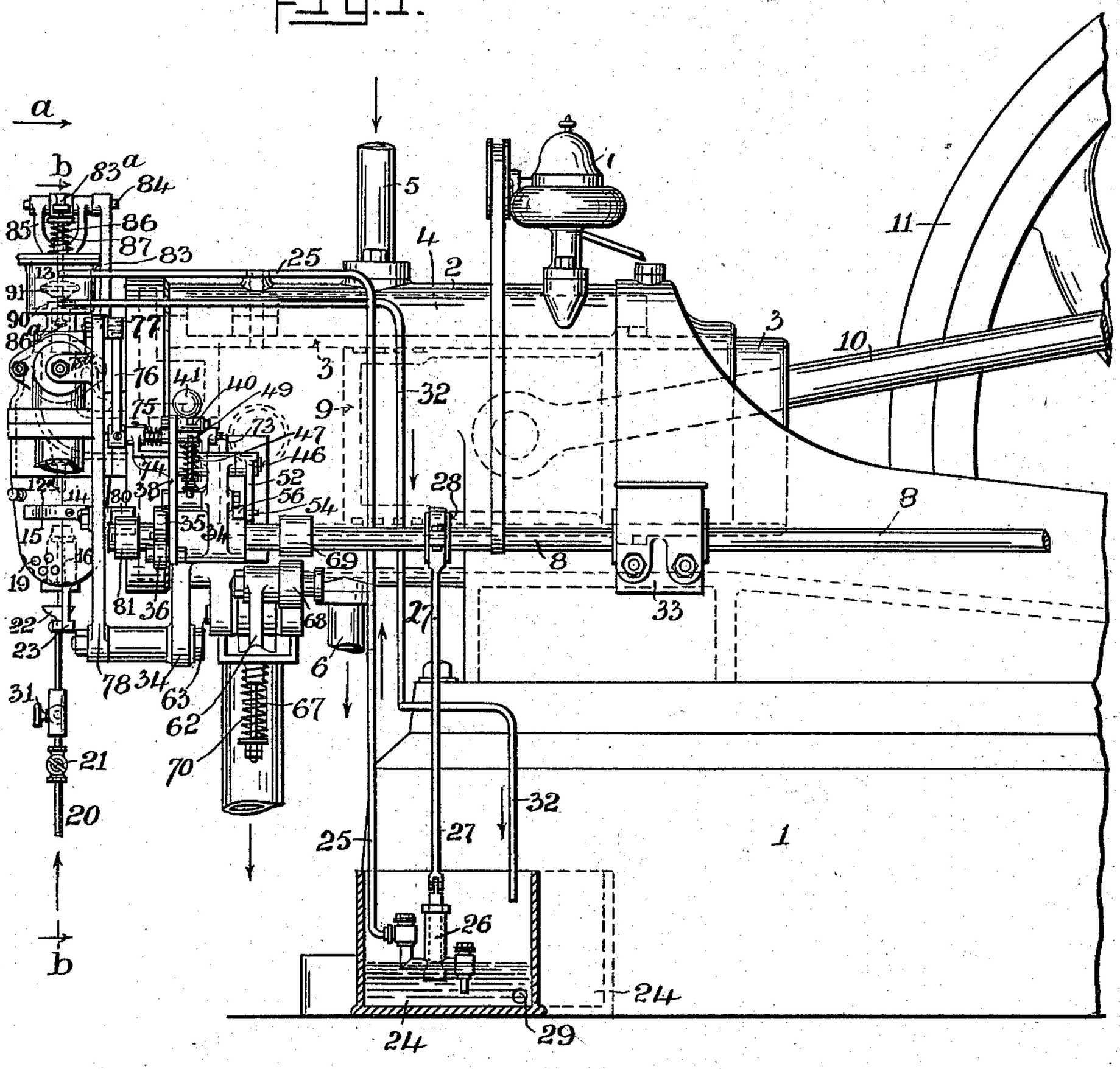
(No Model.) 4 Sheets—Sheet 1.

J. S., R. D., W. D. & H. C. CUNDALL.

OIL AND GAS MOTOR ENGINE.

No. 568,017. Patented Sept. 22, 1896.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

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OIL AND GAS MOTOR ENGINE.

