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L. F. WASHBURNE.

FEED MECHANISM FOR EXPLOSIVE ENGINES.

APPLICATION FILED APR. 2, 1903.

NO MODEL.

Fig. 1.

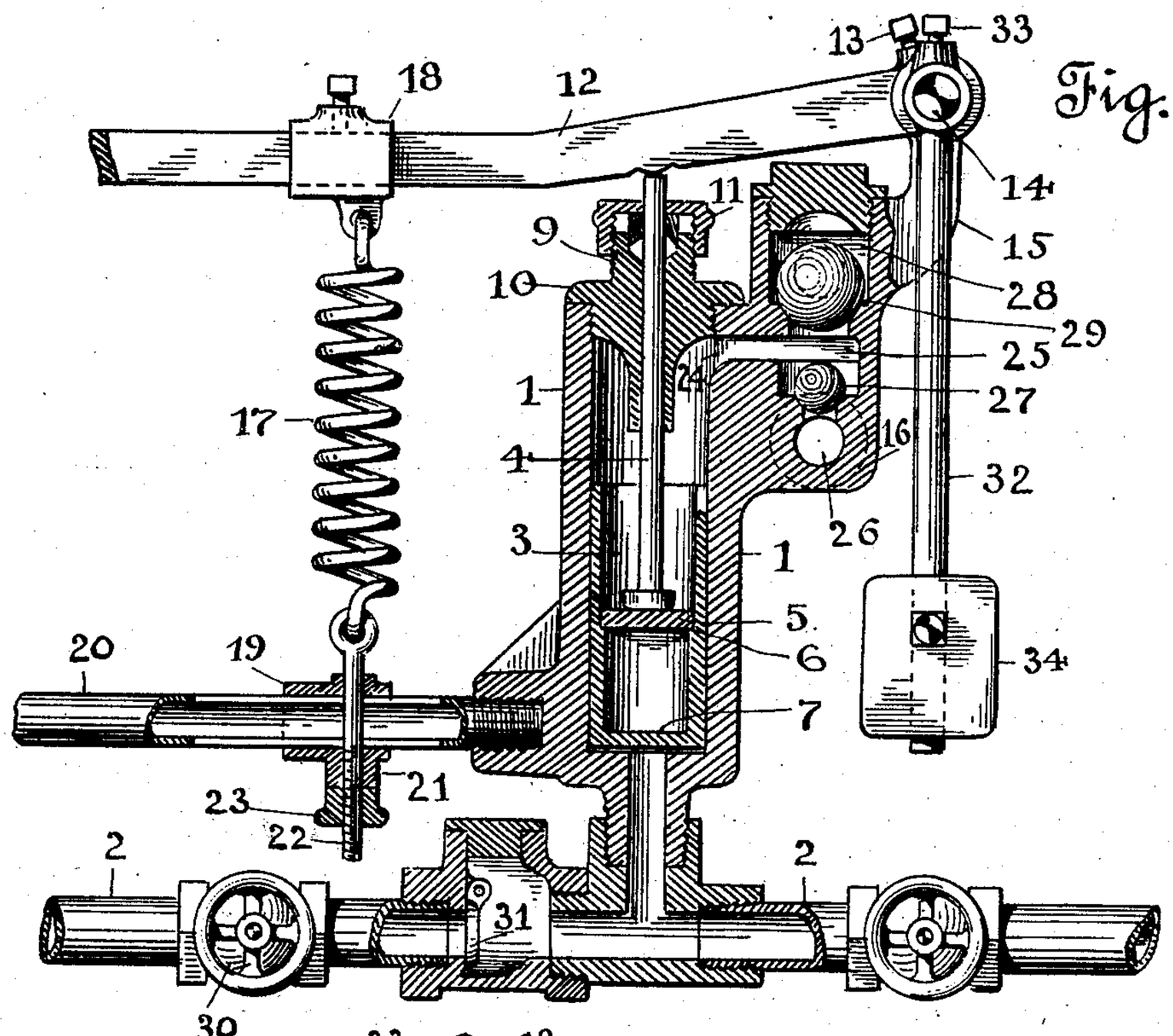


Fig. 2.

