(No Model.)

2 Sheets—Sheet 1.

A. M. COYLE.
PUMPING APPARATUS.

No. 548,629.

Patented Oct. 29, 1895.

Fig. 1

Fig. 5.

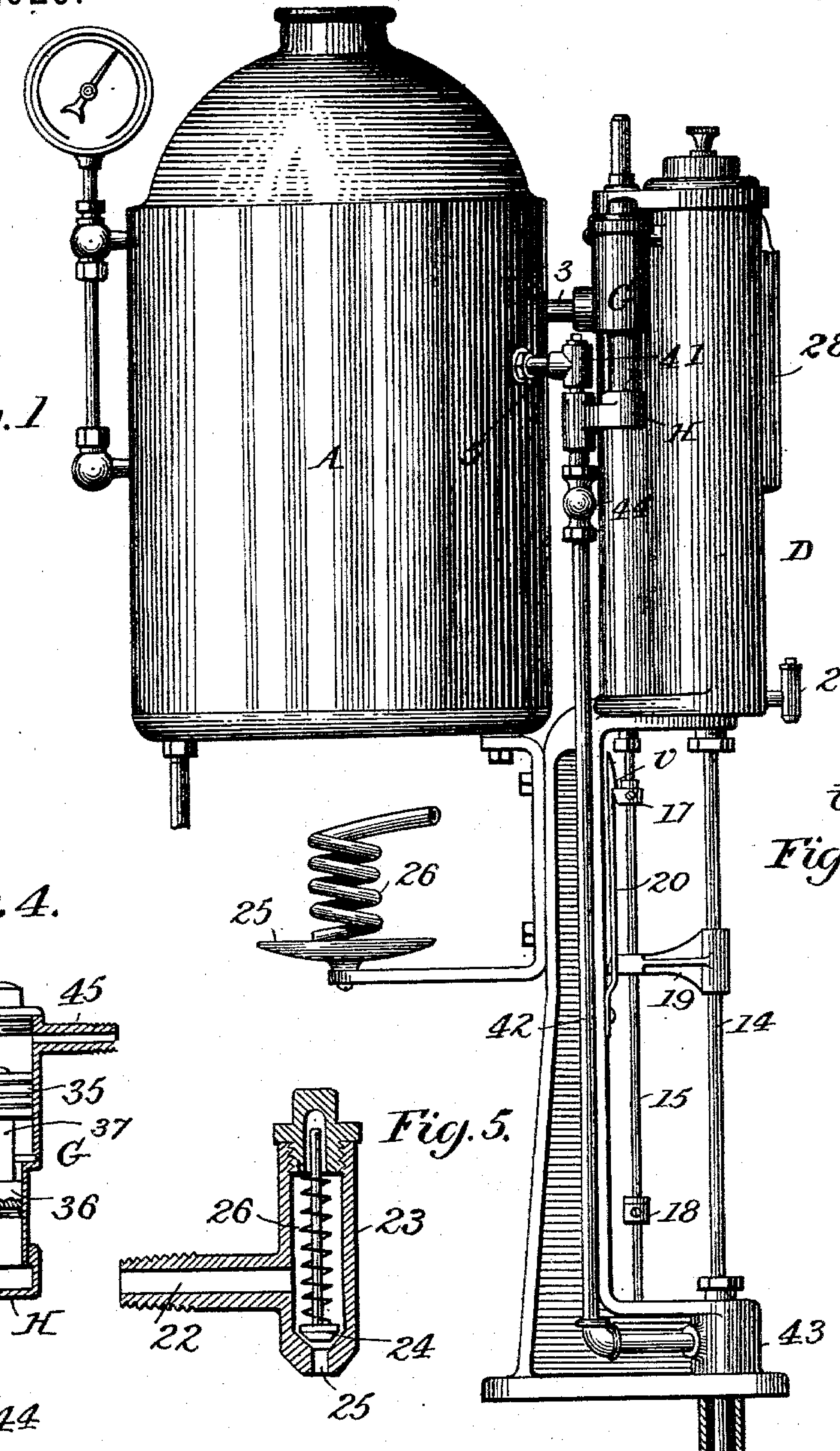


Fig. 7.