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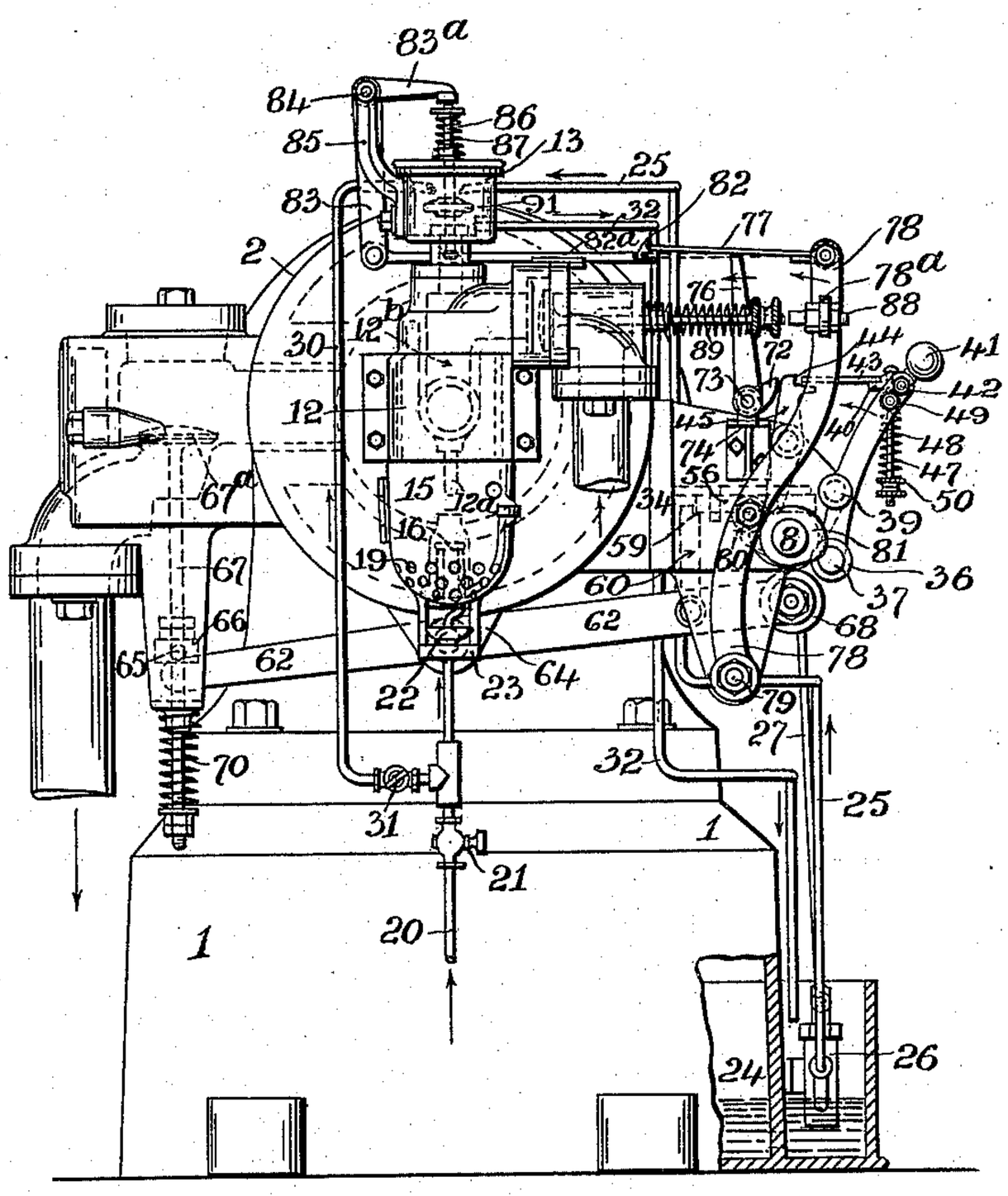
Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

J. S., R. D., W. D. & H. C. CUNDALL.

OIL AND GAS MOTOR ENGINE.

No. 568,017. Patented Sept. 22, 1896.

