No. 833,889. PATENTED OCT. 23, 1906.

J. F. McCANNA.

LOCOMOTIVE LUBRICATOR.

APPLICATION FILED JULY 25, 1904.

4 SHEETS—SHEET 1.

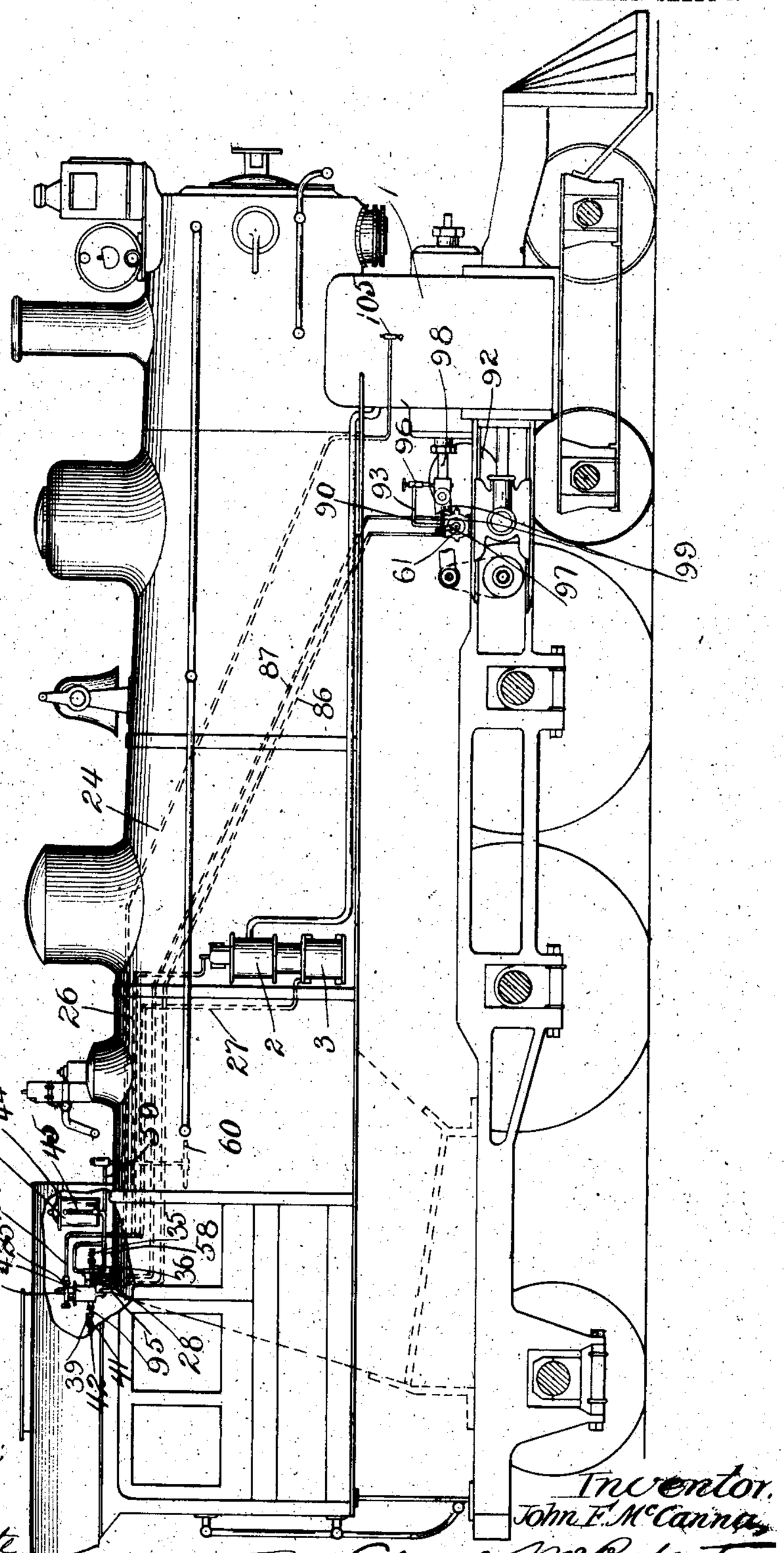

Fig. 1.

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4 SHEETS—SHEET 2.

