(No Model.)

3 Sheets—Sheet 1.

C. S. EDMONDS.

FEED REGULATOR.

No. 506,773. Patented Oct. 17, 1893.

Fig. I

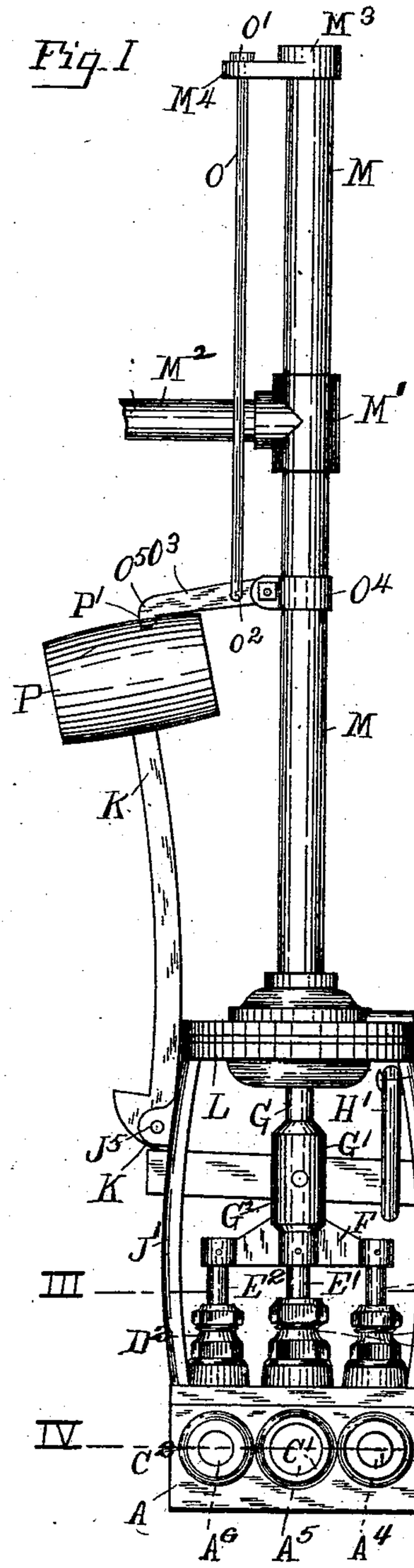
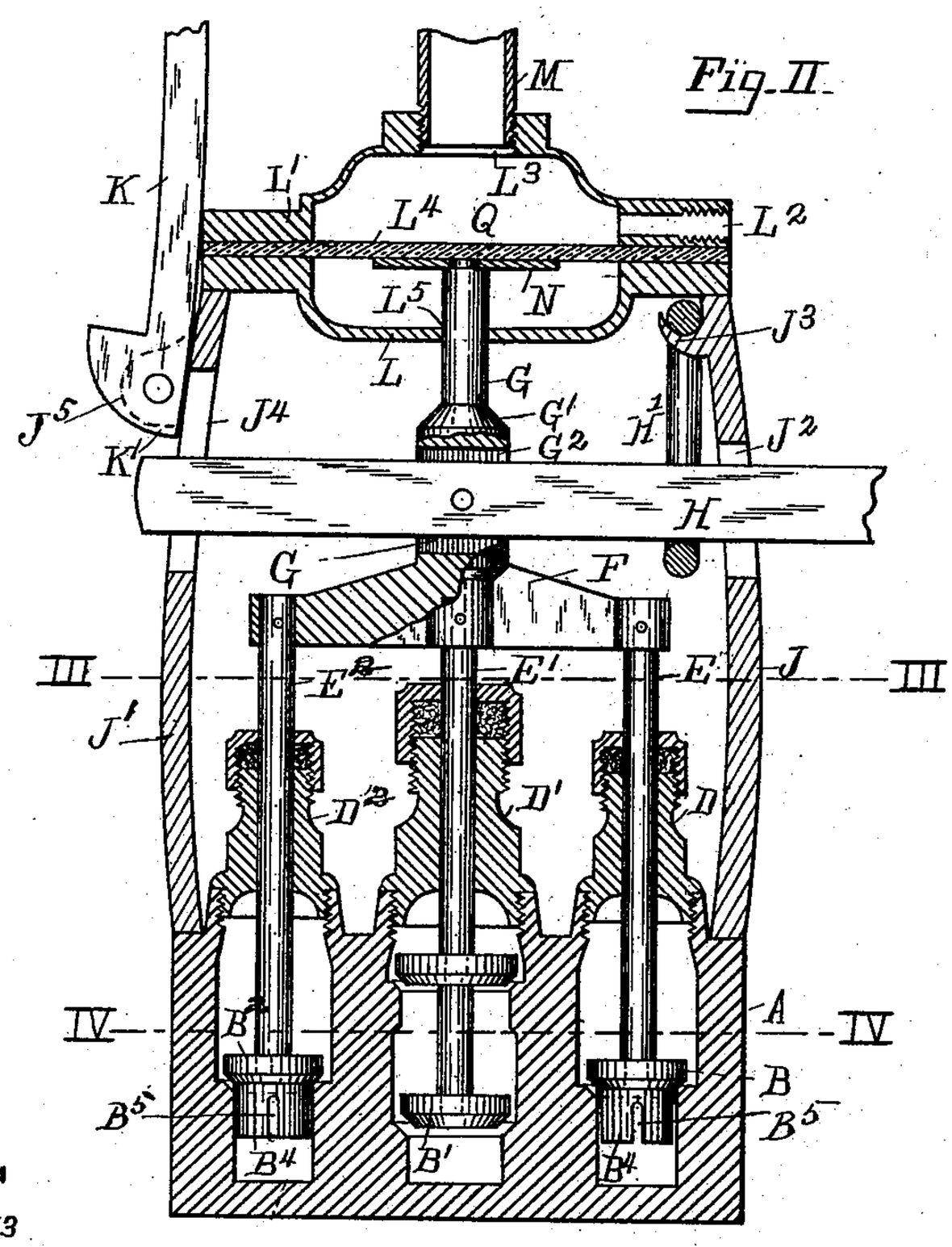


