I. HOVEY.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED NOV. 27, 1908.

943,598.

Patented Dec. 14, 1909.

4 SHEETS—SHEET 1.

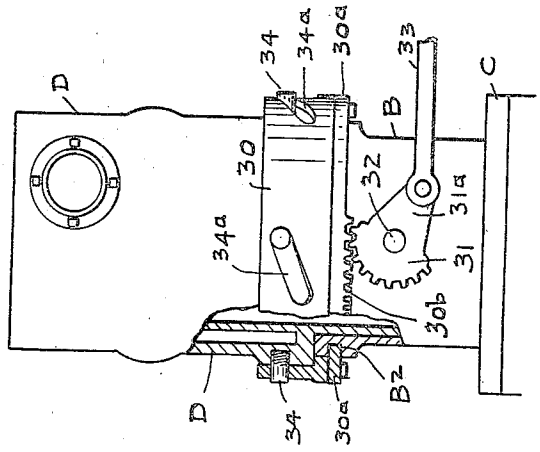

Fig. 7.

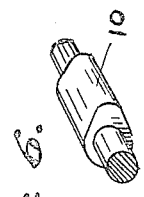

Fig. 6.

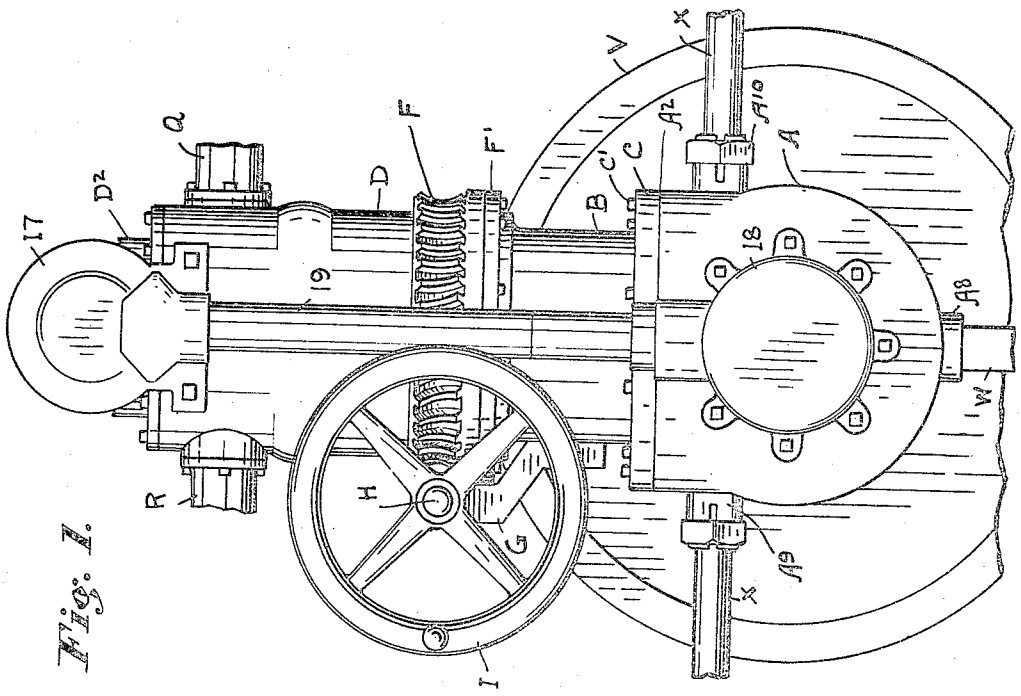

Fig. 1.

WITNESSES:

Robert E. Scott

Marian E. Ryan.

INVENTOR

INGLE HOVEY.