Fig. 2

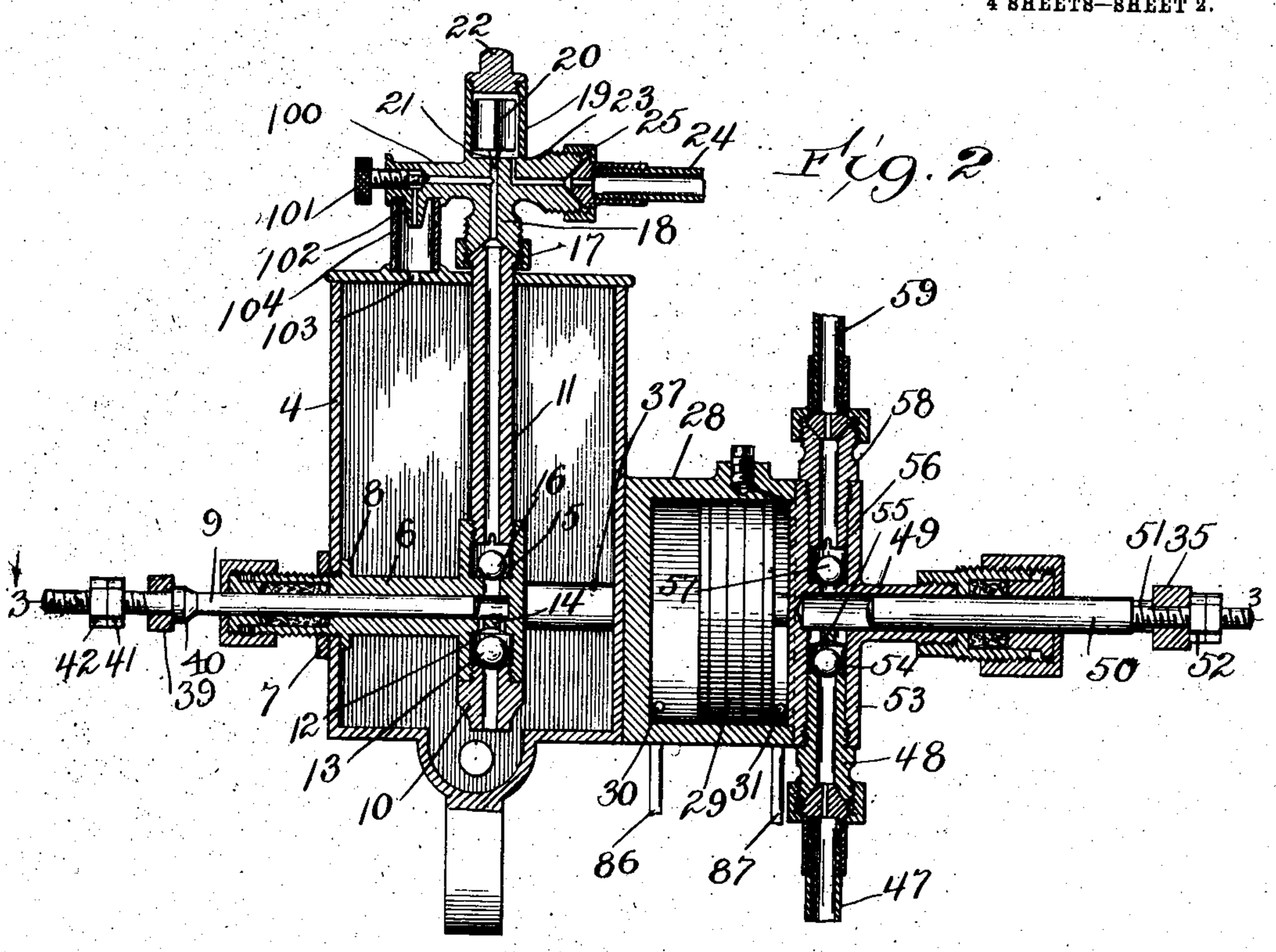
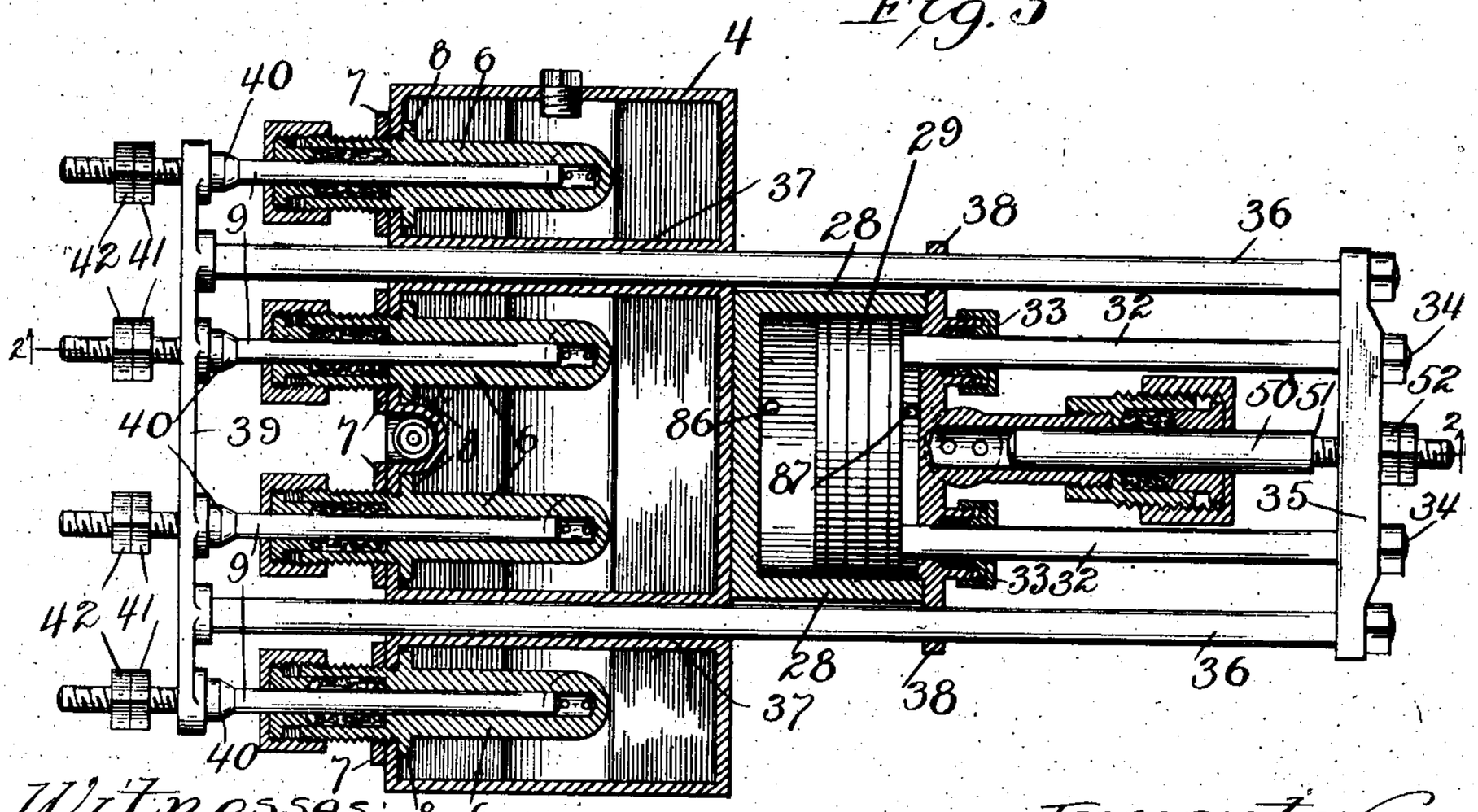


Fig. 3



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4 SHEETS—SHEET 3.