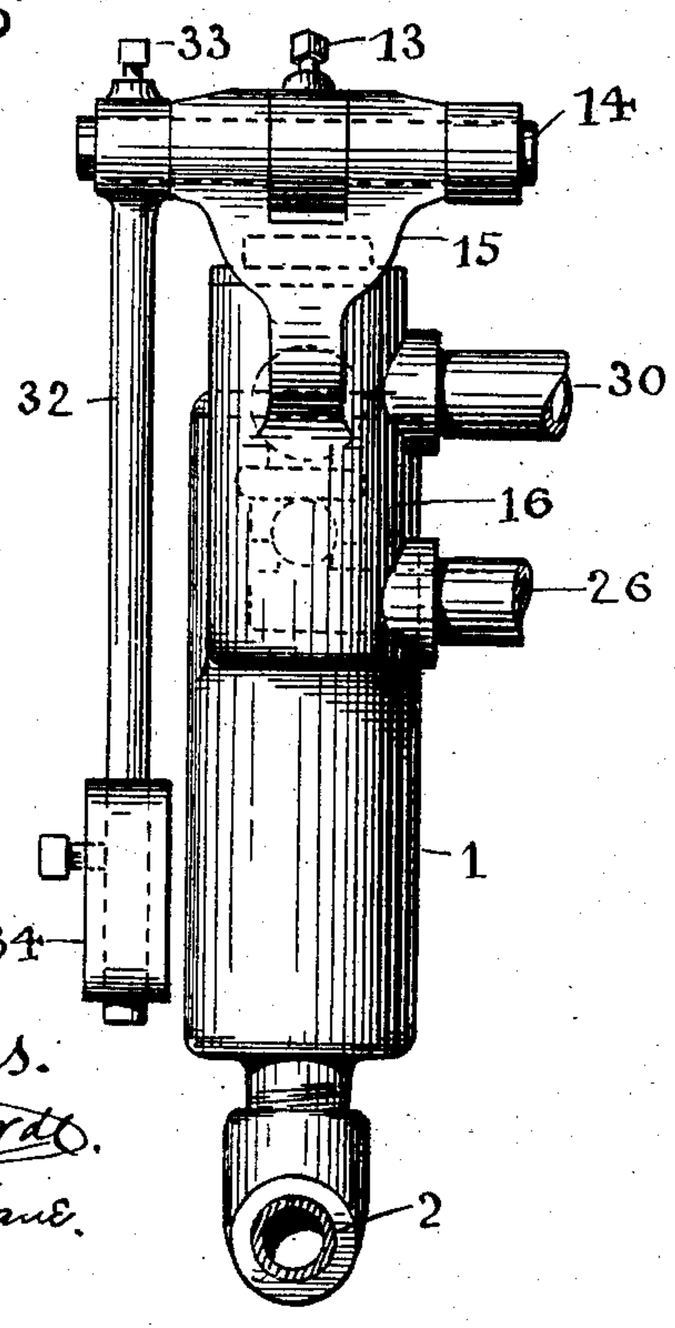
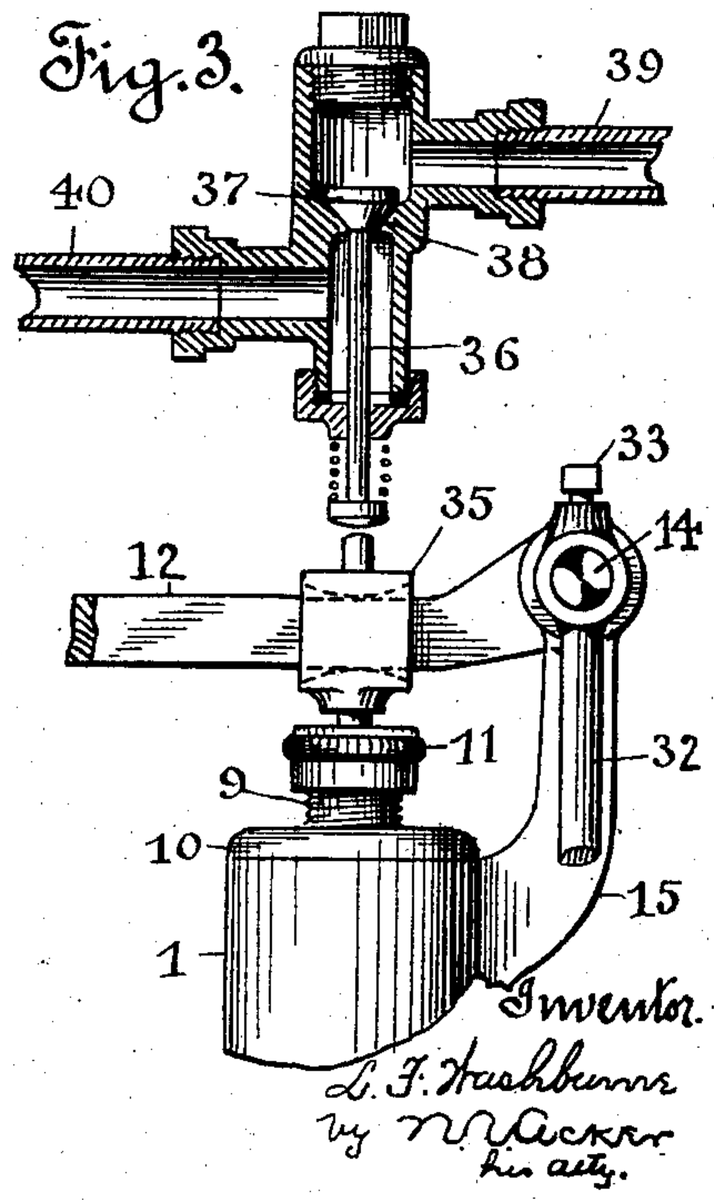