BY Thomas L. Ryan

ATTORNEY

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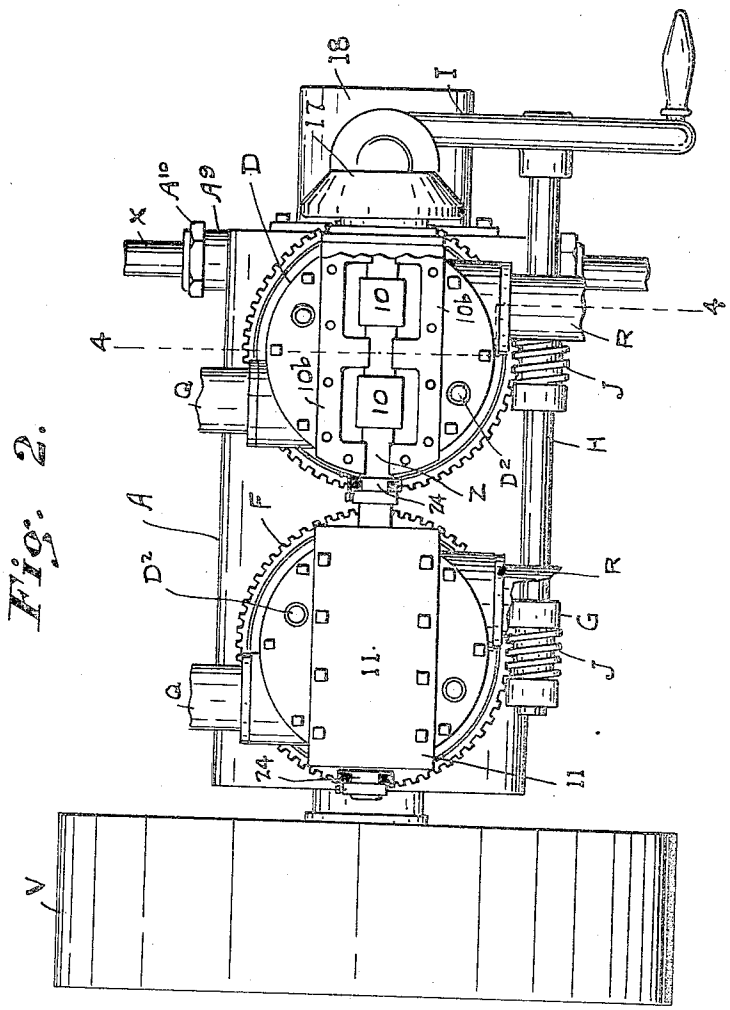

Fig. 2.

WITNESSES:

Robert E. Scott

Marcan E. Ryan

INVENTOR

INGLE HOVEY.

