

E. TROIKE.
HYDROCARBON ENGINE.
APPLICATION FILED NOV. 30, 1908.

932,918.

Patented Aug. 31, 1909.
4 SHEETS—SHEET 1.

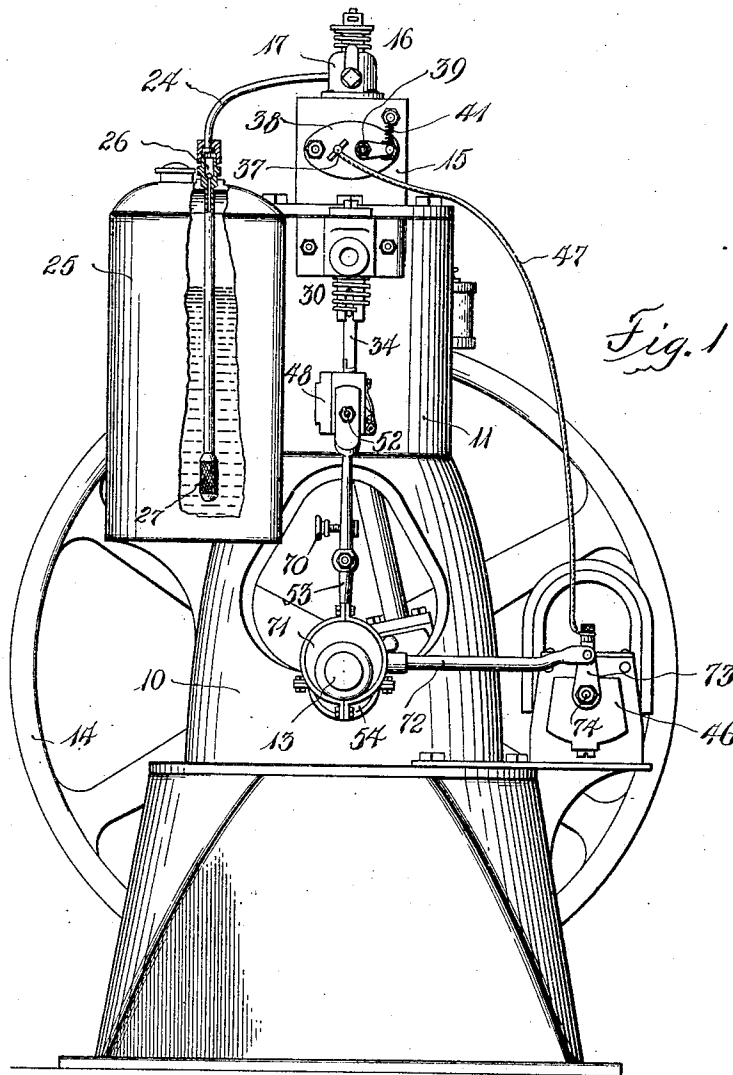


Fig. 1

Witnesses

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N. F. Kim.