Fig. 3.



Witnesses.

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UNITED STATES PATENT OFFICE.

LESTER F. WASHBURNE, OF SAN FRANCISCO, CALIFORNIA.

FEED MECHANISM FOR EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 762,965, dated June 21, 1904.

Application filed April 2, 1903. Serial No. 150,691. (No model.)

To all whom it may concern:

Be it known that I, LESTER F. WASHBURNE, a citizen of the United States, residing in the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Feed Mechanism for Explosive-Engines; and I do hereby declare the following to be a full, clear, and exact description of the same.

The qualifications required for the production of an absolutely-automatic feed for explosive-engines, which is the object of the present invention, are, first, to closely proportion the amount of feed to the work being performed by the engine, and, second, to quickly readjust any accidental change in the proportions of the explosive mixture to be fed to the engine. The second condition requires that the feed shall automatically distinguish between two weak explosions of the engine of exactly the same total power or indicator diagram area, one being weak from a lack of fuel and the other from an excess, feeding as nearly as possible a maximum amount of fuel in the former case and a minimum or none at all in the latter case.

To comprehend the invention, reference should be had to the accompanying drawings, in which—

Figure 1 is a vertical sectional view of the improved feed mechanism. Fig. 2 is a side view of the said feed mechanism, and Fig. 3 a detail broken view disclosing a modified form of the said feed mechanism.

In connection with the description of the invention it has not been deemed necessary to describe or illustrate a motor-engine, as such is well understood.

The invention desired to be protected comprises a comparatively small cylinder 1, one end of which is in communication with the combustion-chamber of any suitable explosive-engine by means of the pipe connection 2. Within the cylinder 1 is located and works a long hollow well-fitted piston 3 and a piston-rod 4. The lower end of the said piston-rod is not connected with the piston, but rests upon a false piston-head 5, which bears upon an interior circular flange or seat 6, located about the middle of the height of the piston 3. This false head prevents the oil or hydrocarbon fed into the cylinder 1, as hereinafter described, from coming in contact with the bottom 7 of the piston, while at the same time providing a chamber 8 within the piston for preventing the heated air acting against the bottom 7 affecting the hydrocarbon fed into the cylinder 1.

