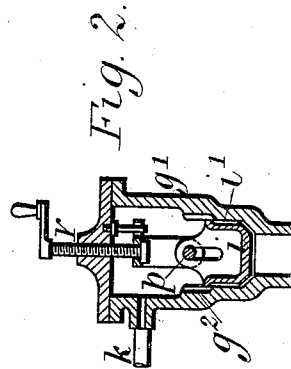
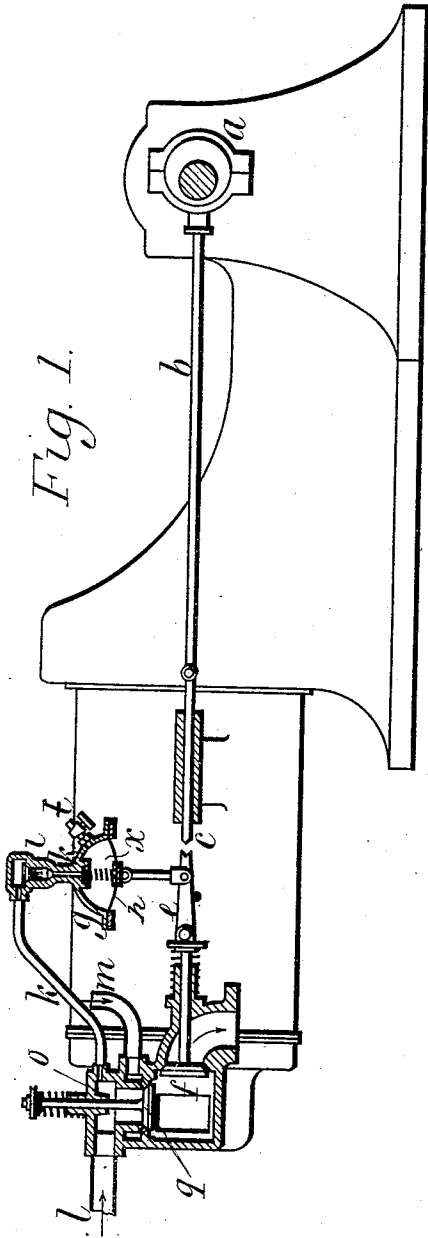


(No Model.)

C. STEIN.  
GAS AND OIL MOTOR ENGINE.

No. 511,661.

Patented Dec. 26, 1893.



Witnesses,  
G. W. Rea,  
Robert Connett.

Inventor,  
Carl Stein,  
By *James L. Norris*  
att'y.

# UNITED STATES PATENT OFFICE.

CARL STEIN, 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. 511,661, dated December 26, 1893.

Application filed June 26, 1893. Serial No. 478,863. (No model.) Patented in England May 8, 1893, No. 9,181; in Belgium May 25, 1893, No. 104,812; in Switzerland May 26, 1893, No. 6,726, and in Italy June 10, 1893, LXVII, 54.

*To all whom it may concern:*

Be it known that I, CARL STEIN, a citizen of Württemberg, residing at Cologne-Deutz, Germany, have invented certain new and useful  
5 Improvements in Gas or Oil Motor Engines, (for which I have obtained Letters Patent in Belgium May 25, 1893, No. 104,812; in Switzerland May 26, 1893, No. 6,726; in Italy June 10, 1893, Vol. LXVII, 54, and in Great Britain  
10 May 8, 1893, No. 9,181,) of which the following is a specification.

This invention relates to improved means for regulating the speed of four-stroke-cycle gas or oil motor engines of the kind described in the specifications to Patents Nos. 433,809, 433,810, 433,811 and 433,812. In the motor engines there described a chamber containing a flexible diaphragm, piston or the like was subject to the varying pressures  
20 occurring in the working cylinder, whereby the said diaphragm or piston was moved so as to actuate a hit-and-miss device in conjunction with the discharge valve of the engine and a lever or rod actuated by the engine shaft, in such manner as to cause such  
25 valve to be opened during the discharge stroke of the engine piston, and to remain closed during the suction, compression and firing strokes. According to the present invention the said chamber with diaphragm or piston and hit-and-miss device are utilized  
30 for regulating the speed of the engine in the following manner. The space in the said chamber behind the piston or diaphragm is put in communication with the interior of the cylinder, or with the air supply passage to the combustion space thereof by means of a pipe  
35 or passage provided with a check valve which closes automatically after the air pressure in the chamber has either been reduced by the suction stroke of the piston, or has been increased by the compression stroke so as to  
40 either restrict or entirely prevent entrance or escape of air pressure to or from the chamber. In the case where the valve closes completely, the chamber is furthermore provided with a cock or valve by which a restricted  
45 communication with the atmosphere can be

established. The action of the apparatus thus arranged is as follows. Assuming the chamber to be provided with a flexible diaphragm connected by a rod to a hit-and-miss lever pivoted to the discharge valve and to be put in communication with the air supply passage of the explosion space of the cylinder by a pipe with a check valve that allows the air pressure to be withdrawn from the chamber by the suction stroke, but then in closing, prevents its re-entrance, then on the occurrence of the suction stroke, the diaphragm in being forced inward by the atmosphere on account of the reduced pressure in the chamber, will draw the hit-and-miss lever of the discharge valve to one side, and will prevent this from being forced open by the eccentric rod during the return or compression stroke as in the arrangement described in the said Patent No. 433,809. Instead however of the hit-and-miss lever being at once brought back into its normal position by the free re-admission of the air into the chamber, as was formerly the case, the air cock or valve on the chamber, being only slightly open, will restrict such entrance of the outer air in such manner as only to allow the diaphragm to move the lever slowly back into the normal position. This action is so timed that the hit-and-miss lever will only arrive in its normal position at the time when the piston is at the end of its working stroke, so that the eccentric rod can then force open the discharge valve. From this arrangement it will be seen that if the engine is running too fast, then the working stroke will have been completed before the hit-and-miss lever has arrived in the normal position, to be acted upon by the eccentric rod, so that the latter will fail to open the discharge valve and consequently the piston in performing its return stroke will compress the combustion gases in the cylinder, and on the following outstroke these gases will expand again and no combustible charge will be admitted.