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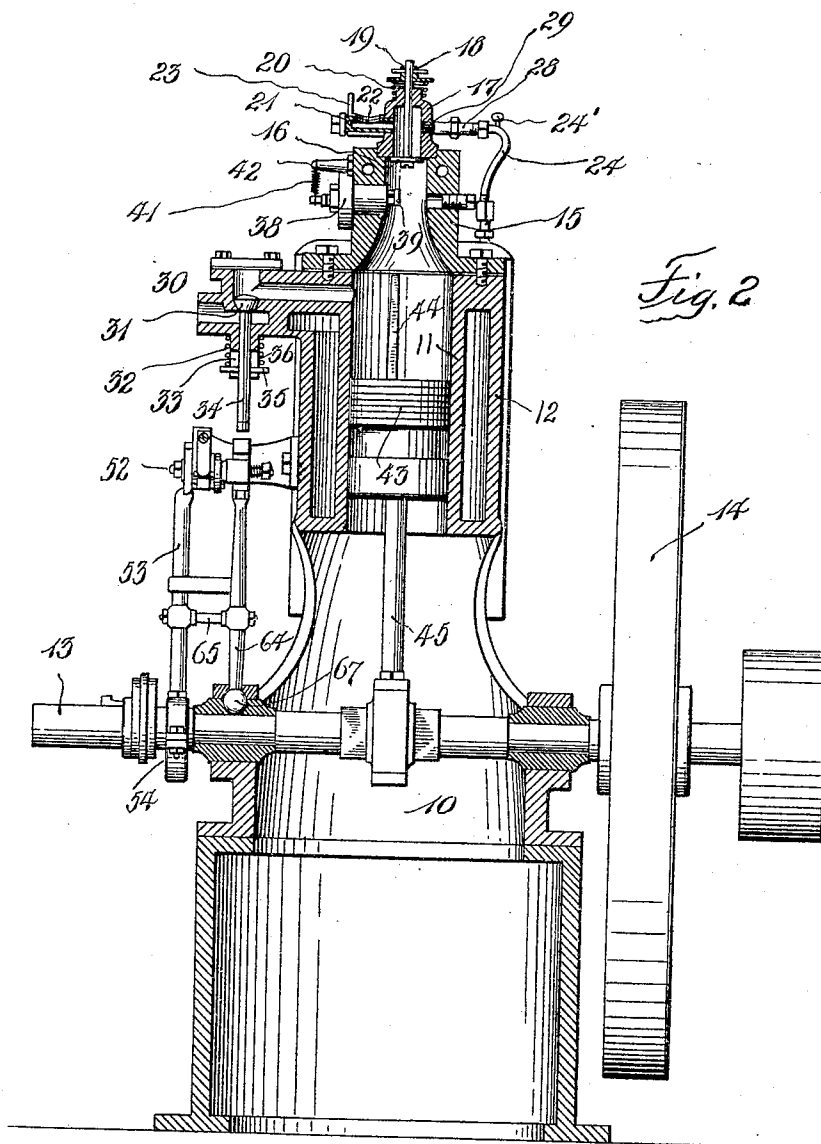
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4 SHEETS—SHEET 2.



Witnesses

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4 SHEETS—SHEET 3.