Fig. II



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(No Model.) 3 Sheets—Sheet 2.

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Fig. III

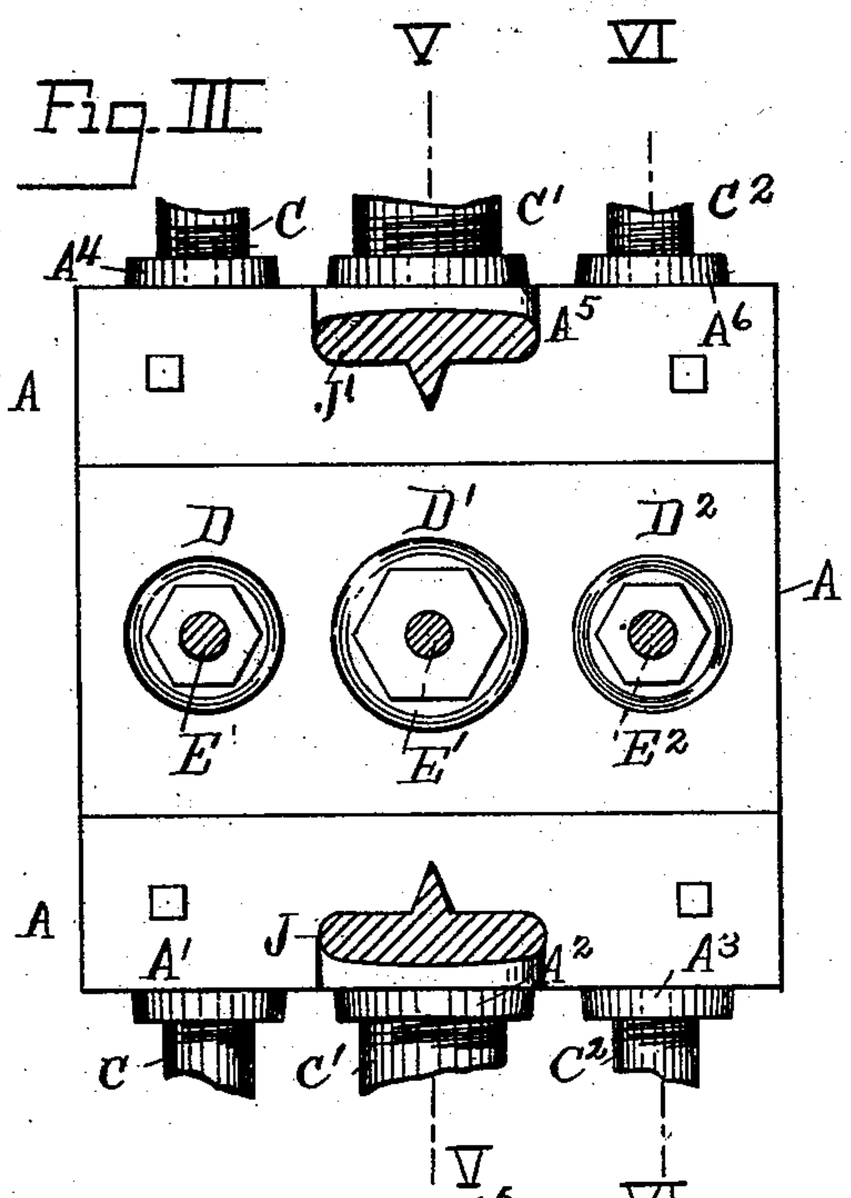


Fig. IV

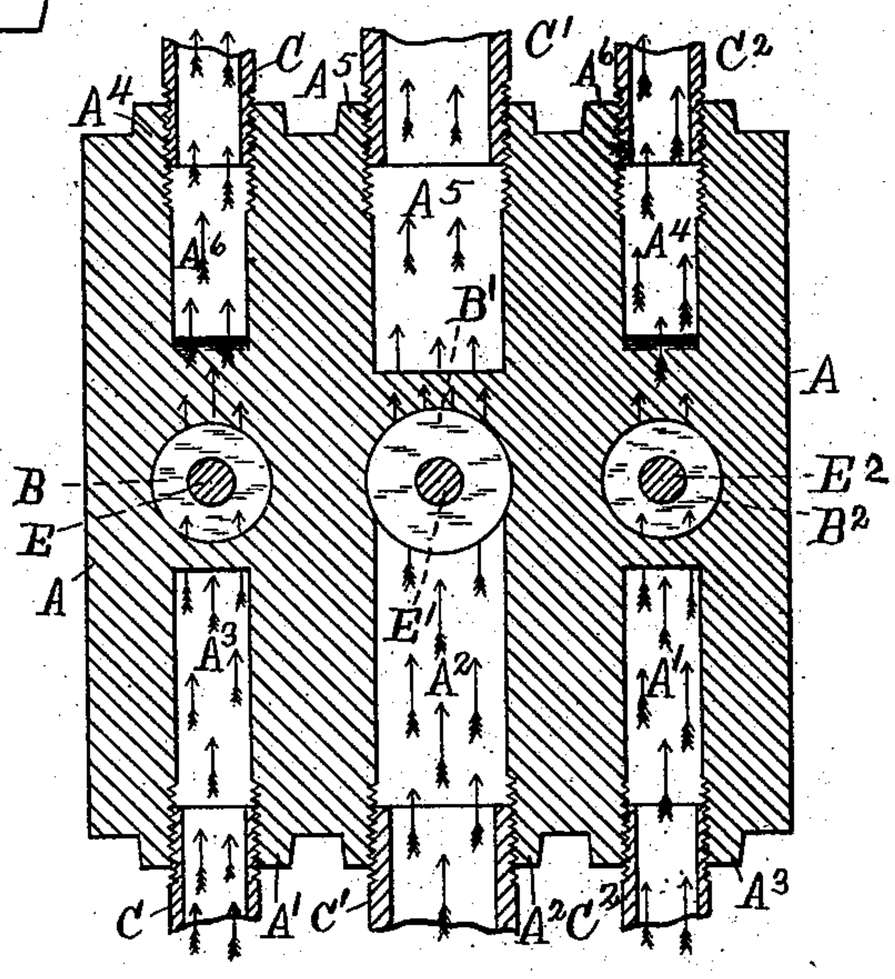


Fig. V.