BY Thomas L. Ryan

ATTORNEY

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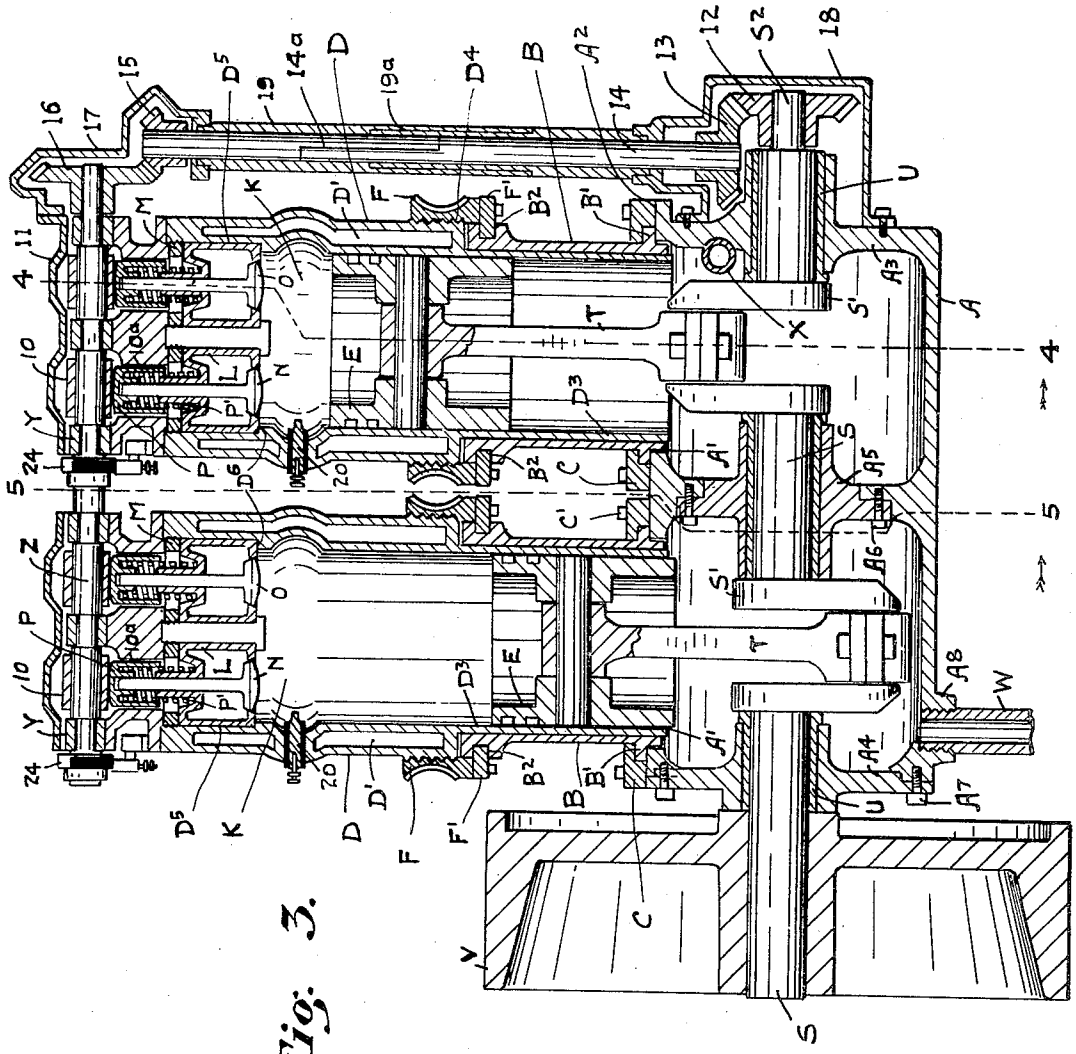

Fig. 3.

WITNESSES:

Robert E. Scott

Marian E. Ryan.

INVENTOR

INGLE HOVEY.

BY Thomas L. Ryan

ATTORNEY

I. HOVEY.

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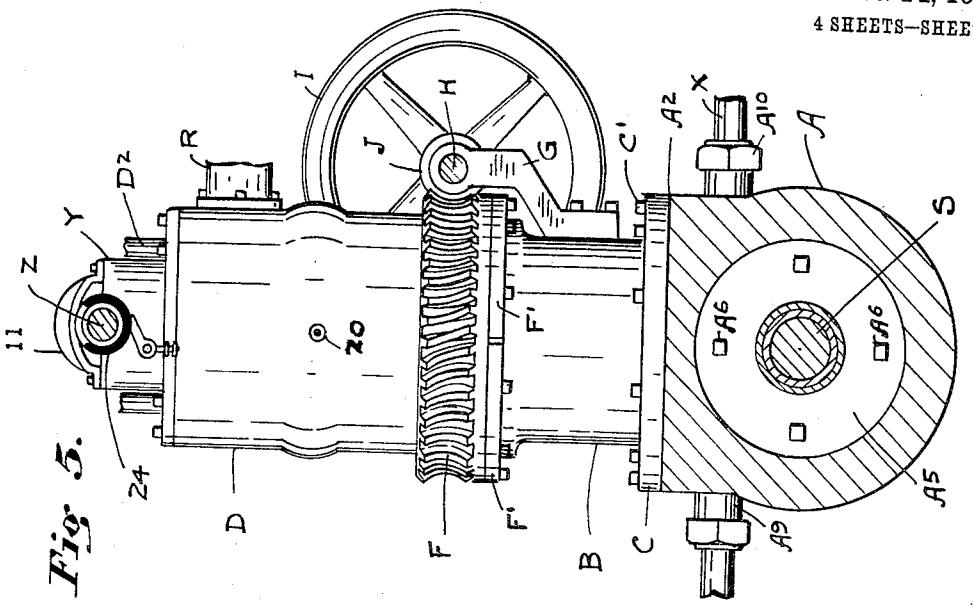