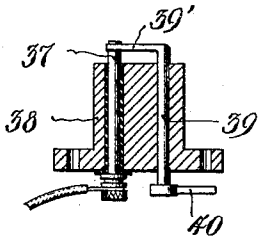


Fig. 10

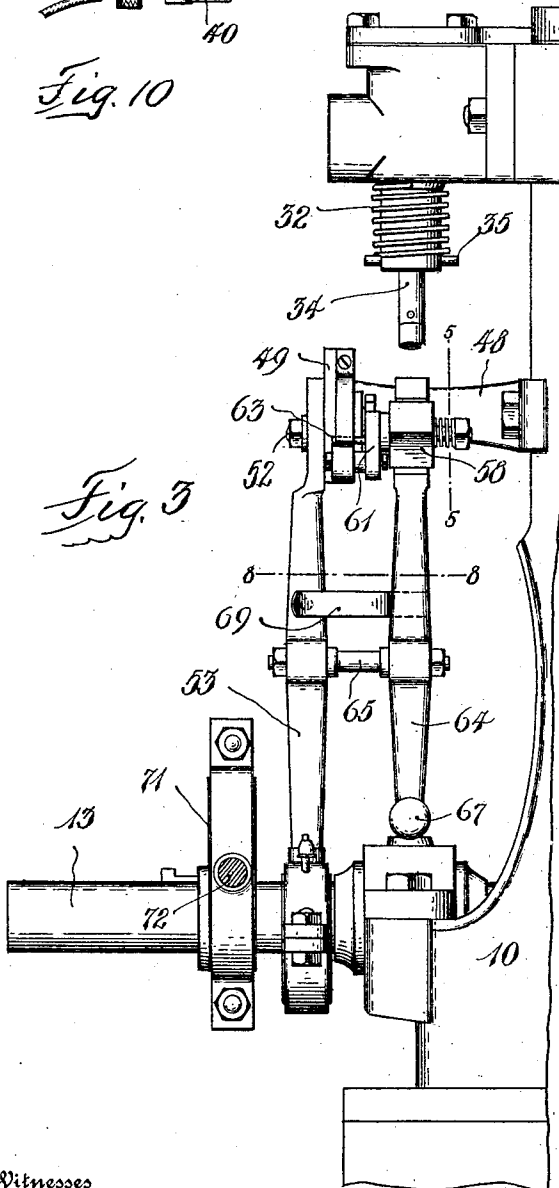
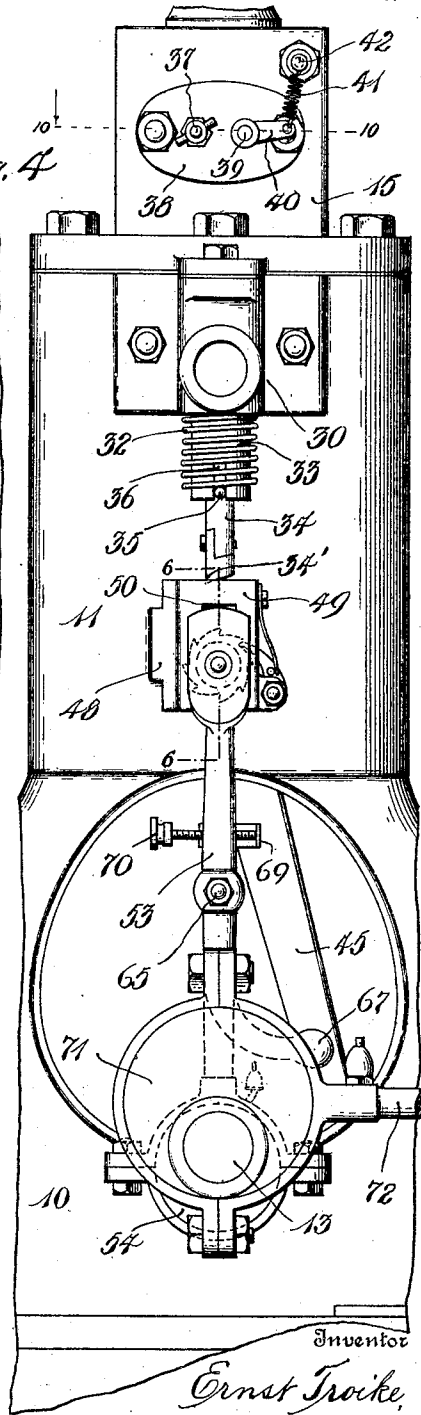


Fig. 3

Fig. 4



Witnesses
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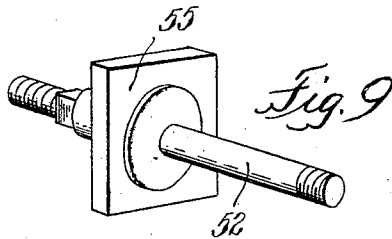
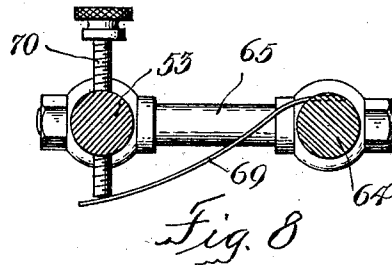
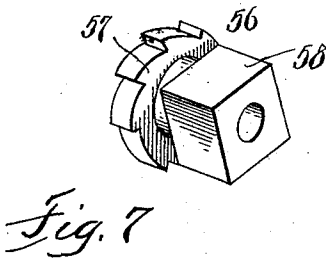
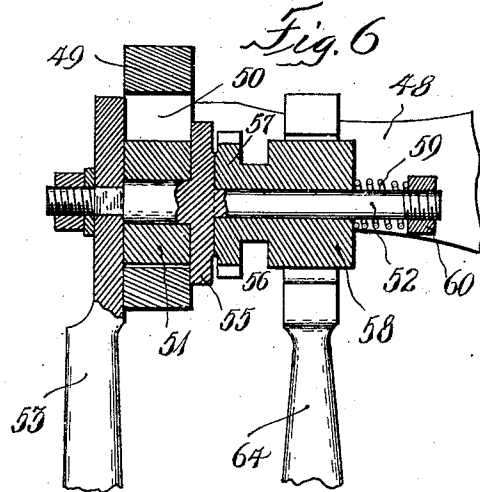
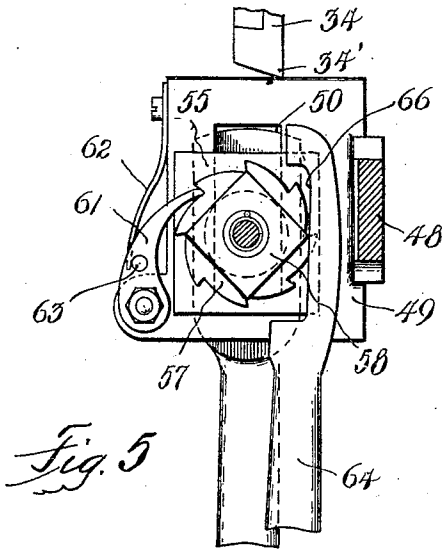
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4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

