

R. M. ROOF.
INTERNAL COMBUSTION ENGINE.
APPLICATION FILED DEC. 23, 1908.

956,423.

Patented Apr. 26, 1910.

3 SHEETS—SHEET 1.

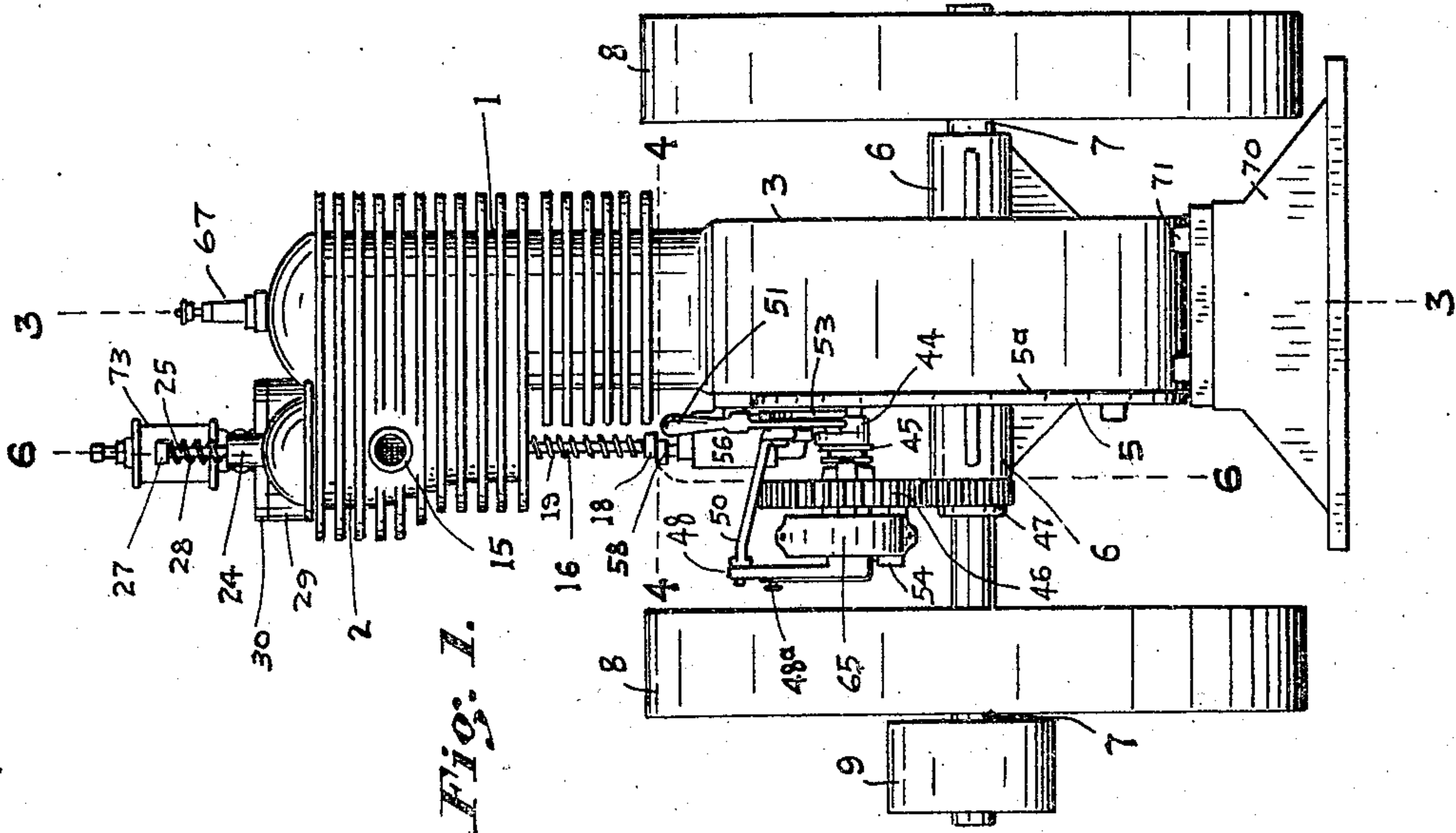


Fig. 1.