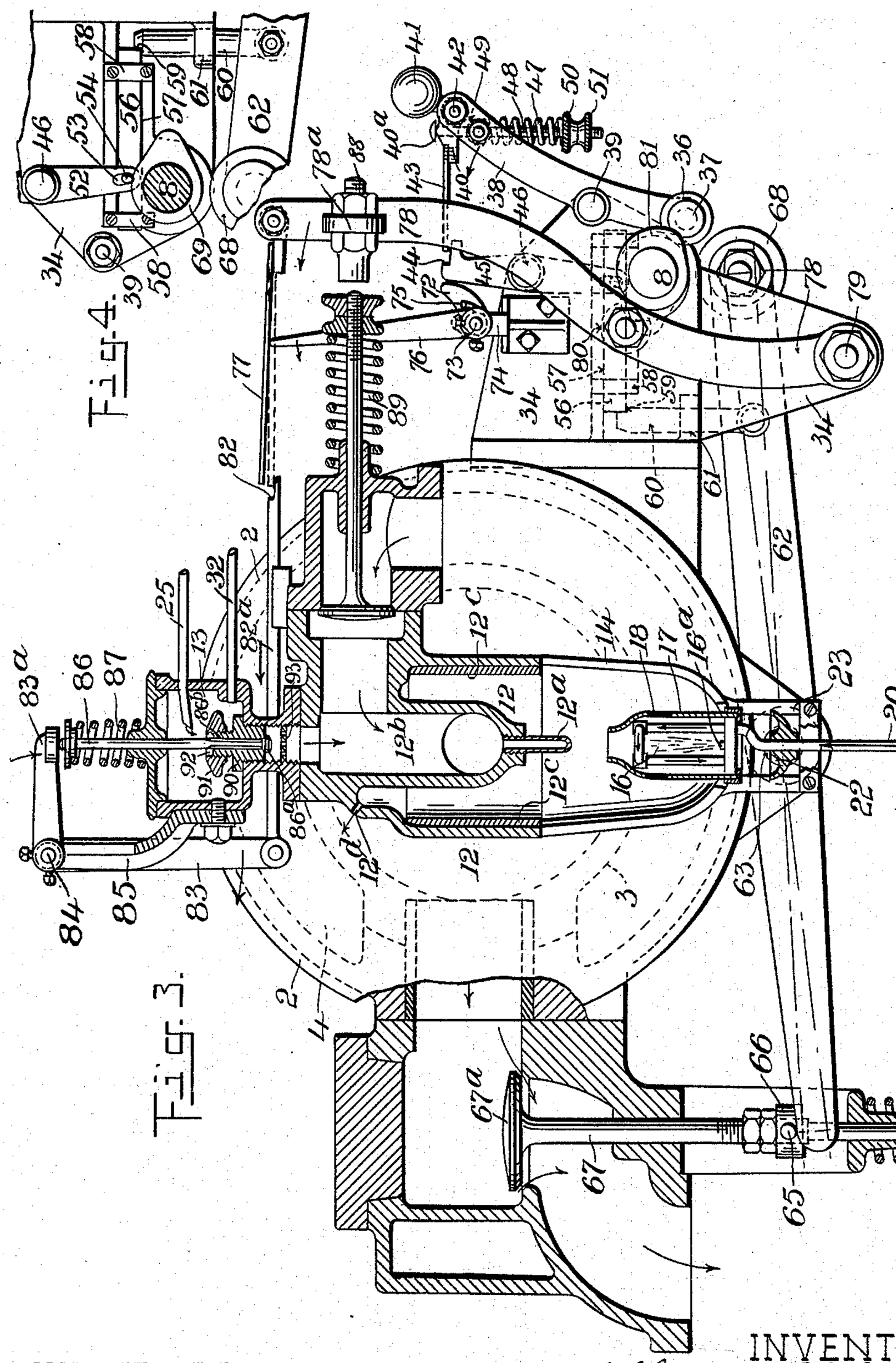

Fig. 4.

Fig. 3.

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(No Model.) 4 Sheets—Sheet 4.

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OIL AND GAS MOTOR ENGINE.

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Fig. 5.