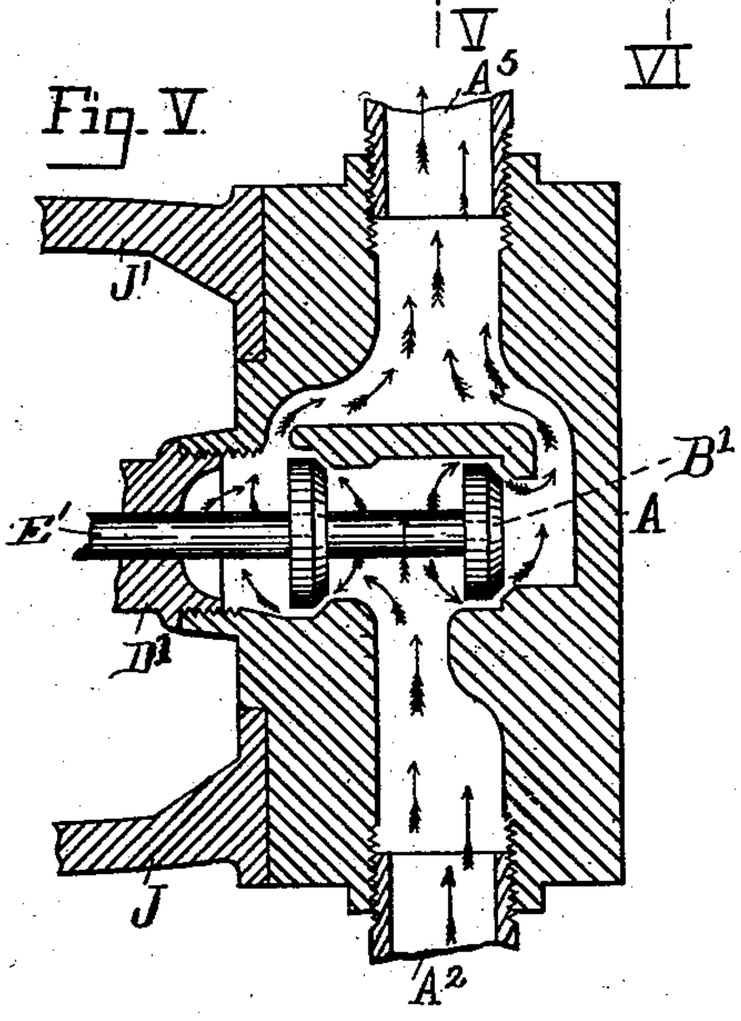


Fig. VII

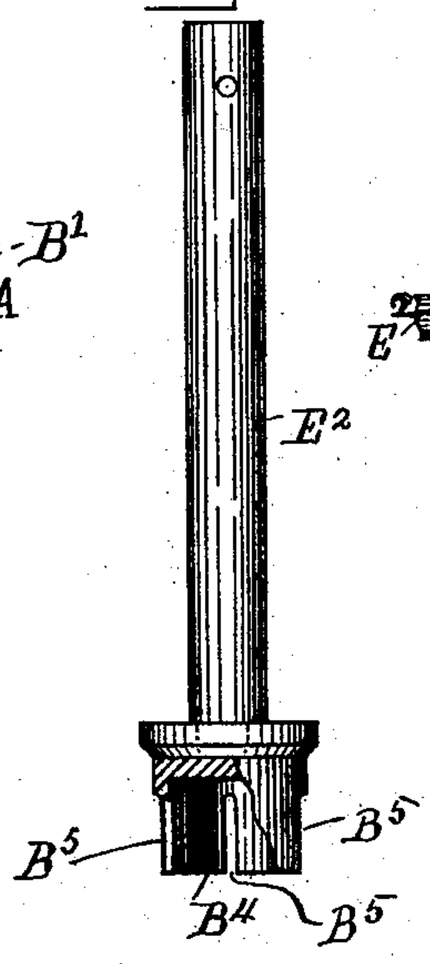
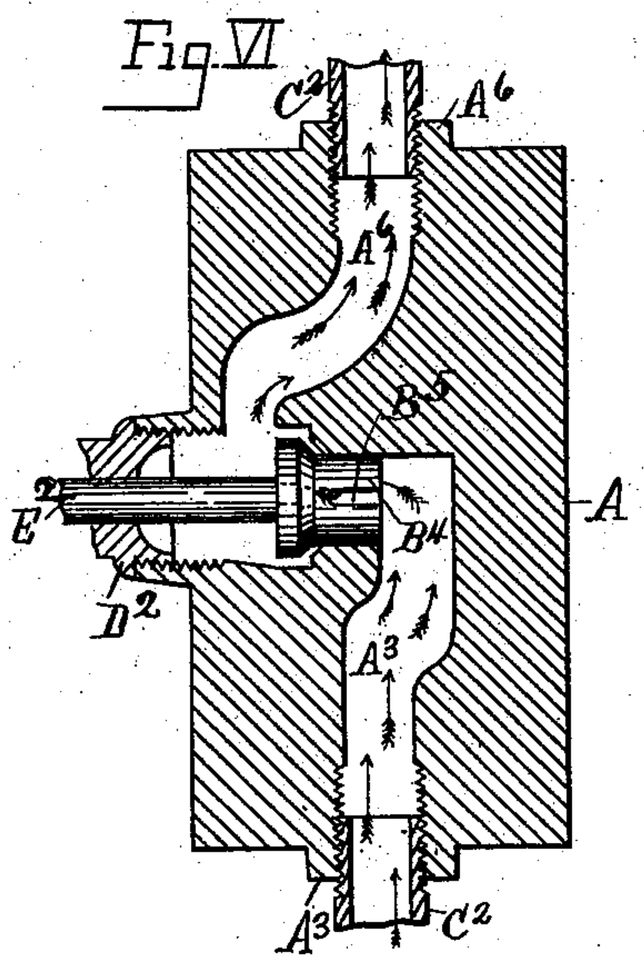