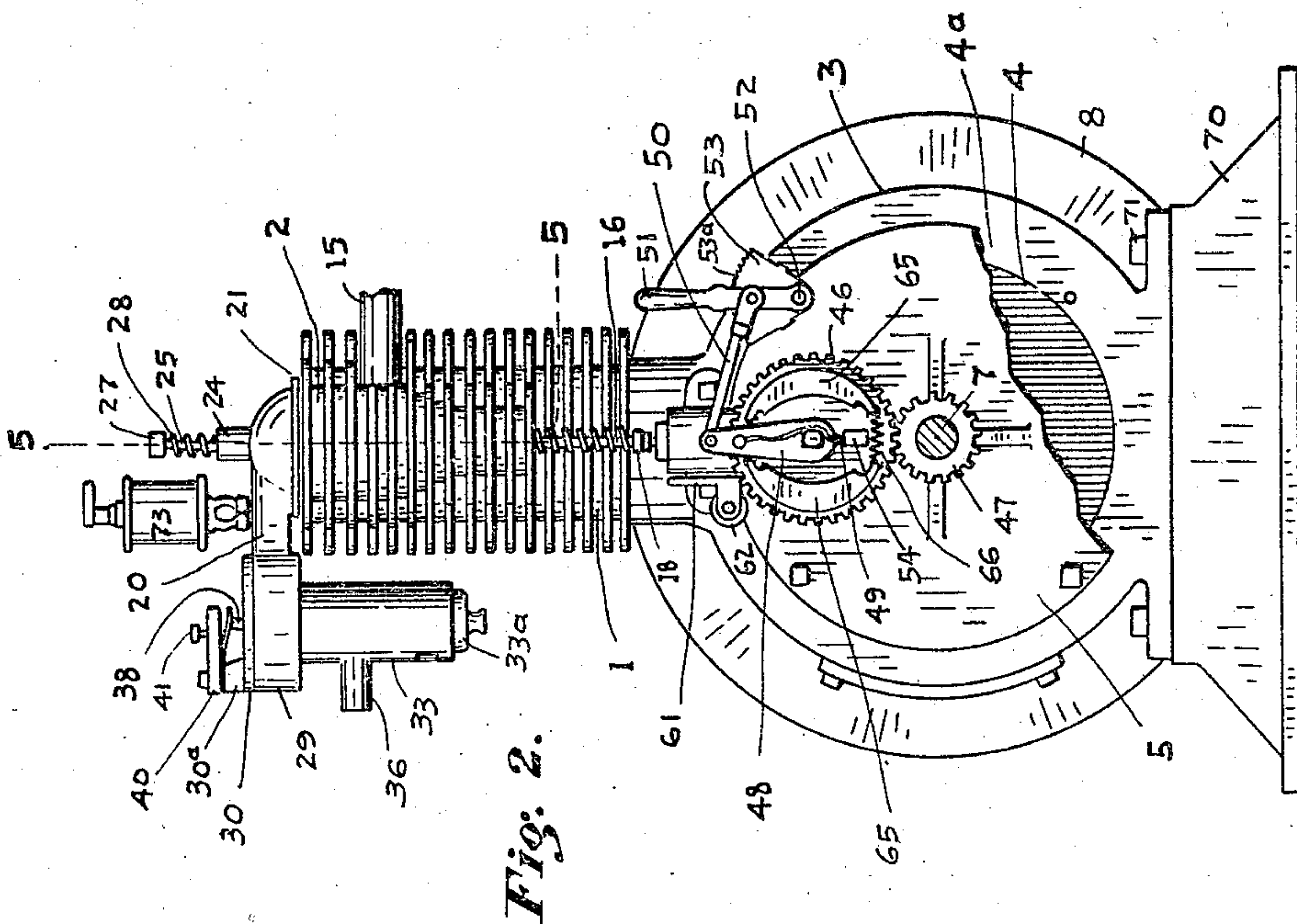


Fig. 2.