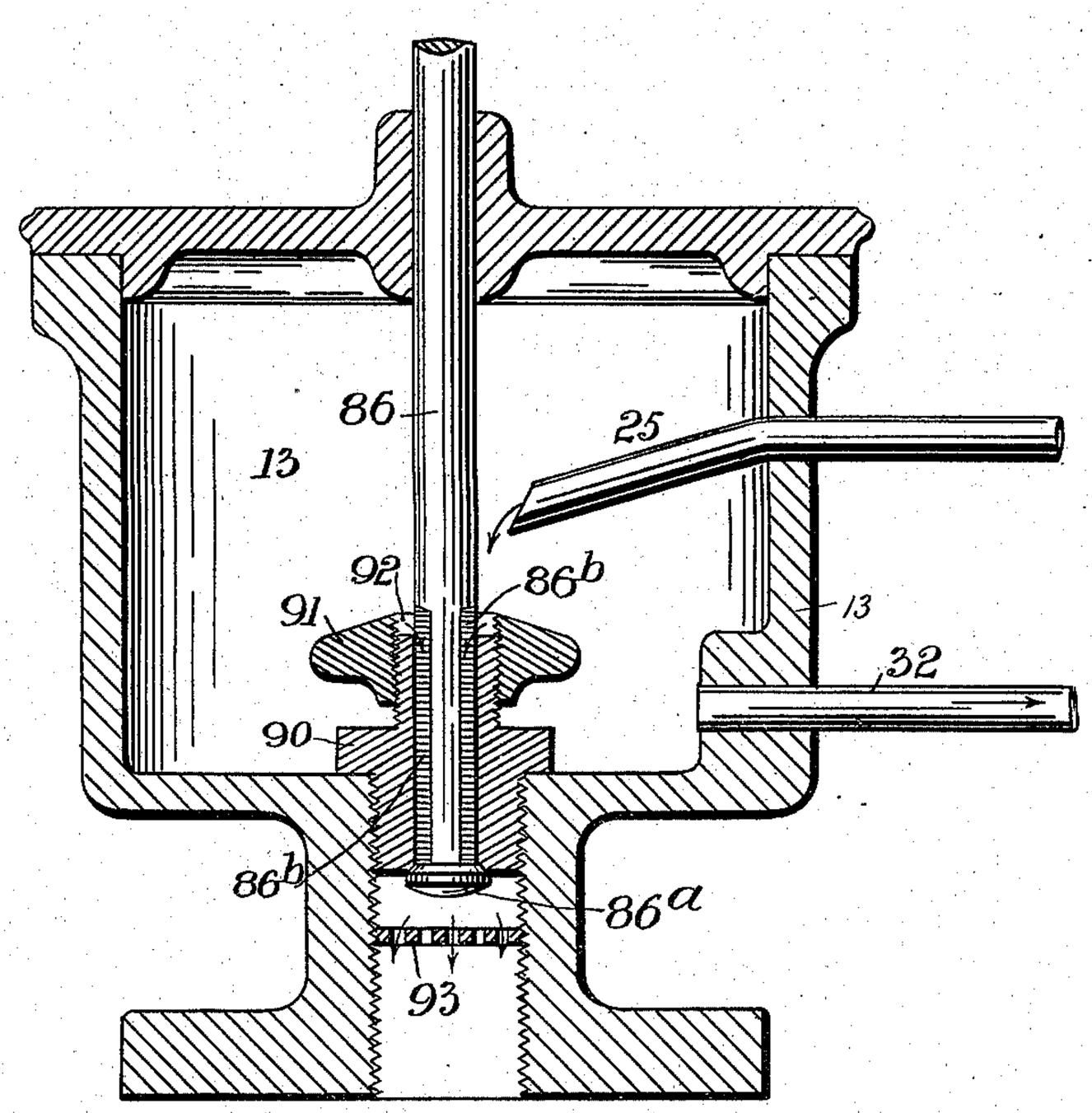
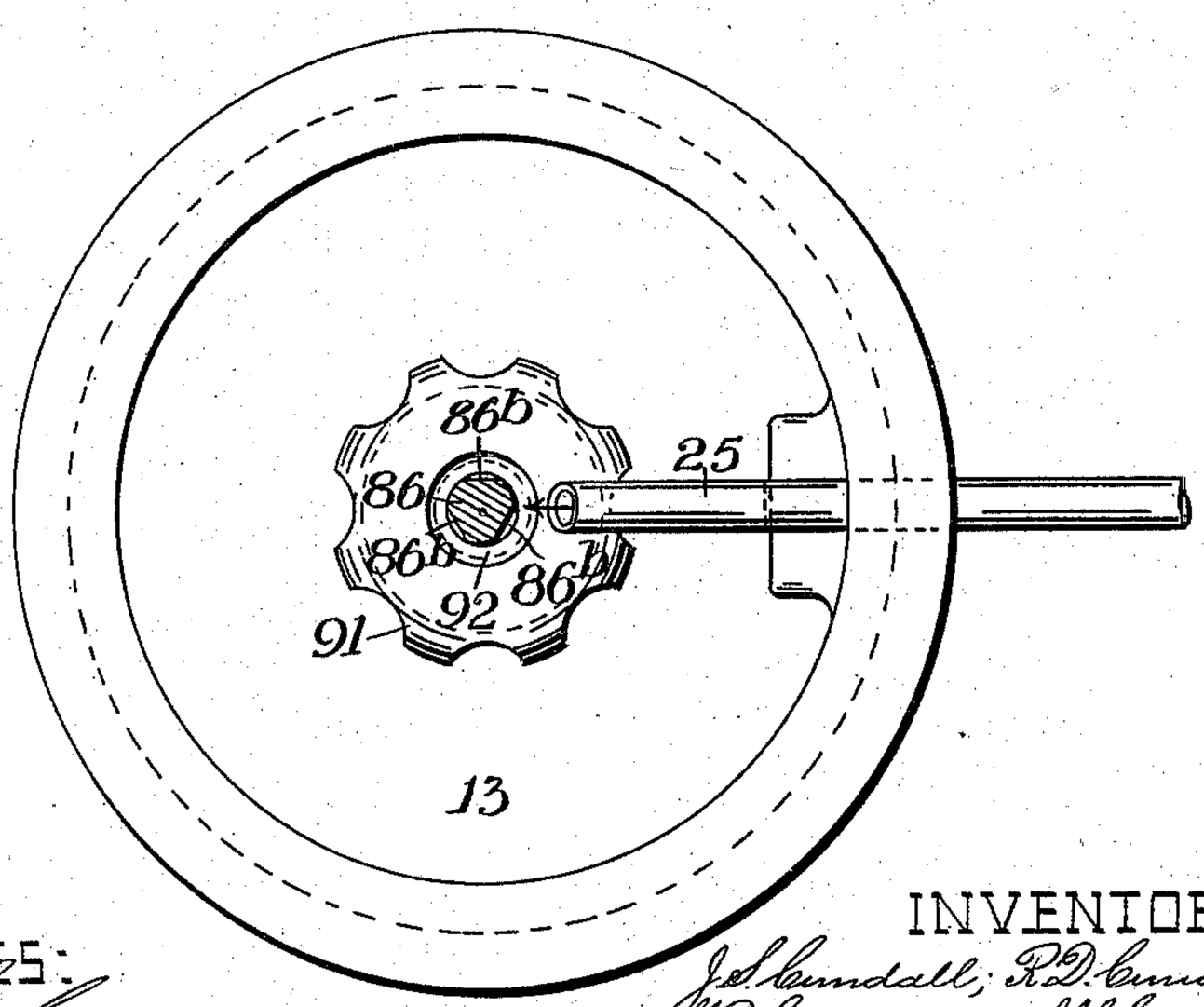


Fig. 6.



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UNITED STATES PATENT OFFICE.

JOHN SAMUEL CUNDALL, ROBERT DINSDALE CUNDALL, WILLIAM DENTON CUNDALL, AND HENRY CORDINGLEY CUNDALL, OF SHIPLEY, ENGLAND.

OIL AND GAS MOTOR ENGINE.

SPECIFICATION forming part of Letters Patent No. 568,017, dated September 22, 1896.

Application filed April 25, 1896. Serial No. 589,120. (No model.)

To all whom it may concern:

Be it known that we, JOHN SAMUEL CUNDALL, ROBERT DINSDALE CUNDALL, WILLIAM DENTON CUNDALL, and HENRY CORDINGLEY CUNDALL, citizens of Great Britain, residing at Shipley, in the county of York, England, have invented certain new and useful Improvements in Oil and Gas Motor Engines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to mechanism for governing oil and gas engines of the four-cycle type and for regulating and supplying given quantities of oil as the load demands it.