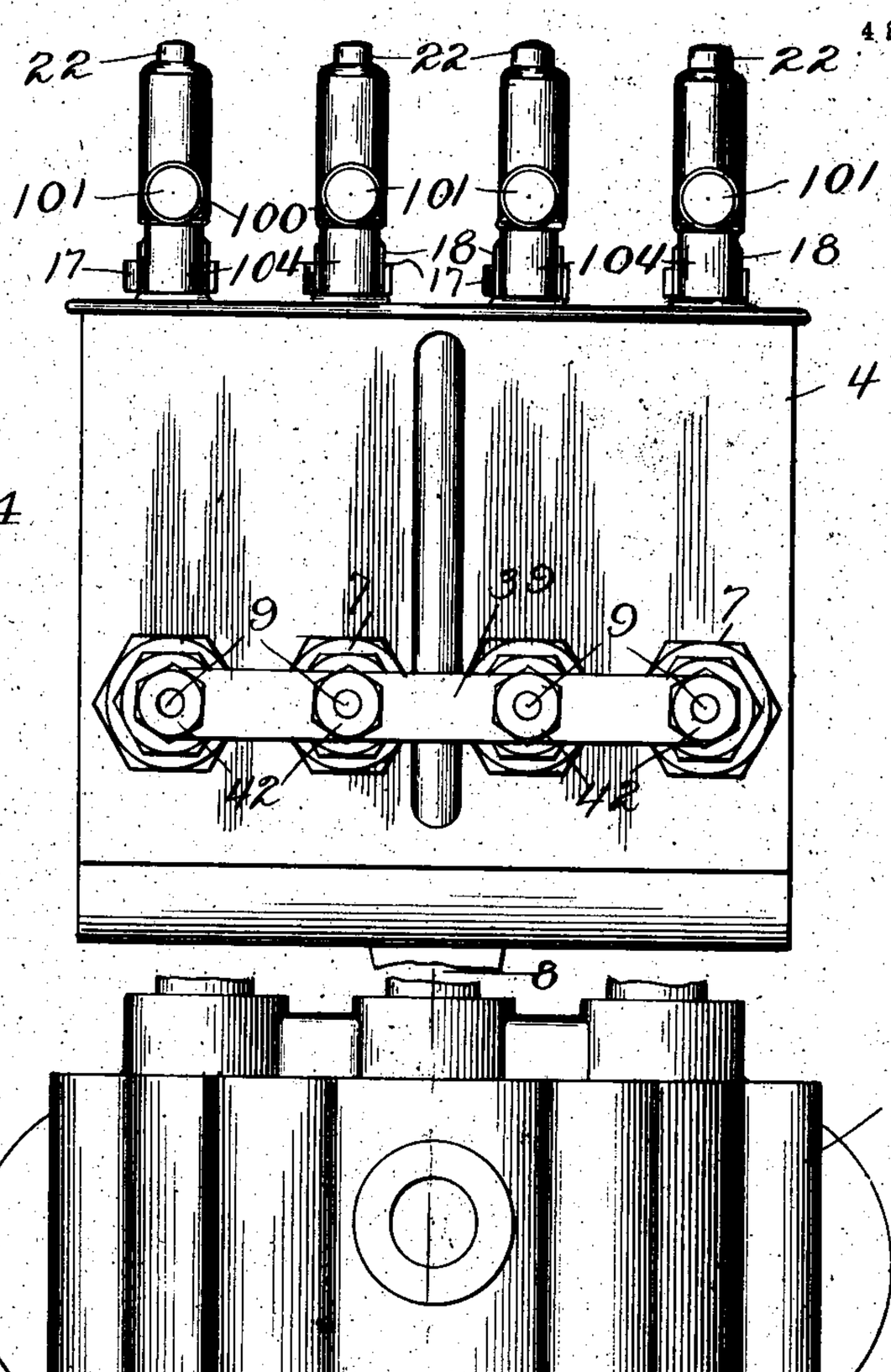

Fig. 4

Fig. 5

Fig. 6

Fig. 7

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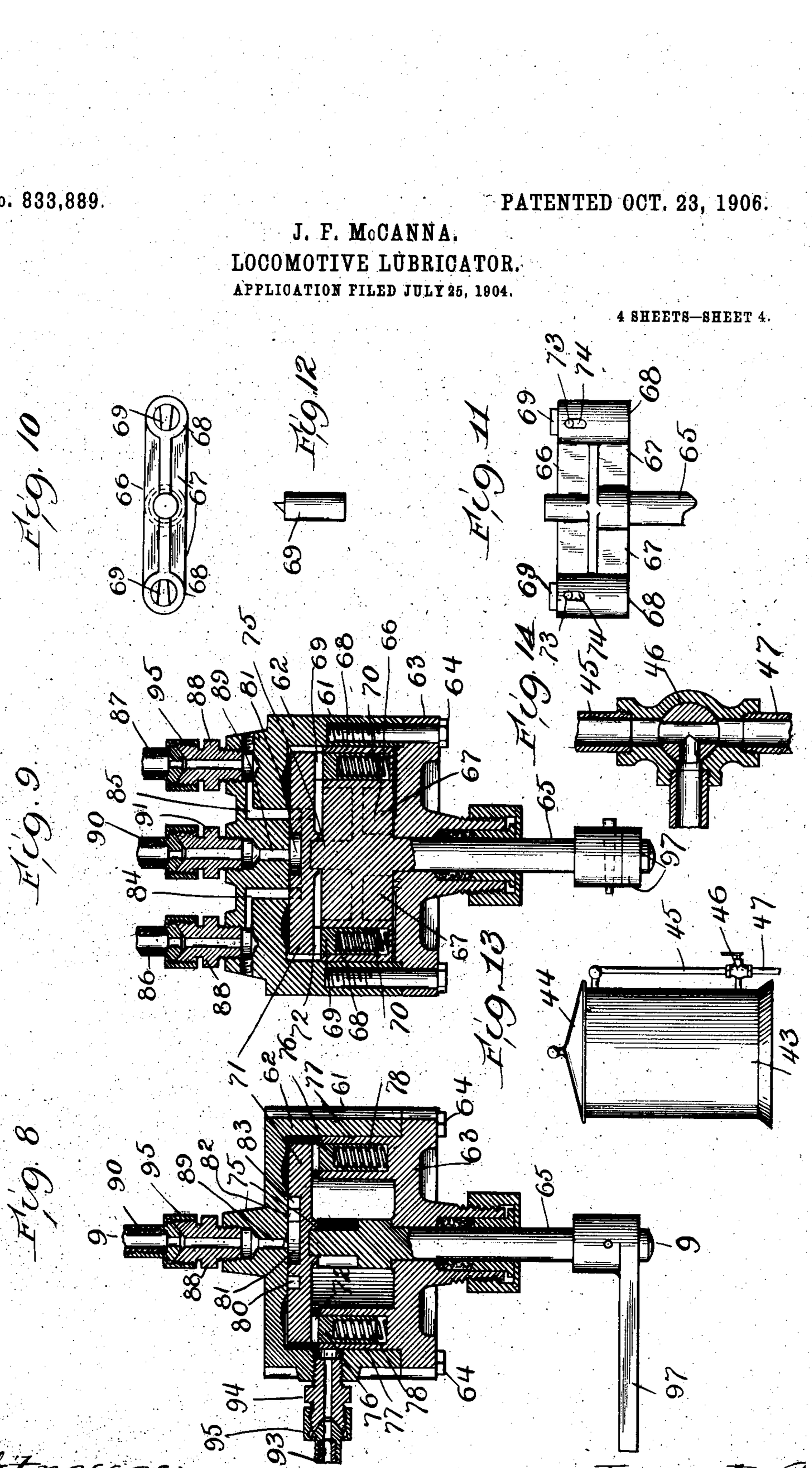
4 SHEETS—SHEET 4.