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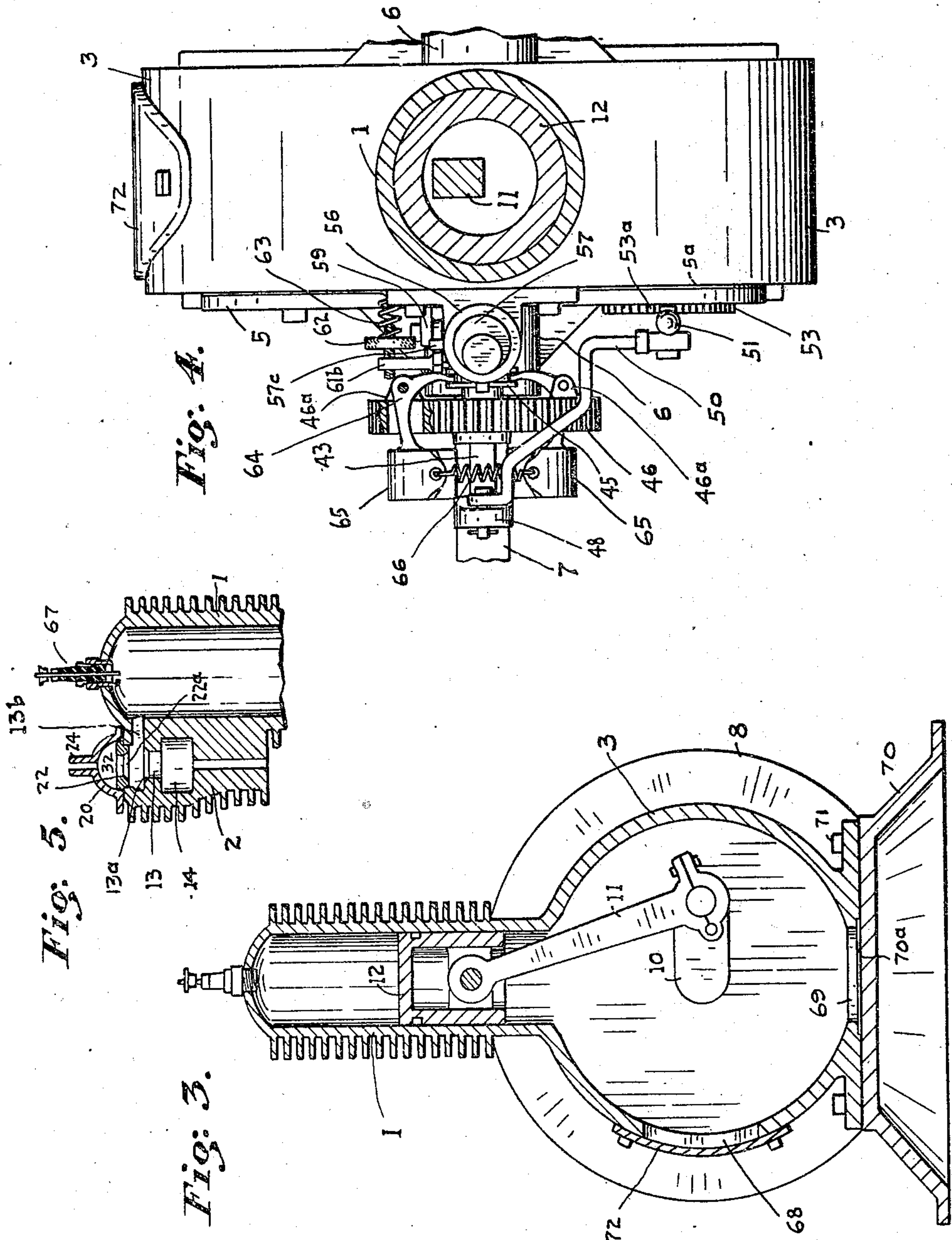
Thomas Ryan
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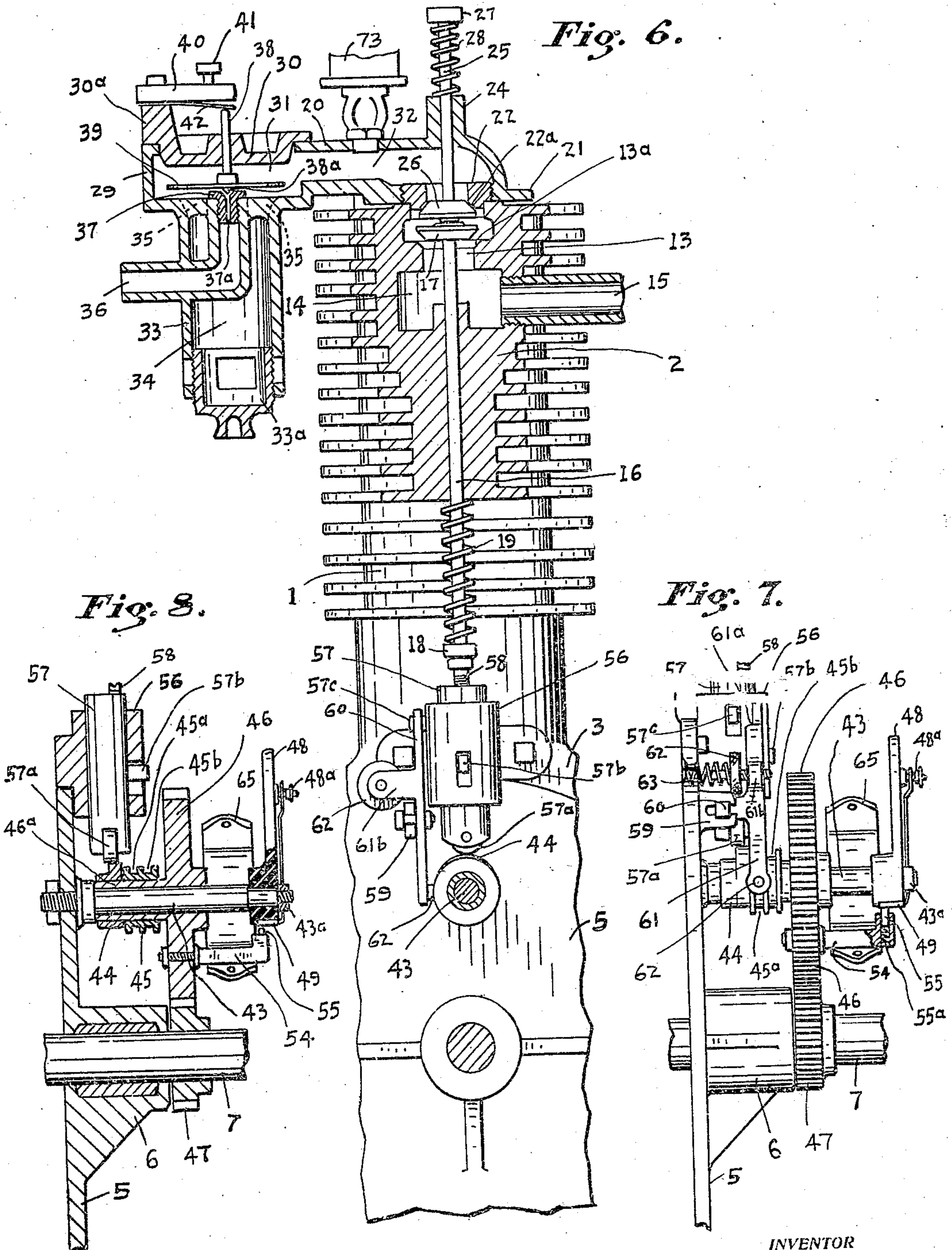
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UNITED STATES PATENT OFFICE.