The upper end of the piston-rod 4 extends beyond the cylinder 1, working through a long guide-opening 9 in cylinder-head 10 and through the stuffing-gland 11. The upper end of the said stem bears against the under face of a lever 12, which lever is fulcrumed at its inner end by being secured by set-screw 13 to the rotatable rod 14. This rod works in bearings of brackets 15, upwardly projecting from the cylinder extension 16. The fulcrumed lever 12 is held downward by the pressure of spring 17, which is attached thereto by the slide-block 18. Said spring at its lower end is held to the slide-block 19, slidable upon the laterally-extending rod or bracket 20. Through a sleeve 21 of the slide-block 19 works the screw-bolt 22, to which the lower end of the said spring 17 is attached. This screw-bolt 22 is actuated by the screw-nut 23 to increase and decrease the tension of the spring 17. By permitting an inward and outward or lateral adjustment of the tension-spring 17 the leverage of the said lever 12 in relation to that of the piston-rod 4 may be changed to accord with the working force acting upon the piston 3, thereby avoiding the necessity of providing springs of different strength.

In the upper end portion of the cylinder 1 is provided an inlet-port 24, which connects the interior of the cylinder with the valve-chamber 25. With this valve-chamber connects the supply or feed pipe 26, which pipe leads from a suitable reservoir for the hydrocarbon. The valve-chamber is controlled by a vertically-movable ball-valve 27, which seats within the valve-chamber to cut off the supply of hydrocarbon to the inlet-port 24.

Above the valve-chamber 25 is located a second valve-chamber 28, communication between said valve-chamber and port 24 being controlled by the vertically-movable ball-valve

29. From this valve-chamber 28 leads the outlet-pipe 30, which communicates with a suitable vaporizer which connects with the explosive-engine. These valves 27 and 29 are alternately operated, as hereinafter explained, by the movement of the piston 3 within the cylinder 1.

When used for the feeding of oil, the upper half of the piston 3 acts upon the oil as a pump for measuring and lifting wherever required during the working of the engine to supply oil to the vaporizer or carbureter. The downstroke of the piston 3 creates a suction sufficiently strong to raise or unseat the valve 27 and draw the oil from the supply into the cylinder 3 through the valve-chamber 25 and port 24. The quantity of oil or hydrocarbon thus admitted into the cylinder 1 is dependent upon the stroke of the piston 3. This downward movement or stroke of the piston 3 is due to the pressure of the fulcrumed lever 12 upon the piston stem or rod 4, which pressure regulates the return of the moving piston. With each explosion of the engine to which the feed mechanism is connected the heated gases from the explosion-chamber thereof are forced back through the pipe 2 against the under face of the bottom 7 of the piston 3. The pressure thus acting against the piston forces the same upward within the cylinder 1. As thus moved upward the oil or hydrocarbon resting within the upper portion of the piston or cylinder is lifted and forced outward through port 24 into the pipe 28, which conveys same to the vaporizer or carbureter. The pressure of the oil or hydrocarbon forced through port 24 during the upstroke of the piston 3 is sufficient to raise or unseat the valve 29. During this stroke of the piston the valve 27 is held to its seat by gravity. The moment the piston commences its downstroke the valve 29 seats itself by gravity, and the valve 27 is raised from its seat by the suction thus created. It will be observed that the feed of oil or hydrocarbon into the cylinder and the discharge thereof from the cylinder into the pipe 30, leading to a vaporizer or carbureter, is entirely dependent upon the length of the stroke made by the piston. This stroke in turn is dependent upon the explosive force of the engine, as the stroke of the piston will vary in accordance as to whether the explosion is a strong one or a weak one. The quantity of hydrocarbon thus fed into the cylinder and discharged therefrom automatically varies or changes in proportion to the explosive force of the explosion of the engine.

To further protect the hydrocarbon within the cylinder from any detrimental effect due to the heat from the explosive-chamber of the explosive-engine to which the feed mechanism is connected, the connecting-pipe 2 is provided adjacent to the cylinder 1 with a regulating-valve 30, through which fresh air is drawn into the pipe 2. Cool air is thus admitted into the said pipe, forming an air-cushion for maintaining cool the said piston 3. This air is prevented from escaping upon a back pressure within the said pipe 2 by means of a hinged inwardly-movable valve 31. By thus checking the outlet of the air the same is forced into the cylinder 1 to act upon the piston 3 and raise the same with each explosive stroke of the engine. By adjusting the air-inlet valve 30 the air admitted into the pipe connection 2 between the cylinder 1 and the engine can be so controlled as to approximately just fill the connecting-passage with cool fresh air upon each suction stroke of the engine, thereby leaving the same in position to transmit the pressure from the following explosion to the piston 3, as described, to actuate the same to feed the hydrocarbon.