Fig. 5.

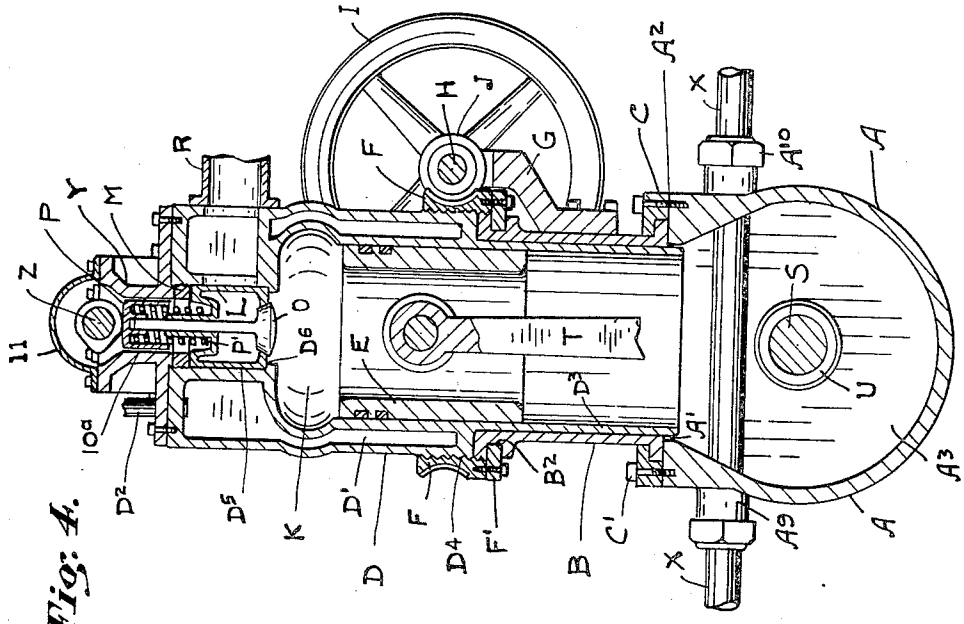

Fig. 4.

WITNESSES:

Robt E. Scott

Marian E. Ryan.

INVENTOR

INGLE HOVEY.

BY Thomas L. Ryan

ATTORNEY

UNITED STATES PATENT OFFICE.

INGLE HOVEY, OF NEWCASTLE, INDIANA.

INTERNAL-COMBUSTION ENGINE.

943,598. Specification of Letters Patent. Patented Dec. 14, 1909.

Application filed November 27, 1908. Serial No. 464,619.

To all whom it may concern:

Be it known that I, INGLE HOVEY, a citizen of the United States, and a resident of Newcastle, in the county of Henry and State of Indiana, have invented a new and useful Internal-Combustion Engine.

This invention relates to improvements in internal combustion engines and has for its primary object to provide an engine of the character referred to which will be capable of having the volume of the combustion chamber or portion of the working cylinder varied whereby the degree of compression of the fuel mixture may be regulated.

Further purposes of my invention are to provide an engine of the kind described which will be compact, of few parts, durable and not liable to get out of repair or adjustment.

To these ends my invention consist of, and the objects of my invention are accomplished by the new construction, combination and arrangement of parts described in this specification, defined in the appended claims and illustrated in the accompanying drawings.