ROBERT M. ROOF, OF MUNCIE, INDIANA, ASSIGNOR OF ONE-THIRD TO FRANK E. HILL,
OF MUNCIE, INDIANA.

INTERNAL-COMBUSTION ENGINE.

956,423.

Specification of Letters Patent.

Patented Apr. 26, 1910.

Application filed December 23, 1908. Serial No. 468,911.

To all whom it may concern:

Be it known that I, ROBERT M. ROOF, a citizen of the United States, and a resident of the city of Muncie, county of Delaware, and State of Indiana, have invented a new and useful Improvement in Internal-Combustion Engines, of which invention the following is a specification.

This invention relates to improvements in internal combustion engines and has for its objects to provide an engine of the character referred to which will be of rigid, simple and economical construction, and which may be easily governed and controlled.

Further objects of my invention are to provide simple and efficient means whereby the starting of the engine is facilitated.

The aforementioned and other objects of my invention which will be apparent as the specification of my invention is disclosed, are accomplished by the new combination and construction and arrangement of parts, described in this specification, illustrated in the annexed drawings and defined in the appended claims.

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

Figure 1 is an end view and Fig. 2 is a side view of my invention in the latter view one of the fly wheels being removed, and a part of the wall plate being broken away. Fig. 3 is a vertical central sectional view on the line 3—3 Fig. 1. Fig. 4 is an enlarged plan view taken on the line 4—4 Fig. 1. Fig. 5 is a vertical central sectional view on the line 5—5 Fig. 2. Fig. 6 is an enlarged sectional view taken on the line 6—6 Fig. 1. Fig. 7 is a rear view of the governor and controlling mechanism. Fig. 8 is a central sectional view of Fig. 7 some of the parts in these two latter views being broken away.