Fig. VI



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(No Model.) 3 Sheets—Sheet 3.

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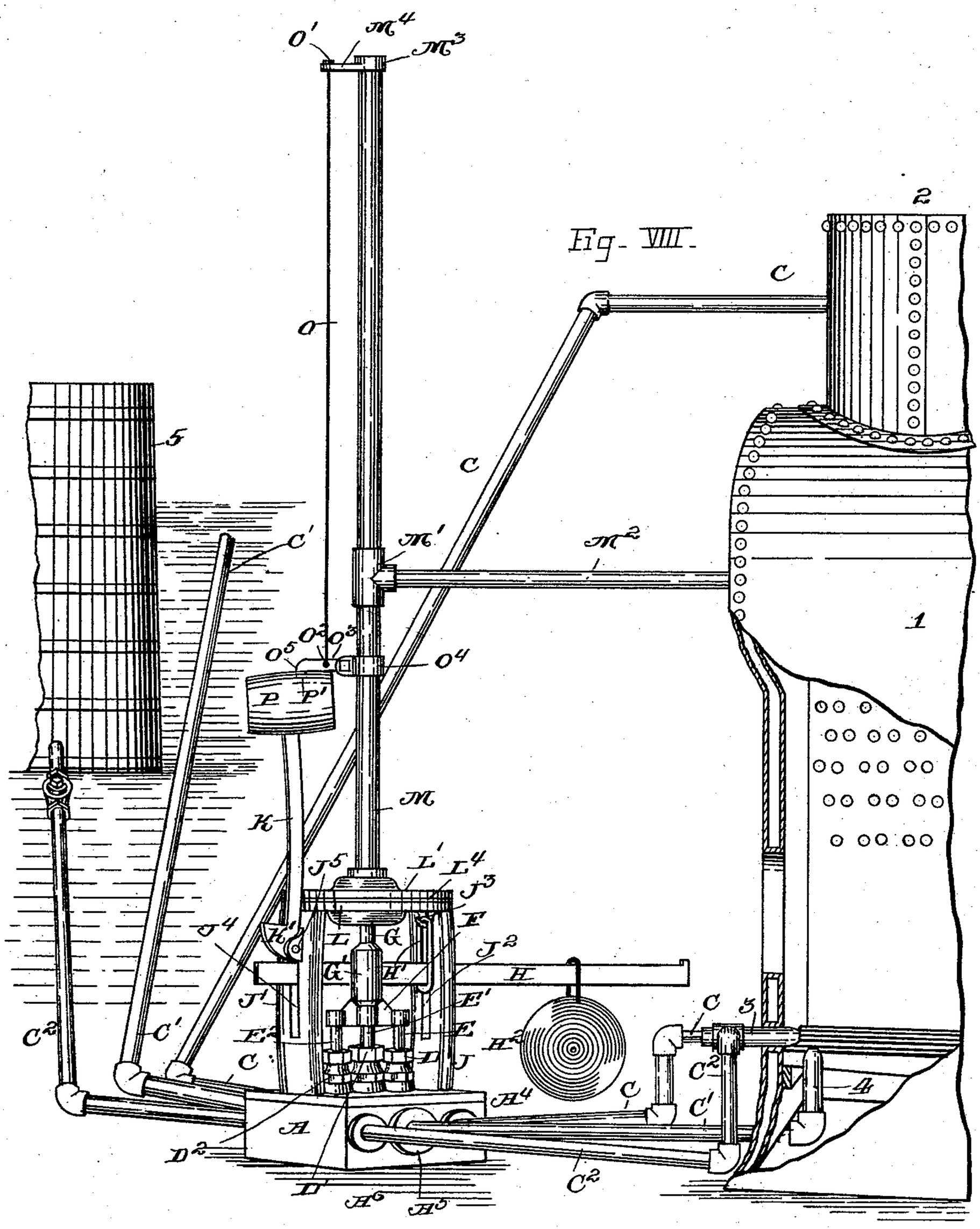
Fig. VIII.