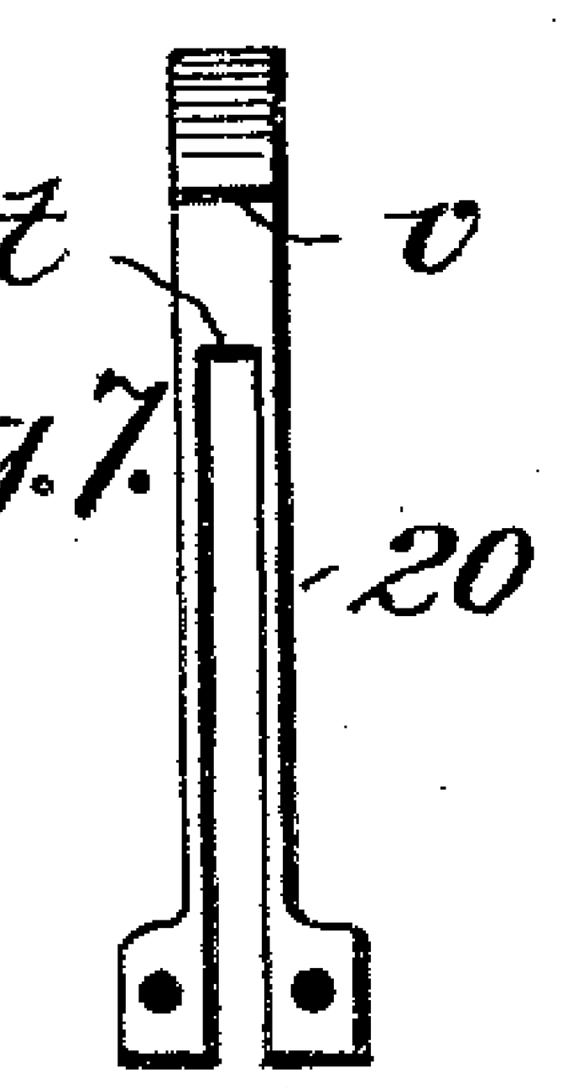


Fig. 4.