This engine is so designed that the working cylinder 1 having the valve chest 2 formed integral therewith, and the crank case 3 are of the form substantially as shown and are of one solid casting. One side of the crank case portion has an ample opening 4 as shown in Fig. 2, and which opening is adapted to be closed by the wall plate 5. Formed integrally upon the wall plate 5 and upon the wall of the crank case are the boxings 6 in which are journaled the shaft 7 which carries the fly wheels 8.

9 designates a pulley from which the power may be transmitted from the engine.

The shaft 7 has the usual double crank 10 to which is loosely connected the pitman 11 that has a suitable connection with the trunk piston 12 which moves reciprocatingly in the working cylinder 1.

In the valve chest 2 is provided the chamber 13 the bottom of which is open and provided with a valve seat 13^a. Communicating with the chamber 13 from below is the chamber 14 which opens into the outlet pipe 15. Leading from the side of this chamber 14 and into the cylinder at its upper portion, as shown in Fig. 5, is the port 13^b.

The lower part of the valve chest is provided with a suitable bore in which is slidably disposed the valve-rod 16 which has the valve head 17 secured on its upper end. The lower end of this valve rod has the head 18 secured thereon. Between the head 18 and the lower end of the valve chest 2 is disposed the coil spring 19 which will hold the valve head 17 yieldingly in place on the seat 13^a.

20 designates a conduit terminated at one end by the base portion and flange 21 adapted to reside and to be bolted to the top of the valve chest. The ring 22 which has the valve seat 22^a, is secured to the said base portion of the conduit 20 by being screwed tightly therein. The lower portion of the ring 22 being of proper diameter will exactly fit the recess provided therefor in the valve chest, as shown in Fig. 6. The boss 24 formed on the upper part of the conduit, has a suitable bore in which is slidably retained the valve stem 25 having the valve head 26 adapted to rest upon the seat 22^a. Between the head 27 on the outer end of said valve stem and the boss 24 is arranged the coil spring 28 which will sustain the valve head in its normal position upon the seat 22^a. The other end of said conduit 20 is terminated by an enlarged portion 29. The head plate 30 is machined to fit into the position as shown. The chamber 31 communicates with the passageway 32 that leads into the chamber 13. Formed integrally upon the bottom of the portion 29 is the extension 33. In the bottom of this extension is provided the usual adjustable air damper 33^a. Communication between the air inlet chamber 34 and the chamber 31, is through

the several passages 35, into the chamber 31. The conduit 36 which leads into the chamber 31 is provided with the plug 37. This plug is adapted to be screwed down into position and has the perforation 37^a through which the fuel such as gasoline or gas may pass, as will be hereinafter described. The upper end of said perforation 37^a is countersunk so that the pointed head 38^a of the valve stem 38 will readily be centered therein. Secured to the said valve stem 38 is the shield plate 39 the function of which will presently be made clear. This valve stem 38 is slidingly retained in the smooth bore therefor provided in the head plate 30. Supported on the lug 30^a is the arm 40 in which is disposed an adjusting screw 41 whereby the pressure of the leaf spring 42 against the valve stem 38 may be adjusted.

Secured in position on the wall plate 5 at a position vertically beneath the valve stem 16 is the shaft 43. The cam 44 is keyed to and the collar 45 which has the grooves 45^a and 45^b, is mounted loosely on the shank 46^a of the gear wheel 46. This gear wheel 46 is mounted loosely on the shaft 43 and meshes with a smaller gear wheel 47 which is keyed to the shaft 7. These gear wheels are so proportioned that with each two revolutions of the gear wheel 47 there will be a single revolution of the gear wheel 46. Loosely mounted on the outer end of the shaft 43 and held in position by the nut 43^a is the arm 48. An electric terminal 49 is carried by this arm which arm may be made of suitable non-conductive material such as hard fiber. The wire connecting the terminal may be arranged and the binding post 48^a may be positioned on the said arm substantially as shown.

50 designates a connecting rod one end of which is loosely connected to the free end of the said arm 48, and the other end of which is loosely connected to the regulator-lever 51. This regulator lever is pivotally secured to the stud 52 upon which is disposed and held rigidly in position the sector plate 53 provided with the notches 53^a. A pawl carried by the regulator lever is adapted to engage the notches 53^a whereby the said lever may be held at different positions.