ERNST TROIKE, OF SANDUSKY, OHIO, ASSIGNOR OF ONE-FOURTH TO PAUL TROIKE, OF SANDUSKY, OHIO.

HYDROCARBON-ENGINE.

932,918.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ERNST TROIKE, a subject of the Emperor of Germany, residing at Sandusky, in the county of Erie and State of Ohio, have invented certain new and useful Improvements in Hydrocarbon-Engines, of which the following is a specification.

This invention relates to the class of internal combustion engines, such as are designed to be operated by the use of gasoline, kerosene, alcohol, or any other well known hydrocarbon fuel.

The subject-matter of this invention consists of certain specific details of improvement hereinafter fully described and claimed and illustrated in the accompanying drawings, in which—

Figure 1 is a front elevation of the engine complete, certain parts being in section; Fig. 2 is a vertical sectional view of the principal parts of the engine complete, other parts being in side elevation; Fig. 3 is a side elevation of the governing mechanism; Fig. 4 is a front elevation of the same mechanism; Fig. 5 is an end elevation of the tumbler and a cross section of the supporting bolt substantially on the line 5—5 of Fig. 3; Fig. 6 is a sectional view of the cross head and tumbler taken on the line 6—6 of Fig. 4; Fig. 7 is a perspective view of the tumbler detached; Fig. 8 is a transverse section of the eccentric rod and pendulum, showing the regulating spring; Fig. 9 is a perspective view of the cross head bolt, and Fig. 10 is a cross sectional detail on the line 10—10 of Fig. 4.

Throughout the following detail description and on the several figures of the drawings similar parts are referred to by like reference characters.

Carrying out the specific description of this invention the frame 10 may be of any suitable type, either vertical or horizontal, and it is to be understood that the invention contemplates the employment of any number of cylinders arranged in any suitable manner. Furthermore, the motor may be made of any desired size and power and is intended for general application, wherever a motor of this class may be employed. In the invention illustrated the cylinder 11 as made is an integral part of the main frame and is provided with a cooling jacket 12 of conventional form. A crank shaft 13 is journaled in the frame 10, and carries preferably at one

end a fly wheel 14 and at the other end certain specific governing mechanisms to be hereinafter fully described.

Although certain features of this invention are applicable to any type of engine, that disclosed herein is of the four-cycle type. At any convenient place a combustion chamber and a sparking device will be secured to the compression end of the cylinder. As shown herein the combustion chamber 15 is connected to the upper end of the cylinder and is fitted preferably on its upper end with a combined air and fuel inlet valve 16. The chamber 17 in which the said inlet valve is mounted for reciprocation is preferably tapped into the structure of the combustion chamber. The valve 16 is provided with a stem 18 having threaded connection with an adjusting nut 19, between which nut and the top of the valve chamber 17 is a coiled spring 20, whereby the tension on the valve is regulated. Secured upon one side of the valve chamber 17 is an air inlet duct 21 having a lateral port 22, controlled by a rotary slide valve 23, whereby the amount of air introduced into the valve chamber and cylinder may be regulated. A fuel pipe 24 leads into any other convenient portion of the valve chamber 17 in order that the fuel may be thoroughly mixed with the air. The pipe 24 may be of any suitable length and supply fuel from any suitably located reservoir, herein indicated at 25 and located adjacent to the cylinder. The pipe 24 will be provided preferably between the tank 25 and the chamber 17 with a one-way valve 26, and at its lower end adjacent to the bottom of the tank with a screen 27. At the upper end of the pipe 24 is preferably provided a coupling 28 having immediate connection with the valve chamber 17, and secured within the inner end of said coupling is a nipple 29 having a minute bore through which the oil is sprayed in a small quantity into the valve chamber 17 at each suction stroke of the piston. At any suitable place, the pipe 24 may be provided with a shut-off valve 24', whereby the flow of fuel and consequently the operation of the engine may be stopped.