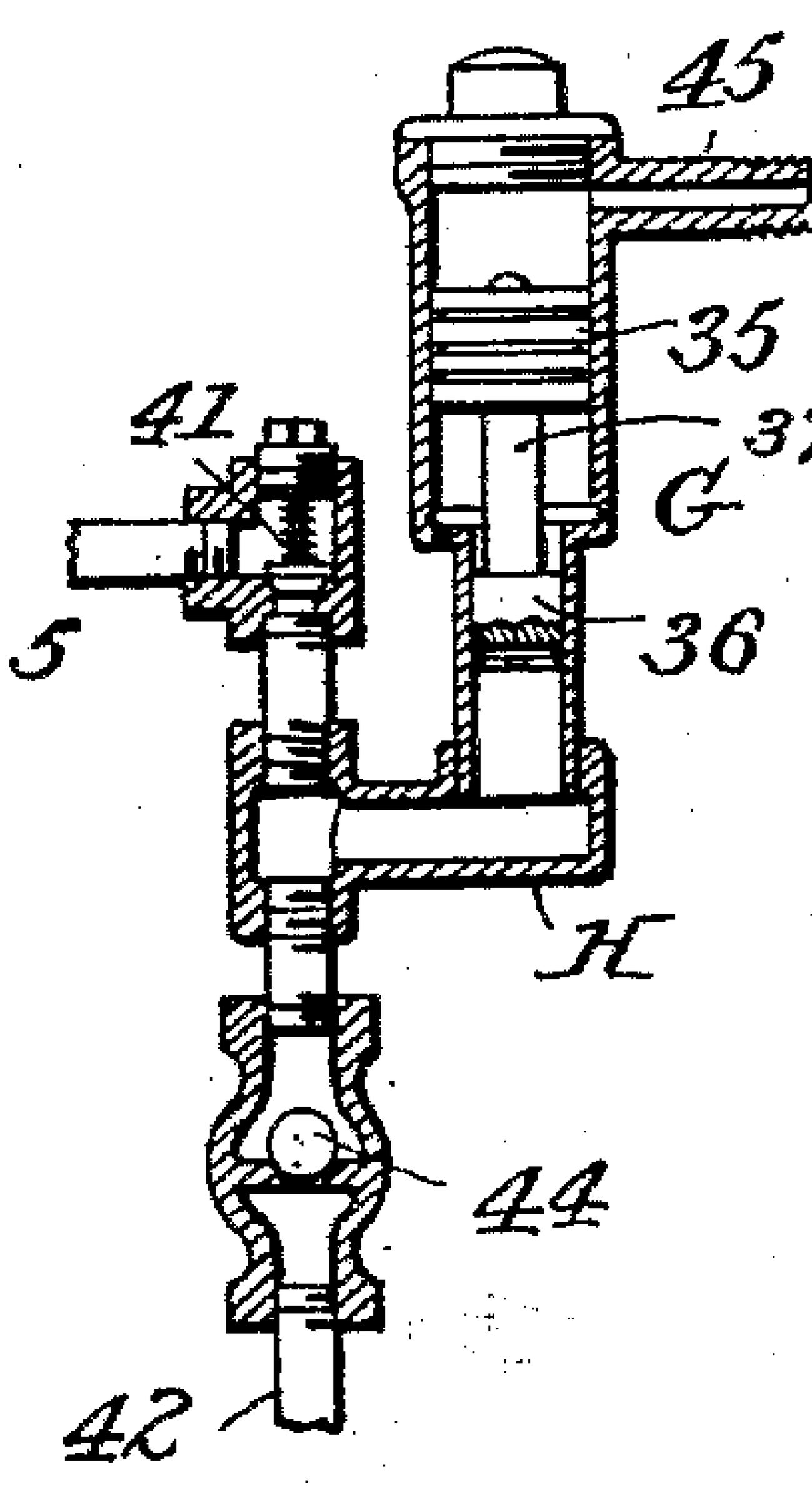
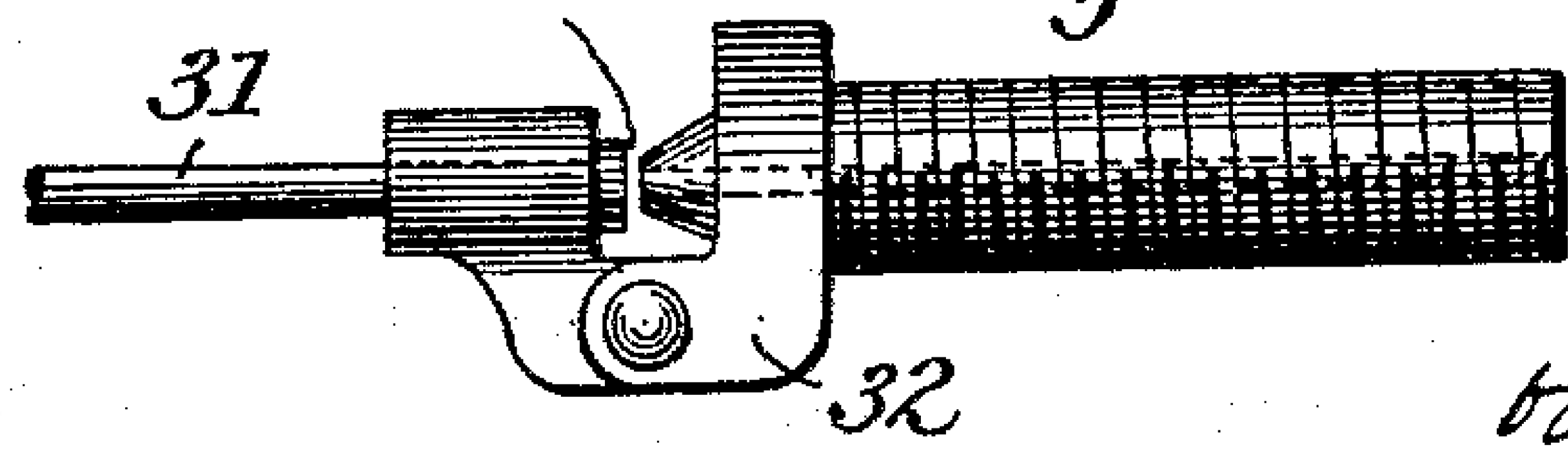


Fig. 6.



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 2.