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UNITED STATES PATENT OFFICE.

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LOCOMOTIVE-LUBRICATOR.

No. 833,889. Specification of Letters Patent. Patented Oct. 23, 1906.

Application filed July 25, 1904. Serial No. 217,943.

To all whom it may concern:

Be it known that I, JOHN F. McCANNA, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Locomotive-Lubricating Apparatus and Compound-Feeders, of which the following is a specification.

This invention relates to a new and useful force-feed system of mechanism for lubricating the steam-cylinders and other parts of locomotive-engines and the like, wherein certain and accurate lubrication is of great importance in order to keep up the speed and efficiency of the engine and prevent undue wear of the parts.

The invention also has reference to certain new and useful improvements in boiler-compound feeders; and it consists in certain organizations and arrangements of parts whereby the mechanism which operates the pump or pumps of the lubricating apparatus may be employed for actuating the boiler-compound feeder.

The invention, furthermore, consists of certain combinations of instrumentalities and details of construction, as will be hereinafter fully described and which are designated in the appended claims.

Referring to the accompanying sheets of drawings, Figure 1 is a side elevation of a locomotive equipped with my lubricating system and boiler-compound feeder, a portion of the cab being broken away to disclose the arrangement of the parts. Fig. 2 is a vertical longitudinal section through the lubricant-reservoir, showing one of the oil-pumps, the pump for supplying boiler compound to the boiler, and the mechanism for reciprocating the pump-plungers. Fig. 3 is a horizontal section on the line 3 3 of Fig. 2 looking in the direction of the arrow. Fig. 4 is a front elevation of the lubricating apparatus as arranged for a series of four pumps. Fig. 5 is a top plan of the casing containing the valve for controlling the supply of fluid-pressure for the pump-actuating piston. Fig. 6 is an outer face view of the rotary valve, showing the ratchet-teeth with which the pawls engage to rotate the valve. Fig. 7 is a view of the opposite face of the valve and the arrangement of inlet and exhaust ports. Fig. 8 is a section on the line 8 8 of Fig. 5, illustrating the valve mechanism. Fig. 9 is a section on the line 9 9 of Fig. 8, illustrating the rotary valve and the pawl-carrier and pawls for rotating the valve. Fig. 10 is a detail end elevation, and Fig. 11 a detail plan view, of the pawl-carrier seen in Fig. 9 Fig. 12 is a detail of one of the pawls. Fig. 13 is a detail side elevation of the reservoir of the boiler-compound feeder, and Fig. 14 is a sectional view through a three-way cock and its gage-glass employed in connection with the reservoir containing the boiler-cleaning compound.

In illustrating my invention I have shown the system applied to the lubrication of the driving steam-cylinder 1, the air-pump steam-cylinder 2, and the air-pump 3 of a locomotive, as shown in Fig. 1, and it is to be understood that a connection is also provided for the opposite side of the locomotive for lubricating the cylinder at the other side corresponding with the steam-cylinder 1 and also that, if desired, connections may be made for lubricating other parts than those illustrated.

As the oil used for lubricating the several operative parts is of the same character, I preferably employ a single reservoir 4, which is mounted in any suitable and convenient position in the cab of the engine, as by screwing it to a bracket 5 on the rear end of the boiler, as shown in Fig. 1. This reservoir has associated therewith a plurality of pumps for forcing oil therefrom to the bearings, connection being made from each of such pumps to one of the bearings supplied with lubricant from the common reservoir. Each pump, as clearly shown in Figs. 2 and 3, comprises a horizontal barrel 6, extending into the reservoir 4 and the end of which projects through the wall of the reservoir and is held in position by a nut 7, screwing upon the projecting threaded end of the barrel 6 and clamping the wall of the reservoir between such nut and a collar 8 on the pump-barrel within the reservoir. A piston or plunger 9 reciprocates in each barrel 6 and is designed to be operated in the manner hereinafter described. Each pump is provided with an intake 10 and an outlet 11. In the construction illustrated the intake 10 consists of a short tube screwing into a threaded downwardly-extending socket 12, carried by

the barrel 6 at its inner end. A chamber is provided in the socket 12, in which is located a gravity-valve 13, normally resting upon a seat formed by the upper end of the tube 10, and this valve is prevented from being drawn into the pump-barrel upon the outstroke of the piston by a web 14, having apertures opening into the pump-barrel. The outlet 11 consists of a vertical tube screwing at its lower end into an internally-threaded socket 15, which provides a chamber for a valve 16, normally closing a reduced passage providing communication between the pump-barrel and the socket 15. The tube 11 passes through an opening in the top of the reservoir, and its upper end is connected, as by a union 17, to a tube 18, the passage of which enters a casing 19, formed in the present instance upon the tube 18. Seated in the casing 19 is a gravity-valve 20, provided with a conical projection 21, which normally closes the passage of the tube 18. The casing 19 is provided with a cover, such as a screw-cap 22. The tube 18 is provided with a lateral branch 23, having a duct opening through the bottom of the casing 19 and leading to a pipe 24, joined to the branch 23 in any suitable manner, as by the nut 25. This pipe 24 leads to a bearing—such, for instance, as the cylinder 1, as shown in Fig. 1—while pipes 26 and 27, each associated with one of the pumps in the reservoir, conduct lubricant to the steam-cylinder 2 and air-cylinder 3, respectively, of the air-pump, the fourth pump of the series shown being designed to supply oil to the cylinder on the other side of the locomotive.

Mounted in any suitable position, and preferably in the cab of the engine, as shown in Fig. 1, is a cylinder 28, which in the present instance is horizontally disposed and secured to the wall of the cylinder 4 opposite that through which the pistons 9 pass, as shown in Figs. 2 and 3. This cylinder 28 is provided with a reciprocating piston 29 and has near its opposite ends ports 30 and 31, the range of movement of the piston being between such ports, but not sufficient to close the same. Fixed to the piston 29 are rods 32, which pass through the end of the cylinder 28 opposite the reservoir 4, suitable packing-boxes 33 being provided at the apertures through which they pass. These rods 32 are fixed, as by means of nuts 34, to a cross-head 35. Fixed to the outer ends of the cross-head 35 in the same manner as the rods 32 are rods 36, which extend parallel with the rods 32 and pass through walled passages 37, extending through the reservoir 4, as clearly shown in Fig. 3. Guides, such as the lugs 38, extending from the cylinder and having apertures in which the rods 36 reciprocate, may also be provided, if desired. The front ends of the rods 36 are fixed to a cross-head 39 parallel with the cross-head 35, and to the latter the pistons 9 are connected. In the construction illustrated the cross-head 39 is provided with apertures corresponding to the positions of the plungers 9, and the outer ends of such plungers pass through such apertures and are provided with suitable abutments against which the cross-head 39 reacts to reciprocate the plungers. In the present instance these abutments take the form of shoulders 40, formed on the plungers on one side of the cross-head 39, and nuts 41, screwed upon the threaded ends of the plungers and held against rotation by lock-nuts 42.