The exhaust valve mechanism 30 is suitably located at the upper end of the cylinder and includes a valve 31, designed in this particular instance for vertical reciprocation, and being held closed normally by a spring 32 surrounding a projection or hub 33 inte-

gral with the main body of the exhaust structure. The valve stem 34 is provided with a cross pin 35 which operates in notches 36 in said hub. The pin supports the opposite end of the spring 32 and serves also to prevent rotation of the valve stem within the hub, a matter of importance in view of the mechanism for operating the exhaust valve. The exhaust valve stem is provided at its lower end with a contact edge 34' and may be contacted by any suitable governing mechanism for the purpose of opening the exhaust valve.

On the suction stroke of the piston, air and fuel are drawn into the combustion chamber through the valve chamber 17, as above indicated, and at the end of the compression stroke said mixed charge will be ignited by any convenient sparking device, that herein indicated comprising a pair of electrodes secured and operative within the combustion chamber 15.

One of the electrodes 37 is stationary and consists of any suitable conducting metal secured in and projecting through a spark plug 38 and insulated therefrom in any suitable manner. The other electrode 39 is journaled in the spark plug and is provided on its inner end with a laterally projecting contact finger 39' and secured on its outer end is an operating crank or arm 40 whereby by virtue of a spring 41 the contact finger 39 is maintained normally in contact with the stationary electrode 37. The spring 41 will be secured in any suitable manner to a fixed element of the structure, such as a post 42. The piston 43 is provided on its upper end with a stationary rigid finger 44 which engages the movable electrode 39 just as the piston is finishing its up stroke and whereby on separation of the electrodes a spark is produced causing ignition or explosion of the explosive mixture and with the result that the piston and piston rod 45 propel the crank shaft 13 in the customary manner. The spark may be produced by any convenient means, but I prefer to employ a specific type of magneto-electric device constituting the subject-matter of a separate patent, the application for which is filed of even date herewith. Such magneto-electric device, however, is indicated herein at 46. One connection between the magneto and one electrode is through the body of the machine, and the other is through a wire 47 connected to the other electrode.

The governing mechanism is of peculiar type and includes devices through which the operation of the exhaust valve will determine or control the introduction of fresh fuel and air supply to the combustion chamber. Secured to the frame of the machine or to the cylinder adjacent to the lower end of the exhaust valve stem 34 is a bracket 48 having an angularly disposed head 49 the