54 designates a stud carried by the gear wheel 46; in the outer end of this stud which is turned at an angle to the arm 48, is disposed the brush 55 which is slidingly retained in a recess in the said stud, and by the coil spring 55^a is held yieldingly against the hub of the arm 48.

56 designates a guide block that is rigidly secured to the crank case and in which guide block is slidingly disposed the plunger 57. Journaled in the lower end of this plunger is the wheel 57^a which is engaged by the cam 43 as will be hereinafter referred to. A threaded adjusting pin 58 which is screwed

into the top of said plunger, is adapted to have direct bearing against the head 18 of the valve stem 16. 57^b designates a stud carried by the plunger and which stud moves slidingly in the guide slot provided therefor, and prevents rotary movement of the plunger. Disposed near the upper end of the plunger is the stud 57^c which will move slidingly in the suitable guide slot therefor.

Formed integrally upon the wall plate 5 is the bifurcated support arm 59. Loosely sustained on the pivot 60 which may be set at different positions in the slot of said support arm, is the stop-bar 61. The lower end of this stop bar 61 has the stud 62 which resides slidingly in the slot 45^a of the collar 45. The upper end of this stop-bar is so arranged that when the collar 45 is moved outwardly the upper end of the stop-bar will be urged inwardly and will slip under the stud 57^c of the plunger when the latter is at the limit of its upper stroke.

62 designates an adjusting wheel the threaded shaft of which passes through a threaded aperture in the lug 61^b of the stop bar. The coil spring 63 interposed between the adjusting wheel and the crank case, will urge the upper end of the stop-bar outwardly.

Arranged oppositely and on the inner face of the gear wheel 46 are the pairs of lugs 46^a, each pair carries a pin upon each of which is loosely carried a bell crank 64 the inner arm of which bell crank engages the groove 45^b of the collar 45. The outer arm of each of the bell cranks passes freely through a slot therefor in the gear wheel 46 and is secured to the centrifugal weight 65, linked together by the coil springs 66. The interior portion of these weights are of proper form to afford ample room for the intervening parts. Provided in the upper head of the working cylinder is the usual spark plug 67.

In the casting of the structure constituting the working cylinder and crank case, there are formed the openings 4, 68 and 69. The opening 69 affords access for the tools for machining the bore of the cylinder, and the only additional machining is the finishing of the face 4^a against which the wall plate 5 is secured; a layer of packing 5^a may be interposed.

70 designates the base upon which the engine structure will be held securely by the bolts 71. A layer of packing 70^a may be interposed, as shown in Fig. 3 to effect a tight closure of the bottom of the crank case in which a proper amount of oil will be retained for the lubrication of the internal working parts of the engine. Easy access to the interior of the crank case is afforded by removing the cover plate 72 which is held in place by suitable bolts.

73 designates a suitable oil cup the function of which is obvious.

The mode of coöperation of the several parts of my improved engine will be apparent from the description thus far, and from inspection of the drawings. The relative positions of the cam 45 and the terminal 49 and the piston head 12, are such that when the piston head is at uppermost position the valve head 17 is in closed position on the seat 13^a, the plunger 57 being in shifted position. The valve head 26 and the shield plate valve 39 are held normally in closed positions as hereinbefore described. In starting the engine the regulator lever 51 is moved to such position that the spark may occur just after the piston starts downwardly. With the downward stroke of the piston the charge of gasolene and air is drawn into the cylinder through the valve 26 and port 13^b, the valve head 17 being closed on its seat 13^a. With the upward movement of the piston occurs the compression and as the piston reaches the limit of its upward stroke the spark occurs and the piston is driven downwardly. As it again rises and reaches the limit of its upward stroke the valve head 17 has been raised and the spent products of combustion have been swept out through the chamber 14 and outlet 15, and the valve head 17 again closed on its seat 13^a. Then with the next downward movement of the piston another charge of fuel is drawn in, then compressed and ignited in the manner as hereinbefore described. It will be seen that I accomplish precise and effective operation with but few parts and all are so combined and arranged that the general wear is evenly distributed and there is the minimum chance for derangement or undue stress. By the air damper 33 and adjusting screw 41, the regulation of the fuel feed according to the quality of the gas or gasolene, the condition of the atmosphere and performance desired of the engine may be easily effected. The maximum degree of speed at which it may be desired to operate the engine is predetermined by setting the adjusting wheel 62 whereby the tension of the spring 63 is increased or diminished. Thus adjusted, the stop bar 61, when the maximum degree of speed of the engine is reached, will be pressed inwardly so far that the offset 61^a will engage the stud 57^c and will hold the valve 17 open a length of time sufficient that the speed of the operation of the engine will be corrected. It will be observed that while this valve 17 is being so retained in extreme open position it will bear against the valve 26 and will thus hold the latter in closed position whereby the suction into the engine of more fuel is prevented. By this arrangement flooding is effectively prevented, and by the inhalation and exhalation of pure outside air while the