The piston 29 by its reciprocation, as hereinafter explained, serves to operate the pump-plungers 9 to supply the lubricant to the bearings, and I may also employ this plunger to operate a boiler-compound feeder. To this end there is located in any convenient position, as in the cab of the engine and near the reservoir 4, a second reservoir 43, designed to contain a suitable boiler-cleaning compound. This reservoir 43 is provided with a removable cap 44 for convenience in filling the tank. This reservoir is preferably provided with a gage-glass 45, leading from the top of said reservoir and connected thereto at its lower end by a three-way cock 46, Figs. 13 and 14. A supply-pipe 47 leads from the valve to the inlet 48 of a pump designed to discharge the compound into the boiler. The barrel 49 of the boiler-compound-feeding pump is disposed horizontally, as shown in Figs. 2 and 3, and reciprocating therein is a plunger 50, adjustably attached to the cross-head 35. The cross-head is provided with a central aperture through which passes the end of the plunger, which is provided with an abutment taking the form of a shoulder 51 on the plunger, and an adjustable abutment, such as the nut 52, screwed to the outer end of the plunger and held against movement by a jam-nut, as shown. The intake 48 in the present instance consists of a nipple in threaded engagement with a socket 53, extending downwardly from and in communication with the inner end of the pump-barrel 49. The socket 53 provides a chamber for a gravity-valve 54, which is normally seated upon the upper end of the nipple 48 and is prevented from entering the chamber of the pump-barrel by a web 55, having apertures leading from the valve-chamber to the pump-barrel, as shown in Fig. 2. The pump-barrel 49 is provided with a corresponding socket 56, extending above the same and designed to provide a chamber for a gravity-valve 57, which normally incloses a reduced passage leading from the barrel 49 into the said socket. The valve 57 is held in the socket by the lower end of a nipple 58, which is exteriorly threaded to engage an internal thread on the said socket. Connected to the nipple 58 is a pipe or conduit 59, which ex-

tends through the top of and into the boiler of the locomotive and is provided at its end with a sprayer 60 of any suitable character, as shown in Fig. 1.

The piston 29 is designed to be reciprocated by fluid-pressure, and the supply of pressure for this purpose may be drawn from any suitable source. In the present instance I provide a connection with the air-storage cylinder from which pressure is drawn for operating the air-brakes, and in order to regulate and control the movement of the piston 29 a valve is provided and so controlled by a movable part of the operating mechanism of the locomotive as to periodically supply air to the cylinder 28 to reverse the movement of the piston 29 and reciprocate the pump-plungers. This valve mechanism, shown in the present embodiment of the invention and now to be described, is illustrated in Figs. 5 to 12, inclusive.

Mounted in any suitable position, as upon the framework of the locomotive adjacent the cylinder 1, Fig. 1, is a valve-casing 61. This casing is shown as substantially circular in cross-section and as composed of a body portion 62 and a cap 63, which is secured to the body portion by any suitable means, such as the cap-screw 64, as shown in Figs. 8 and 9. Extending concentrically with the casing 61 and passing through an opening in the cap 63 is a shaft 65, provided on its end inside the casing with a pawl-carrier 66, comprising in the present instance a pair of lateral arms 67. The ends of the arms 67 are provided with sockets or cups 68, disposed parallel with the shaft 65 and having their open ends facing the rear end of the body portion of the casing. Seated in the cups or sockets 68 are sliding pawls 69, which are thrust outwardly by means of coil expansion-springs 70, reacting between the bottom of the cups and the inner face of the pawls, the latter being preferably provided with pockets to receive the springs, as shown in Fig. 9. Disposed concentrically with and located in the casing 61 is a valve 71. (Shown in detail in Figs. 6 and 7.) The valve 71 is in the form of a disk and is seated in the casing between the pawls 69 and the rear wall or end of the body 62 of the casing. On its face adjacent the pawls 69 the valve is provided with a concentric row of ratchet-teeth 72, so positioned as to be engaged by the pawls 69, each of the latter being provided with a pin or stud 73, engaging an elongated slot 74 in its associated cup, Fig. 11, thereby permitting the pawl to slide longitudinally, but holding the same against turning in the cup. This valve 71 is of such size as to rotate freely in the casing and is supported in position by the rear wall of the casing and the inner end 75 of the shaft, which enters a recess formed in the adjacent face of the valve, the shaft thereby forming a journal or bearing for the valve.

The valve 71 is held against backward movement by a dog or, as shown in the present instance, a pair of dogs 76, which engage the teeth 72 of the valve. These dogs may be supported in any suitable manner. They are shown in the present embodiment of the invention, as illustrated in Fig. 8, as slidingly mounted in cups or sockets 77 upon the inner face of the cap, and are held in their engaged position with the ratchet-teeth 72 of the valve by coil expansion-springs 78, reacting between the bottom of the cups 77 and the adjacent face of the dogs, the latter being also provided with recesses in which the springs are seated. The dogs 76 are also held against turning in the same manner as the pawls 67 and as shown in Fig. 11. The valve 71 is provided with a port 79, passing therethrough and opening from the chamber in the casing between the valve and the cap 63, and this port preferably communicates with a curved channel 80, formed on the face of the valve adjacent the end wall of the body portion of the casing, such channel being on the same radius with the axis of the valve as a center as the port 79. The face of the valve 71, in which the channel 80 is formed, is also provided with a central recess 81, which connects by a lateral passage 82 with a channel 83, concentric with the valve and on the same radius as the channel 80, such channels being, as shown in Fig. 7, diametrically opposite each other. Passing through the end wall of the casing are two ports 84 85, which communicate with conduits or tubes 86 87, respectively, as by means of connections 88, as shown in Fig. 9. The conduit 87 leads to the port 31, while the conduit 86 leads to the port 30 of the cylinder 28, as shown in Figs. 1 and 2, preferably passing under the sheathing of the boiler of the locomotive, so that these conduits will be kept heated and prevent congealing of the oil in cold weather. The inner ends of the ports 84 85 are so positioned as to register with the channels 80 and 83 when the valve is rotated in the manner hereinafter described. Extending through the wall of the valve-casing is a duct 89, which is centrally disposed and registers at all times with the central cavity 81 in the valve. An exhaust-pipe 90 is in communication with the port 89, as by means of a connection 91, and may be extended to any convenient point to discharge the air from the cylinder 28.