plane of which is vertical and parallel to the vertical axis of the machine. The said head 49 is provided with a vertical slot 50 in which a cross head 51 is adapted to slide vertically. Said cross head is mounted upon a transverse bolt 52 which receives its motion from an eccentric rod 53 driven by an eccentric 54 on the crank shaft 13. That portion of the bolt 52 with which the said eccentric rod 53 is connected is preferably squared and is received in a similarly formed hole in said eccentric rod 53, whereby the said bolt 52 is prevented from excessive rotation. Made integral with or connected rigidly to the bolt 52 in any suitable manner is a flange 55, which coöperates with the inner face of the head 49 and whereby the bolt is prevented from being displaced from a true horizontal. Said flange 55 and the upper end of the eccentric rod 53 operate upon opposite sides of the head 49. Journaled upon the bolt 52 adjacent to the flange 55 is a tumbler 56 comprising a ratchet wheel 57 having eight teeth and a cam 58 having a plurality of flat sides or faces. The rotation of the tumbler on the bolt 52 is controlled by a spring 59 and an adjusting nut 60. A pawl 61 is pivoted on one edge of the head 49 and is held in coöperative relation with the ratchet wheel 57 by a suitable spring 62 connected to the edge of the head 49 and bearing upon a finger 63 extending laterally from the pawl. The teeth of the ratchet wheel 57 are so directed that upon each vertical reciprocation of the bolt 52 the tumbler will be carried therewith and upon the downward stroke the pawl will cause rotation of the tumbler to an extent of one ratchet tooth, or one-eighth of the rotation of the tumbler. The relation between the four-sided cam and the ratchet wheel is such that the flat faces of the cam 58 will be all either vertical or horizontal or else all diagonal, such positions being assumed alternately as the engine operates. The governor employed is of the pendulum type, and comprises a pendulum 64 pivoted intermediate of its ends on a stud 65 carried by and projecting laterally from the eccentric rod 53 on the inner side thereof. The upper end of the pendulum 64 coöperates with the cam 58 and also with the lower or contact end of the exhaust valve stem. The said upper end of the pendulum is provided with a flat face 66 which engages alternately with one of the flat faces of the cam 58 and the corners thereof. The lower end of the pendulum is bent laterally in a direction opposite from that side of the cam 58 on which the said face 66 is located and is provided with a weight 67 by virtue of which the face 66 is held in engagement with the cam 58. During ordinary operation of the engine the upper end 68 of the pendulum engages the contact end of the exhaust valve stem on alter-

nate up strokes,—that is to say on those up strokes of the eccentric rod at which the cam 58 is carried with a flat face adjacent to the flat face 66 of the pendulum. On the next up stroke the cam 58 will have been turned through one-eighth of a rotation by operation of the pawl 61, at which time the effective diameter of the cam will be sufficient to cause the upper end of the pendulum to miss the lower end of the valve stem. Upon increasing the velocity of the engine the inertia of the weighted pendulum will cause the upper end 68 of the pendulum to miss the valve stem oftener than hereinbefore suggested, and whereby the speed of the engine will be automatically regulated. If it is desired to so regulate or control the engine as to provide for a greater number of revolutions, any suitable means may be provided to counteract the tendency of the inertia of the governor above mentioned. In this instance such means are shown as comprising a spring 69 connected to the pendulum and cooperating with a thumb screw 70 carried by the eccentric rod. Upon increasing the tension of the spring 69 the pendulum will be caused to engage the exhaust valve stem regularly on alternate up strokes during higher speed of rotation and for this reason an engine equipped by this regulating device is capable of very great range of speed and without varying in any manner the fuel feeding devices.

The magneto herein described is of the oscillating type and is operated at a comparatively slow speed directly from the engine shaft. For this purpose an eccentric 71 keyed to the engine shaft is provided with an eccentric rod 72 attached to an arm 73 of the armature shaft 74 and whereby on each rotation of the engine shaft the armature shaft 74 will be given a partial rotation.

The structure herein disclosed is of extremely simple construction, an unusually small number of parts being employed in its construction, and by actual practice I have demonstrated its practical utility with respect to a wide range of applicability and speed and with respect also to its ease of operation and control.

Having thus described the invention, what is claimed as new, is:

1. In a hydrocarbon engine, the combination with a cylinder, a piston, a crank shaft, and connecting means between the piston and crank shaft, of exhaust mechanism including a reciprocating valve having a downwardly projecting stem and a spring to maintain said valve normally closed, a cross head slidable toward and from the exhaust valve, a tumbler movable with the cross head, stationary means to cause intermittent rotation of the tumbler while moving with the cross head, means connected to the crank shaft for direct operation of the

cross head, and a governing member connected to the cross head operating means for cooperation with said tumbler and adapted to impinge directly against the said valve stem to control the operation of the exhaust valve.

