any explosions until the speed has been reduced again.

The method of regulating described with reference to Figs. 2 and 4 can also be applied to an engine working a gas pump as at Fig. 7 if care be taken that the action of the gas pump is stopped when the slide keeps the gas supply closed. This can be effected by throwing the suction and delivery valves of the pump out of action simultaneously with the slide *d*, or by using this slide also as a slide valve for the pump, or by providing an arrangement whereby, if the pump continues to force gas while the slide valve remains closed, such gas is made to return to the suction pipe of the pump.

In the above description it has been stated that a part of the cylinder charge of air is expelled by the action of the cam *o* on the discharge valve *i* at the commencement of the compressing stroke. The desired action of the engine would however not be altered if a portion of the charge were expelled by the same or another device during any other part of the compression stroke.

Having thus described the nature of my invention and the best means I know for carrying the same into practical effect, I claim—

In a four-stroke cycle gas or petroleum motor engine, the combination of a piston *a*, a cylinder *b* provided with a self-acting air inlet valve *c*, a discharge valve *i* and an inlet opening *v* for combustible gas or explosive mixture, a slide *d* which controls said inlet

opening, a counter shaft x extending substantially parallel with the axis of the cylinder, revolving at half the speed of the crank shaft and carrying the cams l, n, o, the cam o serving to open the discharge valve during a part of the compression stroke of the piston, the cam n serving to open the discharge valve during the expelling stroke of the piston, and the cam l serving to operate the slide which controls the inlet, and means for supplying combustible gas or gaseous mixture or petroleum vapor under pressure through the said slide to the cylinder during the compression stroke of the piston, substantially as described.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 30th day of May, A. D. 1891.

HERMANN SCHUMM.

Witnesses:

PET. LANGEN.

WILF. BRINKER.