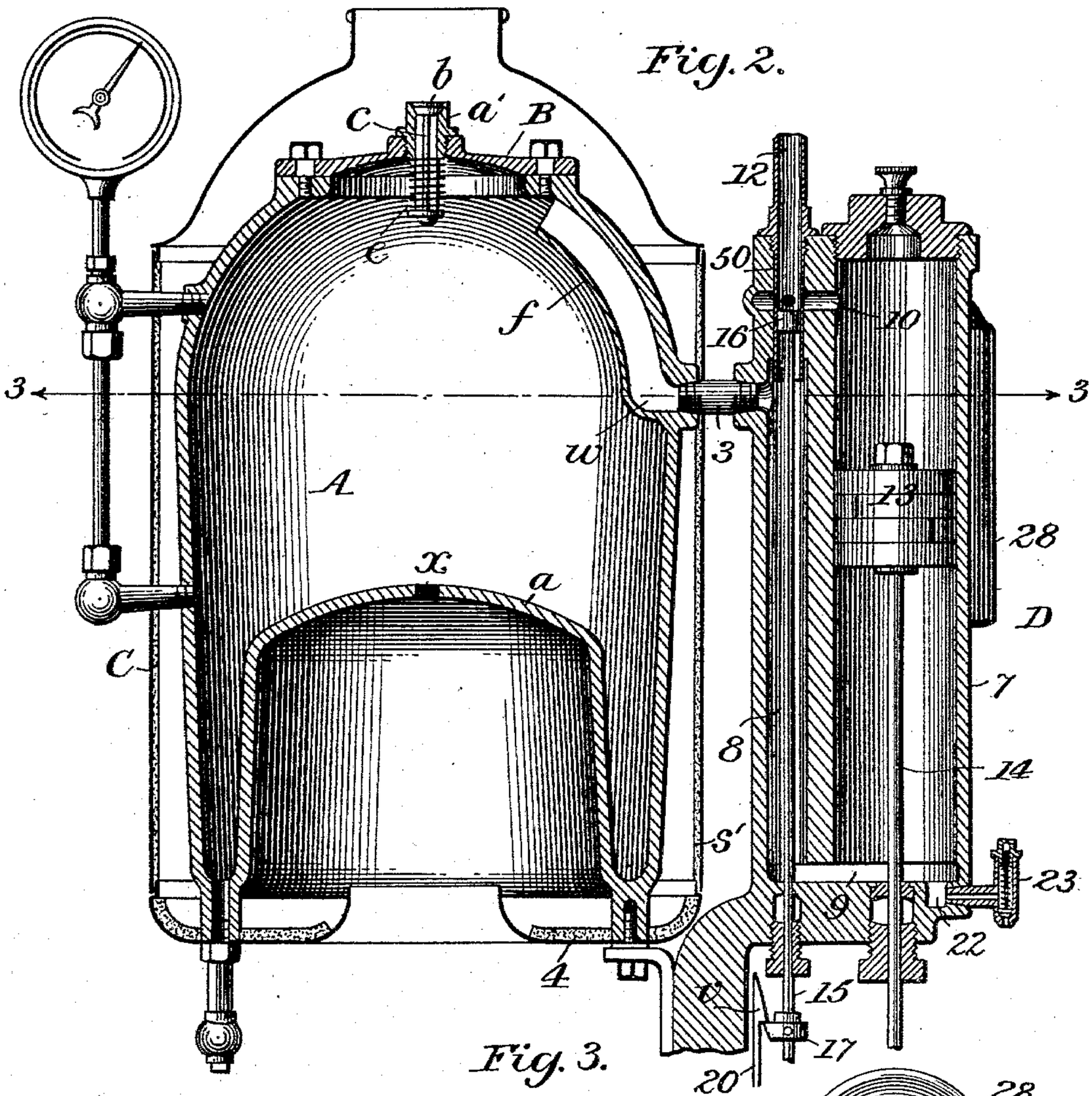