The objects of our improvements are, first, to provide efficient and neat mechanism acting in conjunction with the inertia or high-speed governor for holding the exhaust-valve open at all times when the load on the engine does not demand the admission of combustible mixture, and thus prevent the useless waste of power heretofore expended in overcoming unnecessary compression at each stroke; second, to open the oil or gas inlet valve and also the air-inlet valve positively instead of by vacuum or suction created by the outward stroke of the piston, and, third, to provide the oil-inlet with a regulating and adjustable device by which the quantity of oil to be admitted or drawn into the vaporizer at each charge may be regulated or varied to suit differences in load, quality of oil employed, or atmospheric conditions under which more or less oil is necessary at one time than at another, any such given quantity of oil being then supplied permanently to charge the vaporizer.

To the aforesaid purpose our invention consists of the novel and peculiar arrangement and construction and the various combinations of parts referred to, all as hereinafter fully described.

In the accompanying drawings, illustrating our invention, Figure 1 is a longitudinal elevation of an oil or gas engine, showing the application of our improvements thereto. Fig. 2 is an end elevation of same, looking in the direction of arrow *a*. Fig. 3 is an enlarged transverse section taken on line *b b* of Fig. 1, the exhaust-valve chamber, which lies beyond the vertical plane named, being also shown in section 3. Fig. 4 is a detail showing the reverse side of some of the parts shown in Fig. 3. Fig. 5 is a vertical section of the oil-cup, inlet-valve, and oil-regulator; and Fig. 6 is a plan of same, the lid or cover being removed to show the interior.

Like numerals refer to corresponding parts throughout the several views.

Referring to the drawings, 1 is the bed-plate or foundation of the engine, to which is bolted the cylinder 2, fitted with the liner 3 and provided with a surrounding water-space 4, communicating with the water-circulating pipes 5 6.

7 is the cylinder-lubricator, driven by a strap from the side or cam shaft 8.

9 is the piston; 10, the connecting-rod, attached at one end to said piston and at the opposite end to the crank (not shown) on the driving-shaft of the engine, and 11 is the fly or driving wheel keyed on the driving-shaft.

To the rear end of the cylinder is bolted the vaporizer 12, having attached to its upper end the oil-cup 13, and to the end one half 14 of the burner-chamber, the other half 15 of said chamber being hinged to the part 14, so that it can be opened out to give access to the lamp-burner 16.

The burner is surrounded by a sleeve or envelop 17, (see Fig. 2,) pierced with holes 18 to admit air to the burner to aid combustion, holes 19 being likewise formed in the hinged part 15 of the burner-chamber to admit air thereto. Oil for heating the vaporizer is supplied from an overhead tank or vessel (not shown) through pipe 20 and is admitted through valve 21 to the burner or lamp 16, around which it circulates, as indicated by the arrows, to raise the temperature thereof sufficiently to allow it to ignite on issuing from the jet 16^a.

The burner is first warmed by burning spirits or suitable combustible material placed in the disk 22, which, together with the burner and chimney, are carried by the bracket 23, formed integral with the fixed part 14 of the burner-chamber. The vaporizer is provided with the ordinary ignition-

tube 12ª. The oil for charging the vaporizer is forced from the storage-tank 24, through pipe 25, to the oil-cup 13 by a pump 26, actuated by rod and strap 27 from an eccentric 28, fast on the side or cam shaft 8. The pump is inclosed in a box or casing cast on the side of the bed-plate or foundation 1, and forms part of the storage-tank 24, with which it communicates through the opening 29. The charges of oil necessary to start the engine may be supplied to the oil-cup 13, through a supplementary pipe 30, from the overhead tank which feeds the burner, the tap 31 being opened for this purpose and closed again to shut off the supply as soon as the engine is started. The excess oil in the oil-cup 13 flows out through pipe 32, which empties into the pump-box, as indicated.

On the side or cam shaft 8, which is journaled in bearings in the brackets 33 34 and driven in the ordinary manner by skew, bevel, or worm gear from the crank-shaft, is keyed the cam 35, adapted to engage the bowl or pulley 36, carried on the stud 37 at the lower end of the regulator bar or lever 38, pivoted on the stud 39, secured to the bracket 34, and at every revolution to cause the said lever to move through a small angle toward the vertical or in the direction indicated by the arrow in Fig. 3. A pendulum 40, weighted at 41, is hung on a pin or stud 42, secured to the end of the lever 38, and has attached thereto a finger 43, which is adapted under normal conditions at every forward movement of the lever 38 to engage with the shoulder 44 on the upper end of the lever-arm 45 and force said lever-arm over in the same direction, whereby the short shaft 46 on which said arm is fast is partially rotated in its bearings in the bracket 34. The pendulous governor is held in position normally by a spiral spring 47, surrounding a spindle 48 and confined between the fixed stud 49 on the lever 38 and the adjusting-nut 50, said spindle being passed through the pendulum 40 and stud 49 and the head thereof resting or pivoting on the knife or tapered edge 40ª of the pendulum. which allows for the angular movement of the latter. By adjusting the nut 50 up or down the spindle 48 the engine is caused to run permanently at higher or slower rates of speed, because the altered tension of the spring 47 will require a greater or less vigorous movement of the lever 38 to move the pendulum on its center and throw the finger 43 upward clear of the shoulder 44 on the lever-arm 45. After adjustment of the nut 50 its position is made secure by lock-nut 51.

So far the parts described are those ordinarily found in oil-engines of the four-cycle type, as will be obvious to those skilled in the art.

On the short shaft 46, which is journaled in bearings in the bracket 34, is secured by set-screw a depending lever-arm 52, provided at its lower end with a slot 53, (see Fig. 4,) into which enters and engages with its sides a stud or roll 54, projecting from the side of a bar or bolt 56, capable of being slid endwise in the recess or way 57, formed on the side of the bracket 34, in which it is held by metal straps or caps 58.