In the drawings similar characters of reference refer to corresponding parts throughout the several views.

Figure 1 is a side view and Fig. 2 is a plan view of my improved engine; in the latter view a portion of the conduit R being broken away. Fig. 3 is a vertical central longitudinal sectional view. Fig. 4 is a transverse sectional view taken on the line 4—4 in Fig. 2 and Fig. 3 and in the direction indicated by the arrow in Fig. 3. Fig. 5 is a transverse sectional view taken on the line 5—5 and in the direction indicated by the arrow in Fig. 3. Fig. 6 is a detached view of one of the cams 10. Fig. 7 is a view showing a modification.

The general structure and details of construction and arrangement shown, is that which I have contemplated as preferable for the carrying into effect of my invention.

The crank case A is substantially circular in cross section and has the lateral openings A^1 about which openings are the machined seats A^2.

B, B designate support cylinders. These support cylinders are internally machined and each has the annular lug B^1; adapted to rest on the seats A^2. To secure each of these support cylinders rigidly in position, are provided the divided rings C; the interior edge of each of these rings has a continuous angular recess of proper form to fit the lug B^1 so that when the bolts C^1 which pass through these rings and into threaded holes therefor in the crank case, are screwed down, the support cylinder will be held immovably in position. In the external face of the upper end of each of the support cylinders is provided the groove B^2 the function of which will presently be referred to.

Each of the working cylinders D provided with the usual water passages D^1 and through which the water circulation is afforded by the pipes D^3 are machined internally for the trunk piston E. Each also has the integral cylindrical shank D^3 machined so as to reside slidingly in the support cylinder B. The external portion of each working cylinder is threaded to form a screw D^4 of low pitch. This screw D^4 operates in the suitably threaded gear collar F as shown. This gear collar F is provided with suitable concave gear teeth and has the annular flange F^1 bolted thereto, the interior face of which flange will reside slidingly in the groove B^3. The flange F^1 is made in segments and in assembling my invention said segments are placed in position in the groove and then bolted to the gear collar F as shown.

Disposed adjacent to and journaled in pillow blocks G secured to the support cylinders, is the shaft H. The hand wheel I that is secured to said shaft affords suitable means whereby the said shaft may be rotated. Secured to the shaft H and adapted to mesh with each of the gear collars, are the worms J, as plainly shown in Fig. 2. It will be seen that by this construction combination and arrangement of parts, the working cylinders D will be moved vertically by the rotary movement of the shaft H.

Communicating with the compression chamber K of the working cylinders are the circular recesses D^5 each terminated at its bottom by the annular seat D^6. Fitted in each of the said recesses and adapted to rest on the said seat D^6 thereof, is the valve cage L, held in position by the threaded ring M which is screwed down in the said recess against the top of said valve cage. The stem of the inlet valve N, and the stem of the ex-

haust valve O, each has pivotally supported thereon the hood P within which hood and about the guide in which the stem is slidingly supported, is the coil spring P^1 The ends of the coil spring bear against the upper end of the cage and the under side of the hood P whereby the valve is sustained yieldingly in closed position against its seat in the valve cage casement; this hood constitutes a cross head through which the motion that actuates the valve is imparted. Arranged to communicate with the inlet valves N and with the exhaust valves O through the walls of the cylinders and the walls of the valve cages are the conduits Q and R respectively.

The shaft S having the double cranks S^1 to which are connected the usual pitmen T pivotally connected to the piston heads E, is journaled in suitable bushings U supported in the crank case heads A^3 and A^4 and in the center block A^5. The crank case head A^4 and the center block A^5, are sustained in their proper positions respectively by being bolted to the crank casement, as shown in Fig. 3; this center block is separable as shown in Fig. 5. In assembling these parts the center block is first placed in position between the double cranks, the shaft is then inserted through the open end of the crank case and the journal thereof having the extension S^2 is disposed in the head A^3; the center block A^5 is then secured in position by the bolts A^6 and then the head A^4 is slid into position on the shaft, and secured to the crank case by the bolts A^7; the fly wheel V is then secured to the shaft by being suitably keyed thereto.