fuel inlet is so closed the temperature of the cylinder and the working parts is kept down. With the slackening of the speed to normal, and the release of the stud 57^c, the operation of the engine proceeds as above described. 70

I am aware that minor changes may be made in the general form and arrangement of the several parts and details of my invention without departing from the nature or spirit thereof, or sacrificing any of its advantages. 75

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 main shaft driven by said piston, a valve chest formed integrally with said cylinder, a feed inlet and an exhaust outlet communicating with a single chamber in said valve chest, a puppet valve to sustain the feed inlet normally closed, a port leading from the said chamber into the end of said cylinder, a valve in the exhaust outlet which has its stem to extend outside the valve chest and provided with a spring to sustain the said exhaust outlet normally closed, a fixed shaft supported between the said valve stem and the said main shaft, a gear wheel keyed to the main shaft, a gear wheel loosely disposed on said fixed shaft adapted to mesh with the first named gear wheel, a cam adapted to be driven by the gear wheel which is carried by the fixed shaft, a guide block, a plunger in said guide block that has its one end to engage said cam and the other end to engage the end of the said valve stem, a speed governor operated by the engine, connections between the said plunger and the governor whereby the former may be temporarily held out of engagement with said cam, and against movement, substantially as described. 80 85 90 95 100 105

2. In an internal combustion engine, the combination of a working cylinder having a reciprocatory piston therein, a main shaft driven by said piston, a valve chest formed integrally with said cylinder, a feed inlet and an exhaust outlet communicating with a single chamber in said valve chest, a puppet valve to sustain the feed inlet normally closed, a port leading from the said chamber into the end of said cylinder, a valve in the exhaust outlet which has its stem to extend outside the valve chest and provided with a spring to sustain the said exhaust outlet normally closed, a fixed shaft supported between the said valve stem and the said main shaft, a gear wheel keyed to the main shaft, a gear wheel loosely disposed on said fixed shaft adapted to mesh with the first named gear wheel, a cam adapted to be driven by the gear wheel which is carried by the fixed shaft, a guide block, a plunger in 110 115 120 125 130

said guide block that has its one end to engage said cam and the other end to engage the end of the said valve stem, there being a stud carried by said plunger, a grooved collar slidingly disposed on the said fixed shaft, a lock bar pivotally supported adjacent the said plunger, its one end adapted to loosely engage said collar, and the other end having an offset therein to engage said stud, a spring to normally press the lock bar out of engagement with said stud, centrifugal weights pivotally supported on said gear wheel carried by the fixed shaft, the arms of which weights loosely engage said grooved collar, an arm supported on the said fixed shaft and having an electric terminal

thereon, a similar terminal carried by said gear wheel adapted to contact with said first named terminal with each revolution of said gear wheel, a sector plate supported on the engine frame, a regulator lever arranged to be set at different positions thereon, a member to connect said regulator lever to said arm, substantially as described. 20

In testimony whereof I sign my name to this specification in the presence of two subscribing witnesses. 25

ROBERT M. ROOF.

Witnesses:

FRANK E. HILL,
THOMAS L. RYAN.

It is hereby certified that in Letters Patent No. 956,423, granted April 26, 1910, upon the application of Robert M. Roof, of Muncie, Indiana, for an improvement in "Internal-Combustion Engines," an error appears requiring correction as follows: In the grant and in the heading to the printed specification it is stated that said Roof assigned one-third of his interest in said invention to Frank E. Hill, whereas it should have been stated that he assigned *one-half* to the said Frank E. Hill; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 14th day of June, A. D., 1910.

[SEAL.]

C. C. BILLINGS,
Acting Commissioner of Patents.