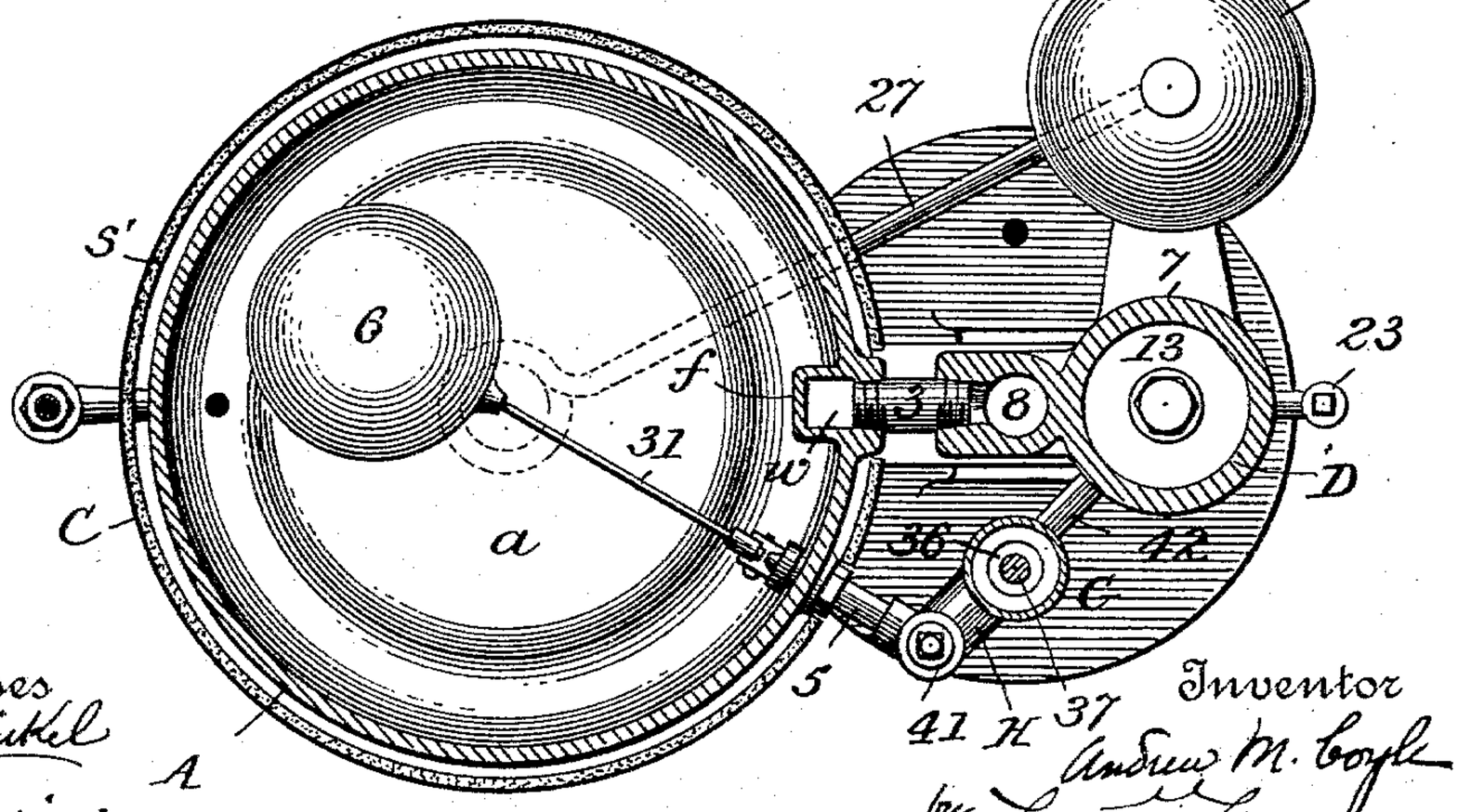