Leading from the reservoir 92, in which the air for controlling the air-brakes is stored, is a conduit or tube 93, which enters the valve-casing 61 through the side thereof, as shown in Fig. 8, the end of the tube 93 being connected to a nipple 94, screwing into the said casing, by means of a nut 95. The connection 93 may be provided with a valve 96 for controlling the supply of air to the valve or for shutting it off altogether when the loco-

motive is not running, if desired. When this valve 96 is open, a constant supply of air under pressure is maintained in the valve-casing.

Secured to the outer end of the shaft 65 is an arm 97, designed to receive motion from a suitable source to rotate the valve. In order to impart to this arm the desired oscillatory movement, it may be connected, as shown in the present instance, to the valve-rod 98 of the locomotive by a link 99, jointed to the said arm and valve-rod.

In operation and when the engine is running, owing to the reciprocation of the rod 98, an oscillatory movement is imparted to the arm 97, and consequently the pawl-carrier 66. As the pawls are moved back and forth they give to the valve an intermittent rotary motion, backward movement of the valve being prevented by the dogs 76. When the end of the channel 80 remote from the port 79 registers with the port 85, leading to conduit 87, the air under pressure passes through the port 85 into the pipe 87 and thence by way of the port 31 into the cylinder 28, thereby moving the piston 29 in one direction. The supply of air is continued until the port 79 by reason of the rotation of the valve passes out of register with the port 85, leading to the conduit 87. At the same time that the channel 80 passes into register with the port 85 the port 84 connecting with the conduit 86 comes into alinement with the channel 83, thereby permitting the air upon the side of the piston 29 adjacent the port 30 to pass pack through the pipe-conduit 86 into the channel 83 and by way of the lateral passage 82 out to the exhaust-pipe 90. By providing the elongated channels 80 and 83 the connection between the inlet and exhaust ports remains established for a sufficient length of time to insure the proper supply of air to and exhaust from the cylinder 28 to produce a full stroke of the piston 29. As the rotation of the valve is continued, bringing the port 79 into coöperation with the port 84 and the exhaust-channel into register with port 85, the action is reversed, air then entering the port 30 and exhausting from the port 31, and the reversal is effected at each half-revolution of the valve.

The movement of the piston 29 by reason of the connecting-rods 32 and 36 and cross-heads 35 and 39 reciprocates the plunger 50 of the boiler-compound-feeding pump and the plungers 9 of the lubricating-pumps. Upon the outstroke of the pump-plungers 9 oil is sucked into each pump-barrel past the valve 13, and upon the instroke the valve 13 is forced to its seat, the valve 16 raised, and the valve 20 lifted from its seat, oil passing into the pipe 24, 26, or 27, depending upon which pipe is associated with the particular pump. In the construction illustrated the forcing or instroke of the piston 50 of the boiler-compound feeder is accomplished at the same time as the outstroke of the lubricating-pumps. Upon the outstroke of the plunger 50 boiler compound is sucked into the barrel 49 past the gravity-valve 54. Upon the instroke of this plunger the valve 54 is forced to its seat, the valve 57 lifted, and the compound forced through the pipe 59 to the sprayer 60.

By making the abutment 41 of each of the pumps adjustable the stroke of the piston, and consequently the quantity of oil supplied to any particular bearing, may be varied at will. This variation is accomplished by adjusting the nut 41 upon the threaded end of the pump-plunger to provide or eliminate, as the case may be, lost motion between the cross-head and the abutments 40 and 41 of the pump-plungers, it being apparent that the greater the lost play the shorter the stroke of the plunger will be. If desired, any pump may be thrown out of action at will by moving the nut 41 far enough away from the abutment 40 so that the cross-head will merely reciprocate between these abutments without reacting against the same to move the plunger.

In order to determine when the proper adjustment of the pump has been attained, each tube 18 has a branch tube 100, the duct or passage of which is closed by a screw-valve 101. This branch tube 100 is provided with a downwardly-extending outlet 102, located over an aperture 103 in the top of the reservoir, and in order to insure the oil passing out of the outlet 102 flowing back into the tank by way of the aperture 103 a glass tube 104, surrounding the said outlet and aperture, is provided. This arrangement provides a sight-feed, and when it is desired to determine the rate of feed of a pump, as when an adjustment has been made in the stroke of the piston, the valve 101 is opened, thus permitting the oil to flow out through the branch tube 100 and drip through the tube 104 back into the reservoir, the gravity-valve 20 being of sufficient weight to prevent the oil finding its way past the same when the valve 101 is open.

The stroke of the plunger of the compound feeder may be varied to regulate the amount of the discharge by adjusting the nut 52 in the same manner as the nuts 41 are adjusted, and the rate of discharge of the compound feeding-pump may be readily ascertained by turning the three-way cock 46 to a position one hundred and eighty degrees from that shown in Fig. 14, where it will be seen that the boiler-cleaning compound will be drawn slowly through the gage-glass 45, the small diameter of which permits the ready ascertaining of the amount of the feed by merely watching it.

By means of the mechanism hereinbefore described the engineer in the cab is enabled

to determine by opening the valves 101 the rate at which each pump is delivering oil to the particular bearing associated with such pump and is also able to vary the rate of delivery of each pump at will and independently of the other pumps. The parts are so arranged that the feed may be adjusted to vary the quantity of oil being fed while operating at a given rate of speed and independently of the speed of the engine in order to increase the supply of lubricant when the load is heavy, as upon an upgrade, or to diminish the lubrication when the load is light, as on a downgrade, and by means of the connection with the slide-rod associated with the driving-cylinder the amount of lubrication is increased automatically when the slide is given a long stroke and likewise diminished proportionately when the length of the stroke is decreased for lesser loads.

The pipes or conduits leading to the parts being lubricated being inclosed by the jacket of the boiler, so as to be heated at all times, the oil is prevented from becoming congealed in very cold weather.

Each oil-feed pipe may be provided, adjacent the part being lubricated thereby, with a valve 105, which may take the form of the gravity vacuum-valve shown and described in an application filed by me November 5, 1901, Serial No. 81,424, and designed to prevent the oil in the pipes from flowing down by hydrostatic pressure and wasting the oil when the engine is at rest, as well as to prevent the sucking of the oil into the cylinder when the steam is shut off, or any other preferred character of valve may be employed for this purpose.