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UNITED STATES PATENT OFFICE.

CHARLES S. EDMONDS, OF BRADFORD, PENNSYLVANIA.

FEED-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 506,773, dated October 17, 1893.

Application filed October 24, 1892. Serial No. 449,833. (No model.)

To all whom it may concern:

Be it known that I, CHARLES S. EDMONDS, a citizen of the United States, and a resident of Bradford, in the county of McKean and State of Pennsylvania, have invented a new and useful Improvement in Feed-Regulators, of which the following is a specification.

My invention relates to an automatic hydro-carbon feed regulator and low water shut-off for steam boilers or other similar heating apparatus using hydro-carbon as a fuel, which is located between the mains or reservoirs and the burners and is worked automatically by the pressure of steam.

My device is especially constructed for use with steam boilers at oil wells where the fuel consists wholly of crude oil and natural gas.

In many of the old oil and gas producing districts the wells no longer flow the oil, on account of the gas having become to a great extent exhausted, although in most of the wells, there yet flows a small quantity of gas, but it is not utilized for fuel on account of its insufficiency and the additional care and expense of gas regulating apparatus. One of these wells may be cleaned of the accumulated sediment therein or be "torpedoed," increasing the flow of gas, for the time being to such an extent that no other fuel is necessary, and again the gas may and does at times entirely cease to flow, causing the oil operator to rely solely on the crude oil for his fuel.

In most of the old oil districts the "wells are pumped by heads," that is, each well is periodically pumped, generally once a day, it taking but a short time to exhaust the well of the oil which has accumulated since the previous pumping. Several wells are operated from the same boiler and the pumper who is also the engineer, as well as the fireman, has to leave the boiler unattended and visit all the wells when pumping. Some of the wells are from one quarter to one half of a mile from the boiler thus necessitating the employment of automatic devices for the control of the hydro-carbon fuel, as well as the steam and water in the boiler.

The object of my invention is to provide an apparatus that will work satisfactorily under the several circumstances cited above, that is, to utilize all the gas from the small wells for fuel, and thereby save its equivalent in oil, or should there be a sufficient quantity of gas for fuel, to feed that only, thereby saving all the oil that would otherwise be used for that purpose, or should there be no gas in the well, or from some cause the gas should cease to flow therefrom, then to feed the desired quantity of oil together with a proper amount of steam, to keep up a perfect combustion of oil or hydro-carbon in the fire-box or furnace, and further, should the water in the boiler become so low, as to create a danger of burning the boiler or causing an explosion of the same, then to instantly shut off the fuel supply from the boiler, the said apparatus to act automatically by the pressure of the steam in the boiler, and by its automatic action to keep the said steam at any desired pressure. I attain these objects by the mechanism illustrated in the accompanying drawings which form part of this specification, and in which—

Figure I is an elevation of my improved feed regulator. Fig. II is an enlarged axial section of the body of the device. Fig. III is a top view of the base with the valve-stems cut through on the dotted line III—III of Figs. I and II; the standards being at the front and back respectively instead of at the sides. Fig. IV is a cross section of the body on the dotted line IV—IV of Figs. I and II showing the valves in place. Fig. V is a cross section through the middle valve on the dotted line V—V of Fig. III; the standards being in the same position as that shown in Fig. III. Fig. VI is a cross section on the dotted line VI—VI of Fig. III. Fig. VII is an elevation of the steam-valve and stem, the bottom of the valve being broken away in order to show the chamber therein. Fig. VIII is a perspective view showing the application of my feed-regulator.

Similar letters and figures indicate similar parts throughout the several figures of the drawings.