The boss A^8 on the bottom of the crank case is internally threaded and is adapted to receive a suitable support bar W; and on the sides of the crank case are the bosses A^9. These bosses A^9 are bifurcated and are externally threaded, and have suitable bore to retain the support bar X as shown in Fig. 4. The nuts A^{10} when screwed down on the studs A^9 will cause the walls of the stud to grip the support bar X so tightly that the same will be held immovably in position.

Horizontally disposed above the cylinders and journaled in the pillow-blocks Y, is the shaft Z upon which shaft are secured at proper locations the cams 10 to register with the hoods P. The general form of these cams is illustrated in Fig. 6, the functions thereof are to actuate the said valves N and O. The form and positions of these cams with reference to the valves and to the position of the piston head and to each other and the mode of operation of said valves are not unusual, but will be presently further refererd to.

The pillow blocks Y are of the general form as shown in Fig. 2 and Fig. 4 and are secured to the tops of the cylinders. Each pillow block has the central circular aperture or bore 10^a which forms a suitable guideway for the hood P. The extended flange 10^b is provided to receive and have connected thereto the cover plate 11 the function of which is obvious.

Secured on the extension S^2 of the shaft S is the bevel gear wheel 12 that meshes with the bevel gear wheel 13 that is secured to the end of the shaft 14. To the other end of this shaft 14 is secured a bevel gear wheel 15 which meshes with a similar gear wheel 16 that is secured on the shaft Z as shown in Fig. 3.

In positions to suitably inclose the said bevel gears, are, the cases 17 and 18, secured to the upper portion of one of the working cylinders, and to the crank case, respectively. The shaft 14 has the longitudinal division 14^a throughout a part of its length and is loosely inclosed by the close fitting tubing 19 which is also provided with a longitudinal division 19^a and which has its ends secured to the cases 17 and 18. By this arrangement the transmission of power between the shaft S and the shaft Z regardless of the varied vertical positions occupied by the working cylinder, is continuous.

As a suitable sparking device to be used on this engine, the usual spark plug 20 is shown. The breaking of the circuit, and the consequent spark for ignition may be accomplished by a commutator 24 disposed on the shaft Z, as shown in Fig. 5.

My improved engine in readiness for operation appears as shown in Fig. 3, the valves N and O being sustained yieldingly in closed position. The relative positions of the cams 10 at each cylinder and the gearing of the shaft Z, are such that as the piston head descends the valve N is opened which permits an inflow into the cylinder of the fuel such as naphtha or any suitable carbureted and vaporized mixture. With the upward movement of the piston head the valves N and O remain closed and the mixture so contained is compressed in the compression chamber K, and by the electric spark exploded in the usual manner, and the piston is driven downwardly; upon its upward movement, the exhaust valve O is opened and the spent products of combustion escape. As the piston again descends and rises the valves remain closed and with the following descent the valve N is opened and the operation of my improved engine continues as described. The cylinders and their connected parts are arranged in opposed order as shown, and it is obvious that any number of cylinders may be arranged as shown and may be manipulated by the single shaft H.

In the operation of internal combustion engines, as hitherto devised, wherein there is no means of varying the volume of the

compression interior of the cylinder, the effect in operation is, that with increase of load beyond the point of efficiency of the amount of fuel contained in the compression chamber, the capacity of performance of the engine is immediately reduced, the speed at which the engine is operating will be greatly reduced and abnormal strains on the several parts will occur.

My improved engine is of especial utility for driving of automobiles or like vehicles, in the operation of which the degree of loading of the engines is subject to frequent variation. When operating normally, the working cylinders D occupy the positions with reference to the support cylinders B as shown in Fig. 3. By rotating the shaft J the gear collar F will be given a rotary movement whereby the working cylinder will be raised thereby increasing the volume of the compression chamber K accordingly. By the combination and arrangement of parts as shown the volume of the compression chamber K may be varied to a nicety, the advantages of which are obvious.