When the lever-arms 45 and 52 are at rest, the sliding bolt 56 is in the position shown in Figs. 2, 3, and 4, the end thereof projecting beyond the groove or way 57 and engaging with a shoulder 59 on the upper end of the finger 60, which is supported in the bearing 61, integral with the bracket 34 and attached at its lower end to the exhaust-valve lever 62. These parts are shown clearly in full line in Fig. 4, which shows the reverse side of the bracket 34 to that shown in Fig. 3. The said lever is pivoted on a stud 63, secured in a bracket 64 under the cylinder 2, and engages at one end with studs or rolls 65, projecting from the collar 66, secured on the exhaust-valve spindle 67, and carries at its opposite end a bowl or pulley 68, which is engaged by the cam 69, fast on the cam-shaft 8, at every revolution of said shaft, for the purpose of opening the exhaust-valve 67ª to its full extent to allow for the discharge of the resultants of the exploded mixture.

The speed of the engine being controlled by the adjustment of the tension of the spring 47 by the nut 50 it follows that whenever that rate tends to get beyond the limit assigned the pendulum or pendulous governor 40 will lag behind the motion of the lever 38 in consequence of its inertia, and the finger 43 will therefore move over and clear of the shoulder 44, thereby failing to actuate the lever-arms 45 and 52 and sliding bar 56, so that on the exhaust-lever being returned by the confined spring 70 after opening the exhaust-valve the shoulder 59 on the finger 60 abuts against the end of the sliding bolt and prevents further movement of said lever, with the result that the exhaust-valve is left a little open, as shown, this avoiding the creation of vacuum in the cylinder on the next outward movement of the piston and consequently preventing the indrawing of a charge of oil or gas, whereby there will be no compression and no explosion until the engine has gone back to the normal speed. On the load requiring a further charge or charges of combustible mixture to maintain the velocity of the engine, the slower rotation of the cam-shaft 8 reduces the oscillation of the lever 38, and the finger 43 failing to rise engages with the shoulder 44 on the lever-arm 45 and forces the latter in the direction of the arrow, Fig. 3, thus rocking the shaft 46 and moving the lever-arm 52 in a contrary direction, which causes the sliding bolt 56 to be drawn out of the path of the finger 60 and allows the exhaust-lever, when released by the cam 69, to be returned to its full extent by the spring 38 and to close the exhaust-valve tightly against its seating.

Heretofore the charge of oil has been drawn past the inlet-valve into the inner chamber

12[b] of the vaporizer by the vacuum or suction created by the outward stroke of the piston alone, and as the stroke of said piston is variable the same quantity of oil is not always drawn past the automatic inlet-valve. We desire to open said valve positively by mechanism controlled by the governor or regulator mechanism above described, and for this purpose we secure a curved lever or cam 72 on a short shaft 73, journaled in bearings in the bracket 74 bolted, to the bracket 34, said cam or lever being held in engagement with the lever-arm 45 by a coiled spring 75, surrounding the shaft 73 and secured at one end to the bracket 74 and at the opposite end to the cam or lever 72, said spring serving also to reinstate the lever-arms 45 and 52 in the positions shown after each actuation of same by the governor. Secured on the opposite end of the short shaft 73 is a holding-lever 76, normally engaging with a finger 77, hinged to the upper end of the lever 78, pivoted on a stud 79, secured in the bracket 34 and provided with a friction-bowl or pulley 80, which is engaged at every revolution of the shaft 8 by a cam 81, which imparts an oscillatory motion to said lever.

When the parts are in the positions shown, the finger 77 is held by the lever 76 clear of the shoulder 82 on the end of the rod 82[a], which is connected at its opposite end to a lever-arm 83, fast on a short shaft 84, journaled in bearings in the bracket 85, bolted to one side of the oil-cup 13, on which said shaft is also fast a second lever-arm 83[a], engaging at its free end with the oil-inlet valve-spindle 86, and so long as the engine requires no charge of oil the parts remain in the said positions and inoperative; but when the lever-arm 45 is moved over in the direction of the arrow by the finger 43 engaging the shoulder 44 the motion is imparted to the cam or curved lever 72, and through shaft 73 communicated to the lever 76, which, moving in the direction of the arrow, Fig. 3, allows the finger 77 to fall onto the end of the rod 82[a], so that on the forward movement of the lever 78 it will engage with the shoulder 82 and push the rod 82[a] endwise, as indicated, thereby oscillating the lever-arms 83 83[a], the latter of which forces down the oil-valve spindle 86 against the resistance of the coiled spring 87 and opens the valve 86[a], past which the charge of oil is then drawn into the chamber 12[b] of the vaporizer by the outward stroke of the piston.

The parts are returned to their normal positions by the energy of the springs, as will be understood.

An adjustable screw 88, secured in the lug 78[a], projecting from the side of the lever 78, engages at each forward movement of the said lever with the end of the spindle of the air-inlet valve 89 to open same for the admission of a charge of air to the vaporizer. The vaporizer is dome-shaped at the upper end to present a larger area of heating-surface and it is provided to near the top thereof with an asbestos lining 12[c].