In the drawings: A is the body or base of the device provided with the inlets A', A^2, A^3 and the outlets A^4, A^5, A^6. These form passage-ways through the body A, which are interposed by the valves B, B', B^2 respectively. To the inlet A' and outlet A^4 is secured the steam-pipe C, which is connected at its one extremity with the boiler 1, (at the dome 2 if

possible) and at its other end to the hydro-carbon burner 3 under the boiler as seen in Fig. VIII. To the inlet A^2 and the outlet A^5 is secured the gas pipe C'. This gas-pipe is connected to the main gas line or reservoir (not shown) at its one end and at its other end to the burner 4 under the boiler. To the inlet A^3 and the outlet A^6 is secured the oil pipe C^2 which is attached at its one end to the oil tank or reservoir 5 and at its other end to the hydro-carbon burner under the boiler, the burner being adapted to receive the three pipes C, C' and C^2. The top of the body A, is provided with the stuffing boxes D, D' and D^2 through which the valve stems E, E' and E^2 respectively pass. These valve stems are pivotally secured to the cross-bar F and with which they align, the cross-bar F being integral with or fixedly secured to the piston rod G.

The piston rod G at its lower end is provided with the enlarged part G' through which is the slot G^2 and in slot G^2 is pivotally secured the lever H which is fulcrumed in the loop H', said lever being provided with the sliding counterbalance weight H^2. J and J' are standards secured to, or integral with, the top of the body A. In Figs. I and II they are shown aligning with the valve stems E, E', E^2. In Figs. III and V, they are shown diametrically opposite said stems. This latter position is preferable on account of there being more room in the top of the body for them. The standard J is provided with the longitudinal slot J^2 through which the lever H is passed and with the hooked projection J^3 which holds the loop H' in suspension.

The standard J' is provided with the longitudinal slot J^4 through which the inner end of the lever H is passed and in which the cam shaped heel K' of the trip lever K can also enter. The standard J' is also provided with two ears J^5 one on each side of slot J^4, said ears being bored for the purpose of pivoting the trip lever K between them. To the standards J and J' at their upper ends, is secured the dish shaped lower disk L, provided with an opening L^5 at its center. To the inverted disk L is secured the dish shaped upper disk L' by bolts or otherwise. It is provided with the orifice L^2 for the purpose of draining off the condensed steam or water, and further provided with the orifice L^3 for the purpose of connecting the upright thermostatic pipe M thereto. Between the said disks L and L' is placed the flexible diaphragm L^4 consisting of any pliant material. I prefer the rubber fibrous sheet packing. Through the opening L^5 of the lower disk L the upper end of the piston rod G extends. It is provided with a pin, which passes through the flat disk or plate N. This plate N shoulders on the piston rod G and contacts with the diaphragm L^4. The upright pipe M is provided between its extremities with the T-coupling M'. M^2 is a pipe connecting at its one end with the T-coupling M' and at its other end at the desired point in the boiler shown in Fig. VIII.

To the upper end of pipe M is fastened the cap M^3 which is provided with a projection M^4 through which the rod O passes. The rod O is provided with a head O' for its support at its upper end, the lower end being hook-shaped and inserted into the hole O^2 and becoming movably secured to the latch O^3. Latch O^3 is pivotally secured to the clamp O^4 which is fixedly secured around the pipe M. The outer end of latch O^2 is provided with a downward projecting extension O^5 which enters the notch P' of the weight P engaging with the said weight and holding it in subjection to the pipe M as hereinafter explained. The weight P is rigidly fixed to the upper or outer end of the trip lever K.

The method of operating my automatic hydro-carbon feed regulator and low water shut-off is as follows: The pipes having been connected to their sources of supplies and to the burner, and the counterbalance weight H^2 being placed on the lever H at such a point as to counterbalance the desired steam pressure which is determined by the steam gage of the boiler, the device is as shown in Figs. I and V, the valves being open and feeding to the burner. The pipe M and the chamber Q which is formed between the diaphragm L^4 and the upper disk L' are filled with water conveyed by the pipe M^2 from the boiler. As the steam is generated in the boiler, its pressure is exerted through means of the water in pipe M and chamber Q on the diaphragm L^4 which impinges on the top of the said diaphragm causing it to bend downward. The piston rod G being in contact with the diaphragm L^4, on its lower side is also forced in a downward direction and would close the valves were it not for the counterbalance weight H^2 on the lever H, which counteracts such pressure up to the amount at which it was set to balance. As soon as the steam in the boiler reaches the desired pressure, the weight H^2 counterbalancing its pressure on the diaphragm L^4 keeps the valves open a sufficient distance to feed the required amount of fuel to keep the steam pressure at that point. A greater pressure of steam would counteract the weight H^2, lower the valves, and diminish the flow of the fuel. With a less pressure of steam, the weight would counteract the steam pressure and raise the valves and increase the flow of the fuel, but as stated above, the steam pressure is counterbalanced by the weight H^2. Therefore the variation of the steam pressure on a boiler furnishing a uniform amount of steam would be very slight. Should the water in the boiler be lowered below the desired point, live steam will take the place of water in the pipe M^2 and also in the pipe M above the T-coupling M'. The additional heat of the live steam will cause the pipe M to expand longitudinally and thereby draw the latch O^3 out of the notch P' of the weight P by means of the rod O. The weight P immediately swings