2. In a hydrocarbon engine, the combination with the cylinder, the piston, and the parts driven from the piston, of exhaust mechanism including a reciprocating valve having an extended stem, a stationary bracket, a cross head slidable in said bracket, a bolt extending through the cross head and having a rigid flange thereon, a tumbler journaled on the bolt adjacent to said flange, an eccentric mounted on the crank shaft, an eccentric rod driven from said eccentric and connected to said bolt on the opposite side of the flange from the tumbler, and means associated with said tumbler for intermittently engaging the exhaust valve stem to control the operation of the engine.

3. A hydrocarbon engine comprising cylinder, piston, and crank shaft mechanisms, governor mechanism including a bolt, a cross head associated with said bolt, a tumbler mounted on said bolt, means to cause intermittent rotation of the tumbler, means to operate the bolt and cross head from the crank shaft, and a pendulum carried by said last mentioned operating means and cooperating with said tumbler, and exhaust valve mechanism adapted to be operated by said governing mechanism.

4. In a hydrocarbon engine, the combination with the cylinder, piston, and crank shaft mechanisms, of a bracket secured to the cylinder and having a laterally disposed head, a cross head reciprocating in said head, a pawl mounted on a stationary pivot, a tumbler associated with said cross head and caused to rotate intermittently by said pawl upon reciprocation of the cross head, said tumbler including a plural-sided cam having flat faces, an eccentric rod driven from the crank shaft and connected to the cross head for operation thereof, a pendulum pivoted upon said eccentric rod and having a flat face to cooperate with said flat faced cam, and valve mechanism connected to the cylinder and adapted to be operated intermittently by said pendulum.

5. In a four-cycle engine, the combination with the usual cylinder, piston, and crank shaft mechanisms, of governing mechanism comprising an exhaust valve having a projecting stem, a cross head, a plural-sided cam journaled on the cross head, means to reciprocate the cross head toward and from the said valve stem, means to cause intermittent rotation of the cam, a pendulum carried by the cross head operating devices, and having a flat face adapted to contact said cam and also to intermittently engage the valve stem to reciprocate the same, and means as-

sociated with the pendulum to cause the same to maintain the contact of its flat face with said cam.

5 6. In governing mechanism for a four cycle engine, the combination of an exhaust
10 valve having a stem, an eccentric, an eccentric rod operated by said eccentric, a plural-sided cam connected to said eccentric rod and reciprocated thereby, means to cause
15 intermittent rotation of the cam, said means including a ratchet wheel, and a stationary pawl to cause rotation of the ratchet wheel through the space of one tooth upon each reciprocation of the eccentric rod, and a
20 pendulum operated by the eccentric rod and associated with said cam for making intermittent contact directly with the said valve stem.

25 7. In a hydrocarbon engine of the four-cycle type, the combination with the cylinder, piston, crank shaft, and connecting mechanisms, of a governing mechanism comprising a cross head, a bolt on which the cross head is mounted, a tumbler journaled
30 on the bolt and comprising a ratchet wheel and a plural-faced cam, means to cause intermittent rotation of the tumbler on the bolt, means to prevent such rotation when not under the influence of said rotating means, a pendulum associated with said
35 tumbler and having a flat face cooperating with the said cam, means on said pendulum

to maintain the contact between the flat portion of the pendulum and the said cam, and means driven directly from the engine shaft
40 to cause reciprocation of the cross head and oscillation of the pendulum.

8. In a governing device for hydrocarbon engines, the combination with a crank shaft,
45 of an eccentric rod driven therefrom, a cross head reciprocated by said eccentric rod, a tumbler associated with the cross head, means to cause intermittent rotation of the tumbler including a ratchet wheel, said tumbler also including a cam having a plurality
50 of flat faces, a pendulum pivoted intermediate of its ends on said eccentric rod whereby it is given reciprocation and oscillation, the pendulum having a flat face cooperating with the cam aforesaid, means associated
55 with the pendulum to normally maintain said flat face in contact with the cam, but permitting separation thereof upon excessive speed of the engine, and means auxiliary to the aforesaid pendulum means to vary the
60 times at which the speed of the engine will cause separation of the flat face of the pendulum from the cam.

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

ERNST TROIKE.

Witnesses:

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PAUL TROIKE.