Fig. 3.



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UNITED STATES PATENT OFFICE.

ANDREW M. COYLE, OF WASHINGTON, DISTRICT OF COLUMBIA.

PUMPING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 548,629, dated October 29, 1895.

Application filed January 24, 1895. Serial No. 536,095. (No model.)

To all whom it may concern:

Be it known that I, ANDREW M. COYLE, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Pumping Apparatus, of which the following is a specification.

My invention relates to a pumping apparatus which is intended to be of an extremely simple character, so as to take the place of windmills upon farms; and my invention consists of an engine and boiler the parts of which are constructed and arranged so as to be put in operation and maintained in action by the use of unskilled labor, so as to be cheap in construction, to answer as a substitute for the ordinary windmill, and economical to operate; and to this end I construct the parts as fully set forth hereinafter, and illustrated in the accompanying drawings, in which—

Figure 1 is an external elevation of my improved pumping apparatus. Fig. 2 is an enlarged sectional view of the boiler and engine. Fig. 3 is a transverse section on the line 3 3, Fig. 2; Fig. 4, an enlarged sectional view of the pump for feeding the boiler; Fig. 5, an enlarged sectional view of the outlet-valve; Fig. 6, an enlarged view illustrating the supply-valve; Fig. 7, a face view of the detent-spring.

The boiler A is supported by a bracket above at one side of a standard and is of cast metal, preferably with a dome or hollow annular portion below the bottom *a*, in which there is an opening containing a fusible plug *x*, which will melt and permit the escape of the water and extinguish the flame should the boiler get too hot from any cause.

The upper portion of the boiler is preferably dome-shaped, with a cap B bolted to a flange around a central opening, and in the center of the cap is a threaded opening to receive a nipple *a*, having an opening and valve-seat, to which is fitted a valve *b*, the stem *c* of the valve extending downward and having a nut between which and the cap *a* is a spring *e* of sufficient tension to resist ordinary pressures, but permit the valve to rise and act as a safety-valve should the pressure be excessive. A deflector-plate *f* prevents the passage of water to the outlet-opening *w* of the boiler, with which communicates the outlet steam-pipe 3.

By arranging the outlet-opening at one side of the dome with the deflecting plate *f*, ample steam-space is secured, while a direct connection may be had with the side opening of the engine, which can be arranged closely at one side of the boiler and as low as desired.

The boiler is preferably provided with an ordinary steam and water gage and is surrounded by a casing C, having an internal lining *s'* of asbestos or other suitable refractory or non-conducting material, with a space between the outside of the boiler and the said casing, and at the lower end of the casing is an annular dished flange 4, constituting a part of the casing with an opening in the center, so that the flame which passes upward through the central opening and into the dome-like bottom of the boiler will also pass downward and upward between the boiler and the casing, thus heating the latter throughout its entire surface.

The contracted opening in the flange 4 causes the flame from the burner below to be drawn centrally into the opening with an aspirating action, causing the air to mix with the unconsumed gases, and insures a combustion of the latter.

The feed-water pipe 5 may communicate with the boiler at any desirable point and may be provided with a cock connected with an ordinary float 6, or the water may flow under direct pressure into the boiler or under the action of a pump, as described hereinafter.

By making the boiler of cast metal and surrounding it with a casing, forming a space entirely around the boiler, I am enabled, with a very cheap construction, to get such an extended heating surface as is necessary for the purpose for which this boiler is intended.

D is the engine, which is supported by the standard on the opposite side from the boiler, and which consists of a cylinder 7 and a circulating pipe or channel 8, which communicates with the steam-pipe 3, with the bottom of the cylinder through a port 9, and with the top of the cylinder through a port 10, the channel 8 also communicating with an exhaust-port 12 in line with the said channel. In the cylinder is a piston 13, connected with the rod 14, leading down to the pump-bucket within the well, or whatever it may be, and in the channel 8 is a valve of suit-

able construction. The steam from the boiler flows always to the bottom of the cylinder, so as to raise the piston 13 when the port 10 communicates with the exhaust, and when the bottom and top of the cylinder are in communication the steam can circulate from the bottom to the top and the piston and pump-rod will descend by their weight, the upward motion of the piston expelling the steam from the exhaust-pipe 12. By thus circulating the steam from the bottom to the top during the downward motion I secure a slight buffing action, which prevents the racking of the engine, and I maintain the cylinder in a heated condition, which tends to prevent condensation and loss of power, and I also simplify the construction of the engine very materially.