out and downward causing the cam shaped heel K′ of the trip lever K to enter the slot J^4 and force down the inner end of the lever H, thereby carrying the valves B, B′, and B^2 down to their respective seats, shutting off the flow of the fuel. From the peculiar shape of the heel of the trip lever, it remains fixed in this latter position until released by the person in charge of the boiler.

In the above description of use I have referred to the valves collectively. In Figs. II, V, VI and VII the valves are shown as constructed.

The valves for the steam and oil (see Fig. VII) being similar are provided with a cylindrical lower chamber B^4 which is perfectly fitted in the body as shown in Figs. II and VI. The cylinder is longitudinally slotted part way up, and through this slot only the steam or oil passes. From experience I find one slot in the oil valve and four similar slots in the steam valve, feed the proper proportions of each to the burner to make a perfect combustion.

Fig. V shows the passage-way of the gas through the body A with the valve partly raised from its seats. The valve is a balanced valve. I use this style of gas valve on account of the varying pressures of the gas. With an ordinary valve the automatic action of the device would be very much impaired.

In Fig. VI the passage way of the oil is shown (the steam passage-way being similar). The valve is shown raised from its seat but not high enough to allow the oil to pass through the longitudinal slot B^5 in the chamber B^4.

In Fig. II the valves are shown partly raised allowing a free passage for the gas only, the tops of the slots in the cylindrical chambers of the oil and steam valves not having been raised high enough to allow a passage through them.

It will be observed from the construction of the device as shown that the valves all move in unison; that the gas is fed in preference to the oil; that should there be gas enough to furnish the fuel needed to maintain the steam at a required pressure, no oil will be fed; that only enough oil is fed when the gas is weak, to keep up the steam pressure in conjunction with the gas; that when there is no gas the oil valve will furnish the requisite amount of fuel; that when the oil is fed there is also simultaneously fed, the proper amount of steam, to unite with and make a perfect combustion of the oil, and that when it is necessary to reduce the fuel to a minimum as in the case of a cessation of the consumption of the steam, where there is a small quantity of gas, the oil and steam can be simultaneously shut off and the required amount of gas left to feed the burner.

I use the diaphragm and disk on account of their simplicity and I am aware of their previous use and make no claim thereto.

Having thus described my invention, the following is what I claim as new and desire to secure by Letters Patent:

1. A feed-regulator comprising a base having a passage therethrough, and a valve-chamber located in the passage, a pipe for connecting the outlet of the passage with a burner, a valve for controlling the flow through the passage, having a valve-stem, a pressure device for lowering the valve having a thermostatic pipe for connecting it with a boiler, a counterbalanced lever acting in opposition to the pressure device for raising the valve, a weighted trip-lever having a heel bearing on the inner end of the counterbalanced lever, a rod supported on the thermostatic pipe, and a latch supported by the rod and adapted to engage the trip-lever; substantially as described.

2. A feed-regulator comprising a base having independent steam, gas, and oil passages therethrough and valve chambers located in the passages; steam, gas, and oil pipes for connecting the outlets of the passages with a burner, a valve for controlling the flow of steam through the steam passage, having a stem and a chamber formed with slots, a balanced valve for controlling the flow of gas through the gas passage, having a stem and arranged to open in advance of the steam and oil valves, a valve for controlling the flow of oil through the oil passage having a stem and a chamber formed with a slot, a cross-bar by which the valve-stems are surmounted and connected having a piston rod, and means for controlling the movement of the piston rod; substantially as described.

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