Figure 1 of the accompanying drawings shows a sectional side view of a gas or oil motor engine having the above described improvement applied thereto. Fig. 2 shows a

modification in which the separate air cock is dispensed with. The arrangement shown in these figures is supposed to be applied to that form of the above described apparatus which is shown in Fig. 1 of Patents Nos. 433,809 and 433,810.

*g* is the mixing inlet valve which is supplied with air through the pipe *l*, and with gas or petroleum vapor through the pipe *m*, and which opens automatically on the suction stroke of the engine piston.

*f* is the discharge valve for the combustion gases, which is opened during the expelling stroke of the piston by means of the eccentric *a* on the crank shaft, eccentric rod *b*, reciprocating rod *c*, and hit-and-miss lever *e*, pivoted to the discharge valve *f* and connected to the flexible diaphragm *h* of the cup or casing *g* the interior of which, as before described is put in communication with the air chamber *o* by means of a passage *k*, so as to effect the moving of the lever *e* out of line with the rod *c* during the suction stroke of the piston, as previously explained.

According to the present invention, there is provided in the passage *k* a check valve *i* which opens freely during the suction stroke for allowing the air to be exhausted from the cup or casing *g*, but which then closes so as to prevent the re-entrance of the air. There is also provided on the cup *g* an air cock *t*. Thus with this arrangement it will be seen that during the suction stroke the consequent inward motion of the diaphragm *h* will draw lever *e* out of line with rod *c*, which will consequently fail to force open the discharge valve *f* during the following instroke, so that the combustible charge will then be compressed. At the end of the suction stroke the valve *i* will close so as to prevent the re-entrance of air into *g* through the pipe *k*, but the cock *t* being slightly opened, air will penetrate slowly through it into the cup *g*, thus allowing the diaphragm to move slowly outward again, this action being by preference assisted by a spring *X*. By this means the lever *e* will be gradually brought back into the position in line with the rod *c*, this action being so regulated by the adjustment of the cock *t* that the lever is brought into the said position just before the commencement of the expelling stroke of the piston when the engine is running at the normal speed, so that at the commencement thereof the discharge valve *f* will be forced open. If now the normal speed of the engine be exceeded, the rod *c* will advance for forcing open the discharge valve before the lever *e* has arrived in the normal position, as the action of the diaphragm is constant and independent of the speed of the engine, and consequently as the discharge valve will remain closed, the piston will compress the combustion gases of the previous explosion by its instroke, and these will expand again during the following outstroke,

and thus the engine will continue to work without explosive charges until the speed has been sufficiently reduced for the lever *e* to be brought into its normal position again by the time the rod *c* is being advanced toward it by the instroke of the piston. It will be evident that by increasing or decreasing the opening of the cock *t*, the normal speed of the engine can be increased or decreased.

In the modified arrangement shown to an enlarged scale at Fig. 2 the air-valve *t* is dispensed with and the regulated restricted re-entrance of the air into the cup *g* is effected by keeping the check valve *i* slightly open. For this purpose the valve *i* is suspended by a slotted connection from a pin *p* that can be raised or lowered by a screw spindle *r* screwing through the valve casing, and the valve is provided with side channels *i'* which when the valve is held slightly open, are made to communicate to a restricted extent with channels *g'* formed in the casing *g*, so as to allow a more or less restricted flow of air back to the casing through pipe *k* after the suction stroke. During the suction stroke the valve is free to rise sufficiently, owing to its slotted connection with the pin *p*, to allow the air to be drawn freely from the casing *g*.

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

1. In a gas or oil motor engine wherein a cup or casing communicating with the interior of the cylinder has a flexible diaphragm or equivalent appliance connected to a hit-and-miss device in connection with the discharge valve of an engine and with an eccentric on the engine shaft, the combination with such cup or casing of a freely opening check valve in the communicating passage between the cup or casing and the cylinder, and a device whereby the re-entrance of air into the cup or casing, after having been exhausted therefrom during the suction stroke, is restricted, so that the said diaphragm or equivalent device is caused to bring the hit and miss device into position for effecting the opening of the discharge valve at a retarded constant speed which is independent of the speed of the engine substantially as and for the purposes set forth.

2. In a gas or oil motor engine wherein a cup or casing *g* communicating with the interior of the cylinder by a passage *k* has a diaphragm or equivalent appliance *h* connected to a hit-and-miss device *a, b, c, e* in connection with the discharge valve *f* of the engine, the combination with such cup or casing of a freely opening check valve *i*, which closes the communication between the cup or casing and the cylinder at the end of the suction stroke, and an air cock or valve *t* having a restricted opening through which air can re-enter the cup or casing in a restricted manner so as to allow the diaphragm to bring the

hit and miss lever *e* into position for opening  
the discharge valve only at the time when  
the piston is commencing its discharging  
stroke at the normal speed of the engine, sub-  
stantially as and for the purposes set forth.

5 In testimony whereof I have signed my  
name to this specification, in the presence of

two subscribing witnesses, this 10th day of  
June, A. D. 1893.

CARL STEIN.

Witnesses:

FRITZ SCHROEDER,  
SOPHIE NAGEL.