Various modifications may be made in the invention, and I do not, therefore, restrict myself to the particular embodiment illustrated.

Having described my invention, what I claim is—

1. In a lubricator, the combination with a reservoir, of a pump supplied from the reservoir, reciprocating fluid-pressure mechanism for operating the pump, and a rotary valve actuated by the movement of the apparatus being lubricated for controlling the admission of fluid to the said mechanism to reciprocate the same in both directions.

2. In a lubricator, the combination with a reservoir, of a pump supplied from the reservoir, reciprocating fluid-pressure mechanism for operating the pump, a valve for controlling admission of fluid to the said means to reciprocate the same in both directions, and a connection with apparatus being lubricated for imparting intermittent rotary movement to the valve.

3. In a lubricator, the combination with a reservoir, of a pump supplied from the reservoir, fluid-pressure mechanism for operating the pump and consisting of a cylinder and a piston therein connected to the pump-plunger, a source of fluid under pressure, a rotary valve for controlling admission of fluid to the opposite sides of the piston in alternation, and means for rotating the valve intermittently.

4. In a lubricator, the combination with a reservoir, of a pump supplied from the reservoir, fluid-pressure mechanism for operating the pump and consisting of a cylinder and a piston therein connected to the pump-plunger, a source of fluid under pressure, a rotary valve for controlling the admission of fluid to the opposite sides of the piston in alternation, and an oscillating member for imparting intermittent rotary motion to the valve.

5. In a lubricator, the combination with a reservoir, of a pump supplied from the reservoir, fluid-pressure mechanism for operating the pump, a source of fluid under pressure, a rotary valve for controlling admission of fluid to the said mechanism and provided with ratchet-teeth, and an oscillating pawl-carrier provided with pawls engaging the teeth of the valve to rotate the same intermittently.

6. In a lubricator, the combination with a reservoir, of a pump supplied from the reservoir, fluid-pressure mechanism for operating the pump, a source of fluid under pressure, a rotary valve for controlling admission of fluid to the said mechanism and provided with ratchet-teeth, a pawl-carrier provided with spring-pressed pawls engaging the ratchet-teeth to rotate the valve intermittently.

7. In a lubricator, the coimbination with a reservoir, of a pump supplied from the reservoir, fluid-pressure mechanism for operating the pump, a source of fluid-supply under pressure, a valve-casing having an inlet from the said source and a pair of outlets to the said mechanism, a rotary valve in the casing and having a port alternately registering with the outlets, an oscillating pawl-carrier provided with a pawl for rotating the valve, and a connection with a moving part of the apparatus being lubricated for oscillating the pawl-carrier.

8. In a lubricator, the combination with a reservoir, of a pump supplied from the reservoir, fluid-pressure mechanism for operating the pump, a source of fluid-supply under pressure, a valve-casing, a connection leading from the source of fluid-supply to the casing, a pair of conduits leading from the casing to the said mechanism, a rotary valve located in the casing and having a port adapted to register with the said conduits in alternation, an oscillating pawl-carrier provided with pawls engaging the valve, and a connection for oscillating the pawl-carrier.

9. In a lubricator, the combination with a reservoir, of a pump supplied from the reservoir, fluid-pressure mechanism for operating the pump, a source of fluid-supply under pressure, a connection between the said source

and the casing, a valve-casing having a pair of supply-ports and an exhaust-port in one of its walls, a rotary valve in the casing provided with ratchet-teeth and having a port adapted to register with either of the supply-ports and a channel leading to the exhaust-port, conduits leading from the supply-ports to the said mechanism, an oscillating pawl-carrier in the casing and having spring-pressed pawls engaging the ratchet-teeth of the valve, a connection with a moving part of the apparatus being lubricated for oscillating the pawl-carrier, and spring-pressed dogs for holding the valve against backward movement.

10. In a lubricator, the combination with a reservoir, of a plurality of pumps supplied from the reservoir and having connections leading to the parts to be lubricated, a cylinder, a piston in the cylinder for reciprocating the pump-plungers, a source of fluid-supply, a valve-casing, conduits between the casing and the opposite sides of the piston, a connection between the source of fluid-supply and the casing, a valve in the casing for controlling the supply of fluid to and exhaust from the cylinder and automatically-actuated means for imparting intermittent rotary movement to the valve.

11. In a lubricator, the combination with a reservoir, of a plurality of pumps supplied from the reservoir and having connections leading to the parts to be lubricated, a cylinder, a reciprocating piston therefor, a connection between the piston and the pump-plungers, a source of fluid-supply, a valve-casing, conduits between the casing and the cylinder, a connection between the source of fluid-supply and the casing, a rotary valve in the casing for controlling the supply of fluid to and exhaust from the cylinder, pawl-and-ratchet mechanism for imparting intermittent rotary movement to the valve, and a connection with the mechanism being lubricated to actuate the pawl-and-ratchet mechanism.

12. In a lubricator, the combination with a reservoir, of a plurality of pumps supplied from the reservoir and having connections for supplying lubricant to the parts to be lubricated, a cylinder, a reciprocating piston therefor, a connection between the piston and the pump-plungers, a valve-casing, conduits between the casing and the cylinder, a connection between the source of fluid-supply and the casing, a rotary valve in the casing for controlling the supply of fluid to and exhaust from the cylinder through the conduit, and an oscillating carrier provided with pawls to rotate the valve.

13. In a lubricator, the combination with a reservoir, of a plurality of pumps supplied from the reservoir and each of which has a plunger, a cylinder, a reciprocating piston therefor, a connection between the piston and the pump-plungers, a source of fluid-supply, a valve-casing having a pair of ports, conduits between such ports to the cylinder at opposite sides of the piston, a source of fluid-supply, a connection between the source of fluid-supply and the casing, a rotating valve having an outlet-port and an exhaust-channel alternately communicating with the said conduits, the valve having ratchet-teeth, an oscillating carrier, pawls on the carrier and engaging the ratchet-teeth, and a dog engaging the valve to hold the same against backward movement.

14. In a lubricator, the combination with a reservoir, of a plurality of pumps supplied from the reservoir and each of which has a plunger, a cylinder, a reciprocating piston therefor, an operative connection between the piston and the pump-plungers, a valve-casing having a pair of ports, conduits between such ports and the cylinder at opposite sides of the piston, a source of fluid-supply, a connection between the said source and the casing, a rotating valve having an outlet-port and an exhaust-channel alternately communicating with the said conduits, the valve having ratchet-teeth, an oscillating carrier provided with cups, a spring-pressed pawl in each cup and engaging the ratchet-teeth, cups on the casing, and spring-pressed dogs in the latter cups engaging the ratchet-teeth to hold the valve against backward movement.