While any suitable valve arrangement may be employed, that which is shown is exceedingly simple and cheap, and consists of a valve-rod 15, supported to slide in suitable bearings and carrying a piston-valve 16 in such position that it will cross the port 10, rising above the port when the steam is to circulate to permit the descent of the piston 13, and descending below the port 10 when the steam is to escape from the upper part of the cylinder to the exhaust-pipe 12. This valve-rod 13 is preferably operated by tappets. As shown, there are two tappets 17 18, and from the pump-rod 14 extends an arm 19 with a beveled end, and a forked spring 20 has a shoulder V, which engages the upper tappet 17 when the latter is at the lower limit of its motion, the shoulder on the spring having an inclined face above it adapted to engage an inclined face of the tappet 17 when the latter descends, so as thereby to permit the spring to be forced back until the two shoulders of the spring and the tappet pass each other, when the spring will spring to the position shown in the drawings, engage the tappet 17, and act as a detent to prevent the upward movement of the valve-spindle and the valve. As thus constructed, the steam passes to the channel 8, and pressing upon the lower face of the valve 16, tends to lift the latter, but the spring-detent holds it in place. When the piston 13 approaches the upper limit of its movement, the arm 19 bears with its beveled end against a shoulder *t* of the spring 20 and forces the latter back until the shoulder *v* thereof disengages from the shoulder of the tappet 17, when the steam-pressure will lift the valve 16 above the port 10, and the piston 13 will then descend. As the piston 13 reaches the lower limit of its movement, the arm 9 is brought in contact with the lower tappet 18 and forces down the valve-spindle and valve to the position shown in the drawings, when the spring 20 moves forward and engages the tappet 17 and holds the parts in place. These movements will be repeated in constant succession, thereby maintaining a continous operation of the piston.

The cylinder may be provided with a drip-outlet 22, communicating with a casing 23, containing a valve 24, closing an outlet-opening 25, a light spring holding the valve normally in an open position, so as to permit the escape of water, yielding readily when there is a slight increase of pressure, so as to bring the valve to its seat and close the outlet port whenever there is any steam-pressure in the cylinder.

The engine above described is intended for use upon farms and other places as a substitute for windmills ordinarily employed, and for such purpose it is exceedingly desirable that it shall readily be put into and out of operation and operated at a comparatively slight expense; and I therefore provide means for heating the boiler by a volatile fluid—as, for instance, naphtha or coal-oil. Any suitable form of liquid-fuel burner may be employed. As shown, there is a cup 25 arranged below a spiral pipe 26, supported by the standard, communicating with a pipe 27, leading to a reservoir 28, of any suitable construction and containing the liquid fuel. In most instances a sufficient amount of fuel is placed in the reservoir 28 to run the pump for a desired definite length of time—as, for instance, one or two quarts or more, according to the size of the engine—and after this is done the liquid is ignited adjacent to the coil, which soon becomes heated, so that the liquid is volatilized. The gas issues from the bottom of the coil as a flame, which passes upward into the dome-like bottom of the boiler and around between the outside of the same and its casing. This condition will continue and the pump will continue in operation until the fuel is exhausted, when the pump will stop. Therefore, by regulating the quantity of oil put in the reservoir, the apparatus may be set for operating any desired length of time and then left without further attention to perform its functions.

Whenever there is such a condensation either in the cylinder or in the boiler that the pressure therein is less than that of the atmosphere, the outlet-drip spring will readily rise at once and permit the air to pass in, preventing a vacuum and also drawing any water which is in the bottom of the cylinder back into the boiler.

The water-feed valve may be of any suitable construction. As shown, the float 6 is connected with a rod 31, pivoted to a bracket 32, and the end of the rod forms a valve-seat 33, which closes against the end of the water-inlet pipe 5, the latter being threaded to extend through the casing and the bracket 32 being cast as a part of the pipe 5.

While any suitable form of feed-pump may be employed to supply the boiler, I prefer to make use of a casing G, containing a piston 35 of a greater diameter than a connected piston 36 upon the end of a rod 37. The casing G communicates with another casing H, having two ports, one communicating with the pipe 5, leading to the boiler and containing a check-valve 41, and the other communicating through a pipe 42 with the interior of

the closed cap 43 of the pump, there being a check-valve 44 in this line of pipe. The upper end of the casing G communicates through a pipe 45 with the channel 8.