Openings 12[d] are made through the upper end of the vaporizer for the escape of the heated gases arising from the lamp or burner 16. For regulating the oil supply we preferably screw into the bottom thereof a bush 90, forming a bearing for the oil-inlet-valve spindle. Onto the upper end of said bush we screw a disk or nut 91, whose position thereon is adjustable and together with the upper end of said bush forms a cup or thimble 92, which is deepened or made shallower by screwing the nut 91 up or down, and therefore gives a greater or smaller holding capacity for the oil which is discharged from the end of the pipe 25 into said cup or thimble, the excess flowing over the nut 91 into the bottom of the cup 13. When adjusted to suit requirements, the same given quantity of oil is permanently drawn into the vaporizer each time the load of the engine requires it, and therefore more regular and uniform work is obtained. The valve-spindle 86 is made with three flat sides 86[b], as shown clearly in plan view, Fig. 6, to afford sufficient space between the said spindle and the bush or bearing 90 for the passage of the oil from the cup or thimble 92 to the valve 86[a]. Under the said valve and screwed into the neck of the cup 13 is a perforated disk 93, which breaks up the oil admitted through the valve into fine particles, which are more rapidly acted upon by the heat of the vaporizer. This perforated disk or spray is intended more particularly for engines of about six-horse power and upward, the smaller engines not needing it.

It will be understood that the intermediate connections for actuating the rock-shaft 84 to open the oil-inlet valve when the rate of the engine requires an explosion or explosions to increase or maintain its velocity, and which remain inoperative when no explosion is demanded, may be varied somewhat from what is shown and described, and that instead of the operation or inoperation of the said rock-shaft being determined by the engagement or non-engagement of the regulator-finger 43 with the shoulder 44 on lever-arm 45 the movement of the exhaust-lever may be utilized to raise and lower the finger 77, which would be secured to the lower end of the lever 78 instead of to the top thereof, and cause said finger to engage with or pass clear of a projection on the end of a lengthened lever-arm 83.

We claim as our invention—

1. In an oil or gas engine, the combination with a pendulous governor or regulator, of a lever-arm secured on a rock-shaft and provided with a shoulder adapted to be engaged by a finger controlled by the governor, a depending slotted lever-arm secured on said rock-shaft, a sliding bolt or bar adapted to be slid endwise in a way or groove, a pin or roll integral with or secured to the side of

said sliding bar which takes into and engages with the sides of the slot in the said depending lever-arm, a finger attached to the exhaust-lever, a bearing in which said lever is supported, a shoulder on said finger adapted to be engaged by the end of the sliding bolt, the exhaust-lever actuated in one direction by a cam on the cam-shaft to open the exhaust-valve and in the opposite direction to close said valve by a confined spring and the said exhaust-valve all substantially as described.

2. In an oil or gas engine, the combination, with a regulator-lever actuated by a cam on the cam or side shaft, a weighted pendulum hung on a stud on said lever, a confined spring for giving the required resistance to the inertia of the pendulum, an adjusting-nut for varying the rates of speed of the engine by altering the tension of the confined spring, a finger attached to the pendulum or weighted pendulous lever adapted to engage with a shoulder on the end of a lever-arm when the pendulum fails to move on its center, and to be raised clear of said shoulder when the inertia of the pendulum causes it to lag behind the motion of the regulator-lever, and a lever-arm fast on a rock-shaft, of a depending slotted lever-arm fast on said rock-shaft, a sliding bolt or bar provided with a stud or roll which enters and engages with the sides of the slot in the lever-arm and is moved endwise in the way or recess in the supporting-bracket by said lever-arm when the rock-shaft is turned partially around, and a finger attached to the exhaust-lever arm provided at its end with a shoulder which is engaged by the sliding bolt or bar when the latter is not actuated by the intermediate mechanism from the governor and prevents the complete movement of the exhaust-lever in one direction thereby holding the exhaust-valve open and avoiding the indrawing of a charge of oil and of unnecessary compression and explosion substantially as set forth.

3. In an oil-engine, the combination with a governor or regulator of the pendulous or inertia type, a finger 43 secured thereto, and a lever-arm 45 secured on a rock-shaft 46 journaled in bearings in the bracket 34, and provided with a shoulder 44 adapted to be engaged when the rate of the engine determines, by the finger 43, of a curved lever or cam engaging with said lever-arm, a short shaft on which said curved lever or cam is fast and on which is also fast a holding-lever adapted to engage a finger hinged to a lever pivoted on a stud secured to the bracket 34, the said lever, a cam fast on the cam-shaft 8 for actuating the lever, the said hinged finger normally engaged by the holding-lever to hold it clear of a shoulder on the end of a rod, the said rod provided with a shoulder at one end adapted to be engaged by the finger when the holding-lever is oscillated and attached at the opposite end to a lever-arm fast on a short shaft journaled in bearings in a bracket bolted to the oil-cup, a depression-lever arm also fast on said shaft and adapted, when actuated, to press or force down the spindle of the oil-inlet valve against the resistance of a confined spring on said spindle and to open said valve substantially as set forth.