A modified form of structure and arrangement of parts for accomplishing the objects of my invention, is shown in Fig. 7. Instead of the collar F, I provide the collar 30 which has the annular flange 30^a bolted thereto and which flange works slidingly in the groove B^2. The underside of a portion of the flange 30^a is provided with the teeth 30^b which teeth mesh with the teeth of the segment. This segment 31 is loosely mounted on the stud 32 carried by the support cylinder B. Loosely secured to the arm 31^a of the segment is the reach rod 33. The end of this reach rod is provided with a proper handle or connections and it will be understood may be connected to a segment arm of each engine cylinder that may compose the series of engines being used.

34 designates a stud secured in the wall of the cylinder D. It is preferable that say four of these studs be used. The cam-shaped slots 34^a are of such shape and arrangement that when the collar 30 is moved rotatably the cylinder D will be moved vertically. This modified form of my invention may be preferred on account of it being less expensive to construct and slightly quicker of action.

I am aware that minor changes might be made in the combination, construction and arrangement of parts composing my invention within the scope of the claims appended hereto, without departing from the spirit or nature of my invention nor sacrificing any of its advantages.

What I claim as my invention and desire to secure by Letters Patent of the United States, is—

1. In an internal combustion engine, the combination of a working cylinder having a reciprocatory piston therein, a crank case, a support cylinder in which the working cylinder is slidingly secured, the support cylinder being detachably secured to the crank chamber, an annular member carried by the support cylinder and free to move rotatively but not vertically thereon, said annular member being so connected with the working cylinder that with the movement of the annular member the working cylinder will be raised or lowered, means supported adjacent the support cylinder to move and to hold the annular member in different adjusted positions.

2. In an internal combustion engine, the combination of a working cylinder having a reciprocatory piston therein, and cam tripped valves in the combustion end of said working cylinder, a crank case, a shaft carried by said working cylinder provided with cams to operate said valves, a support cylinder secured to the crank case and in which support cylinder the working cylinder is slidingly disposed, means carried by the support cylinder and to engage the working cylinder so that the working cylinder may be moved to and sustained in different positions with reference to the axial line of the crank shaft, adjustable power transmitting connections between the crank shaft and the said shaft that is carried by the working cylinder, substantially as described.

3. In an internal combustion engine of the kind described, the combination of a working cylinder having a reciprocatory piston therein, the external face of the working cylinder being threaded and the open end portion of said working cylinder being externally machined, a crank case, a support cylinder secured to said crank case and in which the open end portion of the working cylinder is slidingly disposed, a gear collar internally threaded to engage the threads on the working cylinder, said gear collar being supported by a flange that is loosely retained in an annular recess in the support cylinder, a hand controlled worm wheel carried by the support cylinder and adapted to mesh with the gear collar, substantially as described.

4. In an internal combustion engine, the combination of a working cylinder having a reciprocatory piston therein the open end portion of said working cylinder being of reduced diameter, a crank case having a lateral opening therein, a support cylinder adapted to retain slidingly the open end portion of the working cylinder and having an annular flange adapted to reside on the face of the opening in the crank case, the other end of the support cylinder having an annular groove therein, means to secure the support cylinder to the crank case, a gear collar internally threaded and adapted to be screwed on the working cylinder, a seg-

mental flange bolted to the bottom of the gear collar and adapted to move slidingly in the groove of the support cylinder, a shaft journaled on a boxing supported by the support cylinder, a worm gear thereon to engage the gear collar, substantially as and for the purpose described.

In testimony whereof I sign my name to this specification in the presence of two subscribing witnesses.

INGLE HOVEY.

Witnesses:
HENRY HANLEY,
PETER JOSEPH DAVID.