15. In a lubricator, the combination with a reservoir, a pump, and a connection leading from the pump to the part to be lubricated, of a cylinder having a reciprocating piston for operating the pump, a valve-casing, conduits between the casing and cylinder at opposite sides of the piston, a rotary valve in the casing and having a port for opening communication between the casing and the conduits in alternation, means for exhausting the cylinder, an oscillating member actuated by the mechanism being lubricated, pawl-and-rachet connection between the said member and the valve.

16. In a lubricator, in combination with a reservoir, a plurality of pumps in the reservoir, and each of which is provided with a plunger, a cylinder, a reciprocating piston therefor, a cross-head to which the pump-plungers are connected, a connection between the piston and the cross-head, a valve-casing, conduits between the casing and the cylinder at opposite sides of the piston, a source of fluid-supply, a connection between the said source and the casing, a valve in the casing having supply and exhaust ports alternately communicating with the said conduits, a shaft journaled in the casing and having a pawl-carrier, there being ratchet-teeth on the valve engaged by the pawl of the carrier, a connection for oscillating the pawl-carrier, and dogs carried by the casing for holding the valve against backward movement.

17. In a lubricator, in combination with a

reservoir, a plurality of pumps in the reservoir and each of which is provided with a plunger, a cylinder, a reciprocating piston therefor, a cross-head to which the pump-plungers are connected, a connection between the piston and the cross-head, a cylindrical valve-casing having in its end a central port and a pair of ports at opposite sides of the central port, conduits between the said pair of ports and the cylinder at opposite sides of the piston, a source of fluid-supply, a connection between the said source and the casing, a rotary disk-shaped valve having a passage therethrough adapted to register with the said pair of ports in alternation and provided with a channel for connecting one of said ports with the exhaust-port when the other of said ports is in register with the valve-passage, and pawl-and-ratchet mechanism for rotating the valve.

18. In a lubricator, in combination with a reservoir, a plurality of pumps in the reservoir having plungers, a cylinder, a reciprocating piston therefor, a cross-head to which the pump-plungers are connected, a connection between the piston and the cross-head, a cylindrical valve-casing having in its end a central port and a pair of ports at opposite sides of the central port, conduits between the said pair of ports and the cylinder at opposite sides of the piston, a source of fluid-supply, a connection between the said source and the casing, a rotary disk-shaped valve having a passage therethrough adapted to register with the said pair of ports in alternation and provided with a channel for connecting one of said ports with the exhaust-port when the other of said ports is in register with the valve-passage, a shaft extending into the casing and on which the valve is journaled, pawls carried by the shaft and engaging the valve, dogs carried by the casing for holding the valve against backward movement, and a connection with a moving part of the apparatus being lubricated for oscillating the shaft.

19. In a lubricator, in combination with a reservoir, a plurality of pumps connected with the reservoir and each of which is provided with a plunger, a cylinder, a reciprocating piston therefor, an operative connection between the piston and the pump-plungers, a valve-casing, a valve located in the casing and for controlling the supply and exhaust of the cylinder, the said valve being disk-shaped and having a recess in one of its faces, a shaft extending into the casing and seated at its end in the recess, the said valve having an annular row of ratchet-teeth, a pawl-carrier on the shaft and consisting of lateral arms having cups opening toward the valve, pawls seated in the cups, springs in the cups for pressing the pawls into engagement with the ratchet-teeth, cups on the casing, spring-pressed dogs in the cups engaging the ratchet-teeth to hold the valve against backward movement, and a connection for oscillating the shaft.

20. In a locomotive-lubricating apparatus, the combination with an oil-reservoir, of a pump connected therewith, a fluid-pressure cylinder, a reciprocating piston in the cylinder and operatively connected with the pump, pipes connected with the cylinder at opposite sides of the piston, a fluid-pressure-supply pipe, a rotary valve connected with the three pipes to put the supply-pipe in communication with the cylinder-pipes in alternation, and means controlled by the movement of the apparatus to be lubricated for rotating the valve.

21. In a locomotive-lubricating apparatus, the combination with an oil-reservoir, of a pump connected therewith, a fluid-pressure cylinder, a reciprocating piston in the cylinder and operatively connected with the pump, pipes connected with the cylinder at opposite sides of the piston, a fluid-pressure-supply pipe, a rotary valve connected with the three pipes to put the supply-pipe in communication with the cylinder-pipes in alternation and having an exhaust-passage, an arm, pawl-and-ratchet mechanism between the arm and the valve, and a connection between the arm and the apparatus being lubricated for rocking the arm.

22. In combination, a lubricant-reservoir, pumps located therein, and each of which is provided with a reciprocating plunger, a second reservoir, a pump supplied from the latter reservoir and having a reciprocating plunger, cross-heads to which the plungers of the pumps are adjustably connected, a cylinder, a fluid-pressure-operated piston in the cylinder, a connection between the piston and one of the cross-heads, an operative connection between the cross-heads, and means for controlling the admission and exhaust of fluid-pressure for operating the piston.

23. In combination, a lubricant-reservoir, a plurality of pumps located therein and each of which is provided with a reciprocating plunger, a cross-head to which the plungers are connected, a second reservoir, a pump supplied by the latter reservoir and having a reciprocating plunger, a cross-head connected to the latter plunger and to the other cross-head, a cylinder, a fluid-pressure-operated piston reciprocating in the cylinder, a connection between the piston and one of the cross-heads, and an automatic rotary valve for controlling the admission and exhaust of fluid-pressure for operating the piston.

24. In combination, a lubricant-reservoir, a plurality of pumps located in the reservoir and each of which is provided with a reciprocating plunger, a cross-head to which the plungers are connected, a second reservoir, a pump supplied from the latter reservoir and having a reciprocating plunger, a cross-head to which the latter plunger is connected, a

cylinder, a fluid-pressure-operated piston reciprocating in the cylinder, a connection between the piston and the latter cross-head, rods connecting the cross-heads, means for varying the stroke of each plunger independently of the others, a valve for controlling the admission of fluid-pressure for operating the piston, and a connection with a moving part of the apparatus being lubricated for imparting intermittent rotary motion to the valve.

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

JOHN F. McCANNA.

Witnesses:
ARTHUR B. SEIBOLD,
ELIZABETH MOLITER.