4. In an oil-engine, the combination with a regulator or governor of the pendulous or inertia type, a finger 43 secured thereto, a lever-arm 45 provided with shoulder 44, a rock-shaft 46, slotted lever-arm 52, sliding bolt 56, pin or roll 54 integral with said sliding bolt and entering and engaging with the sides of the slot 53 in lever-arm 52, a groove or recess 57 formed in the bracket 34 to receive the sliding bolt 56, a finger 60 attached to the lever for actuating the exhaust-valve, a bearing 61 to support the finger a shoulder 59 on the upper end of said finger which, when engaged by the sliding bolt holds the exhaust-valve a little open to prevent a vacuum or suction in the cylinder on the outward stroke of the piston and avoid the indrawing of a charge of oil, of a curved lever or cam 72 fast on a short rock-shaft 73 and engaging with the lever-arm 45, a coiled spring surrounding said shaft and attached at one end to the curved lever or cam and at the opposite end to the bracket 74 to reinstate the parts, a holding-lever 76 normally engaging with the under side of a finger 77 hinged to a lever 78, said finger 77 and lever 78, a cam 81 fast on cam-shaft 8 for giving an oscillatory motion to said lever, an adjustable stop secured to a lug on the lever 78 and adapted to engage with the spindle of the air-inlet valve and open same at every revolution of the cam-shaft, a rod 82^a provided with a shoulder 82 and connected with lever-arm 83 fast on a shaft 84 and the lever-arms 83, 83^a, the latter engaging the spindle of the oil-inlet valve and adapted when moved or turned about the center by the endwise thrust of the rod 82^a on the engagement of the finger 77 with the shoulder 82 which is brought about through the movement of the intermediate mechanism by the finger 43 striking the shoulder 44 on lever-arm 45, to depress the said valve-spindle and open the oil-inlet valve positively so that a charge of oil can be drawn into the cylinder substantially as described.

5. In an oil-engine, the combination, with an oil-cup and an oil-inlet valve, of a bush screwed into or made integral with the oil-cup and provided with an external screw-thread and a nut or tapped disk adapted to be screwed onto the bush and to form with the upper face of said bush a cup or thimble to receive a given charge of oil for supplying the vaporizer and to adjust or regulate the amount of oil to constitute the charge substantially as set forth.

6. In an oil-engine, the combination of the oil-cup 13, bush 90 forming a bearing for the spindle 86 of the oil-inlet valve, the said valve-spindle provided with flat sides 83^b forming passages for the oil, the valve 86^a adapted to

be closed by confined spring against its seating formed on the under side of the bush 90, an adjusting nut or disk 91 adapted to be screwed onto the bush 90 the upper end of which forms the bottom, and the internal walls of the said nut the sides, of a thimble or cup whose capacity is varied to hold more or less oil by adjustment of the nut 91, the said cup 92 and a perforated plate 93 screwed into the neck of the cup 13 for dividing the oil into finer particles prior to entering the vaporizer, substantially as described.

7. In an oil-engine, the combination of the oil-cup 13, bush 90 adjusting nut or disk 91 for regulating the supply of oil to the cylinder, the charge cup or thimble 92 whose capacity can be increased or decreased by the nut or disk 91, a pump 26 for supplying oil to the cup or thimble 92, the oil-inlet valve 86^a, a depression-lever 83^a mechanism intermediate of said lever and the lever-arm 45 and finger 43 for opening said valve positively as the engine demands it, a pendulous governor actuated from the cam-shaft 8 and a slotted lever-arm 52, sliding locking-bolt 56 engaged thereby and vertical fingers 60 attached to the lever for opening and closing the exhaust-valve for holding the said exhaust-valve a little open when the load does not require the indrawing of a charge of oil substantially as described.

8. In an oil or gas engine, the combination, with a revoluble cam, an oscillatory lever operated by the said cam, and a speed-governor carried by the said lever and provided with a finger 43; of a pivoted lever operated at intervals by the said finger, a slidable bolt operatively connected to the lower end of the said pivoted lever, and a finger attached to the exhaust-valve lever, engaging with the said bolt and thereby preventing the complete closure of the exhaust-valve until the said bolt is retracted by the operation of the said finger 43, substantially as set forth.

9. In an oil or gas engine, the combination, with an exhaust-valve lever, a horizontally-slidable bolt, and a finger attached to the said lever and engaging with the said bolt, thereby preventing the complete closure of the exhaust-valve; of a speed-governor, and intermediate lever mechanism operatively connecting it with the said bolt, whereby the said bolt is retracted, and the exhaust-valve is permitted to close, when the motion of the speed-governor is reduced to a prearranged limit, substantially as set forth.

10. In an oil or gas engine, the combination, with an oscillatory operating-lever provided with a finger 77, and a holding-lever 76 normally supporting the said finger; of a rod normally out of line with the said finger, a fuel-supply valve, intermediate lever mechanism operatively connecting the said supply-valve with the said rod, a speed-governor, and trip mechanism operatively connecting the said governor with the said holding-lever and causing the holding-lever to permit the finger 77 to move into line with the said rod when the motion of the speed-governor is reduced to a prearranged limit, thereby permitting the said fuel-valve to be opened, substantially as set forth.

11. In an oil-engine, the combination, with an oil-supply valve provided with an upwardly-projecting stem, external longitudinal oil-grooves in the said stem and a seat for the said valve; of an annular oil-cup of prearranged capacity surrounding the said stem at the upper part of the valve-seat, means for varying the capacity of the said oil-cup, and means for filling the said oil-cup with oil, whereby a measured charge of oil is delivered to the engine when the oil-valve is opened, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

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ROBERT DINSDALE CUNDALL.
WILLIAM DENTON CUNDALL.
HENRY CORDINGLEY CUNDALL.

Witnesses:
ARTHUR W. CROSSLEY,
FRANK LEWIN.