Actual practice of the described feed mechanism has demonstrated that the same permitted of easy and quick adjustment to act perfectly under all conditions of light and heavy loads upon the engine with which the same was connected and that it responded quickly to correct any increase or decrease of the fuel from its correct proportion as to air.

A mixture which is rich in hydrocarbon is slow in igniting and burning, producing low maximum pressure, while a mixture poor as to hydrocarbon ignites with such rapidity that a comparatively very high pressure is formed before the piston has had time to expand it down. As the pressure due to combustion of mixtures of the latter character subsides with a speed corresponding to that of its formation, it has been found that to take advantage of the high and initial pressure required considerable weight be given to the moving parts, so that the required momentum should continue the stroke of the feed-piston after the actuating pressure partially subsided. It is desirable, however, that the mechanism be made as light as possible, the necessary weight to perform the above-described function being procured in the form of a movable weight capable of being moved or adjusted radially in and out from a pivotal center in order to adjust the momentum as required. For this purpose an arm 32 is pivoted to the oscillatory rod 14, being held thereto by set-screw 33. To the free end of this arm is slidably secured an adjusting-weight 34. This arm may be swung into any position required to give an increased or a decreased weight to the action of the lever 12.

Where ordinary illuminating-gas is utilized as the fuel for the explosive-engine, the piston 4 is connected to the lever 12 by a yoke 35, the piston extending above the yoke and resting upon a depending stem 36 of a puppet-valve 57, which valve works within seat 38, to control communication between the supply-pipe 39 and the feed-pipe 40, connecting with any suitable vaporizer or carbureter,

Fig. 3 of the drawings. The quantity of gas admitted into the feed-pipe 40 is controlled by the outlet area produced by the unseating of the valve 37, which is dependent upon the length of the stroke made by the piston 4.

Having thus described the invention, what is claimed as new, and desired to be protected by Letters Patent, is—

1. An automatic hydrocarbon-feed device for explosive-engines comprising a cylinder, a piston working therein, a connection between the lower portion of the cylinder and the engine whereby the piston will be elevated on the explosive stroke of the engine, mechanism for returning the piston to its normal position upon the suction-stroke of the engine, means whereby a charge of cold air will be drawn into the connection between the cylinder and the engine on the suction-stroke of the engine, means for preventing the escape of cold air upon the explosive stroke of the engine, and devices actuated by the movement of the piston for controlling the flow of the hydrocarbon.

2. An automatic hydrocarbon-feed device for explosive-engines comprising a cylinder, a piston working therein, a connection between the lower portion of the cylinder and the engine whereby the piston will be elevated on the explosive stroke of the engine, means for returning the piston to its normal position upon the suction-stroke of the engine, a cold-air pipe communicating with the connection between the cylinder and the engine, a valve in said pipe arranged to open on the suction-stroke of the engine to admit a supply of cold air to the connection and to close on the explosive stroke of the engine to prevent the escape of the air, and devices actuated by the movement of the piston for controlling the flow of the hydrocarbon.

3. In an automatic feed for explosive-engines, a cylinder, a piston reciprocating therein, connection by which the piston is actuated upon the explosive stroke of the engine, valve mechanism operated by the stroke of the piston to control the flow of hydrocarbon, a spring-held fulcrumed lever acted upon by the piston, said lever causing the return stroke of the piston upon the suction-stroke of the engine, and a weighted arm adjustably connected to act with the fulcrumed lever.

4. In an automatic feed for explosive-engines, a casing, a cylinder in said casing, a piston working in said cylinder, means actuated by the stroke of the piston for controlling the feed of the hydrocarbon, a piston-rod, a lever fulcrumed to the casing and resting on the free end of said piston-rod, a laterally-extending support secured to the casing, and a spring connecting the free end of the lever and the laterally-extending support, the ends of said spring being laterally adjustable on the lever and support.

In witness whereof I have hereunto set my hand.

LESTER F. WASHBURNE.

Witnesses:
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