When the valve 16 is above the port 10 the steam passing through the pipe 45 and pressing upon the top of the piston 35 will force it down with the piston 36, and when the valve 16 is below the port 10 the main piston will be lifted, raising the water in the well, and a portion of water will pass from the cap of the pump upward through the pipe 42 and, pressing against the piston 36, will lift the piston 35, the steam above the piston 35 exhausting, there being practically no resistance at this time. When the pipe 45 is again put in communication with the port 10, with the valve 16 above said port, the steam will press upon the top of the piston 35 and force down the piston 36 and force the water past the check-valve 41 and through the pipe 5 to the boiler. The pump G, therefore, is operated, in fact, by the valve 16 opening and closing the port 10 and exhaust-pipe 12, so that a single valve controls the flow from the pump as well as the flow from the main cylinder.

In order to avoid the expense of boring out the casting, I prefer to put a sleeve or lining 50 in the upper part of the channel 8, which constitutes a cylinder or lining in which the valve 10 may slide without any other nice fitting of the parts.

As the engine and boiler, with its burner, are all supported at the top of the standard, easy access to and below all the parts is secured.

Without limiting myself to the precise constructions and arrangements of parts shown, I claim as my invention—

1. A combined pump and boiler having a standard with a bracket at one side supporting a pumping engine, a bracket at the opposite side serving as a rest for a boiler, and a support for a burner below the boiler, substantially as described.

2. The combination of the boiler having a dome-like bottom, a surrounding casing having an annular flange at the lower end and a space between the casing and the boiler and supported by a standard in an elevated position, and a burner below the central opening of the casing also supported by the standard, substantially as set forth.

3. The combination with the boiler of an engine having a channel at one side communicating with upper and lower ports and in constant communication with the latter, an exhaust port communicating with the upper port, a port for communicating with the boiler below the exhaust port, and a valve arranged to close the opening between the exhaust port and the steam inlet port in one position and between the exhaust port and the exhaust pipe in the other position and means for operating the valve from the piston-rod, substantially as set forth.

4. The combination in an engine, of a cylinder having a piston, a channel at one side of the cylinder, ports 9 and 10 communicating with the cylinder at opposite ends and with the said channel, the port 9 being in constant communication with the channel, a steam pipe communicating with the channel between the ports 9 and 10, and a piston valve sliding in said channel across the port 10, substantially as described.

5. The combination in an engine, of a cylinder having a piston, a channel, ports connecting the channel and cylinder at opposite ends, one of the ports being in constant communication with the channel, an exhaust port, an inlet between the communicating ports, a valve in said channel controlling one of the ports, and means for carrying the valve in the same direction as the piston at each movement, substantially as described.

6. The combination with the engine, its piston and piston rod and valve in a casing to which steam is admitted to normally lift the valve, of tappets upon the valve rod, a spring engaging one of the tappets and an arm upon the piston rod arranged to force back the spring as the piston reaches the position into which it is carried by the steam pressure, substantially as set forth.

7. The combination of a boiler, an engine communicating therewith, a valve controlling the flow of steam to and from the cylinder of the engine, a water supply pump for the boiler and connections whereby the said valve controls the flow of steam to the said water supply pump, substantially as set forth.

8. The combination with the valve of an engine and with the boiler supplying steam thereto, of a valve rod provided with tappets, a detent for engaging one of the tappets, a projection upon the piston rod of the engine arranged to engage the said detent, and a water-supply pump communicating with the port controlled by the said valve, substantially as set forth.

9. An engine provided with a piston, piston rod, and port 10, and valve in a casing to which steam is admitted to normally lift the valve for putting the said port alternately in connection with the exhaust and with the steam port or channel of the engine, a valve rod extending from the said valve and provided with tappets, a detent for engaging one of the tappets, and an arm upon the piston rod arranged to engage the detent to release the tappet when the piston reaches the limit of its movement under the pressure of the steam, substantially as set forth.

10. The combination with a boiler and engine, of a pump casing G having pistons of different diameters, a pipe forming a communication between the upper part of the said casing, and a port 10 which constitutes a steam and exhaust port for the engine, and inlet and outlet pipes provided with check valves and communicating with the lower

part of the casing, the inlet pipe communicating with a water supply under pressure, substantially as and for the purpose set forth.

11. The combination of a boiler engine having a valve main pump and a feed pump provided with a piston and cylinder, the latter communicating with a passage controlled by said valve, and also with pipes leading to the casing of the main pump and to the boiler, provided with check valves, substantially as described.

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

ANDREW M. COYLE.

Witnesses:

G. P. KRAMER,

I. A. FAIRGRIEVE.