No. 772,419. PATENTED OCT. 18, 1904.

H. LEMP.

CONTROLLING MECHANISM FOR FLASH BOILER SYSTEMS.

APPLICATION FILED OCT. 2, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

Fig. 1.

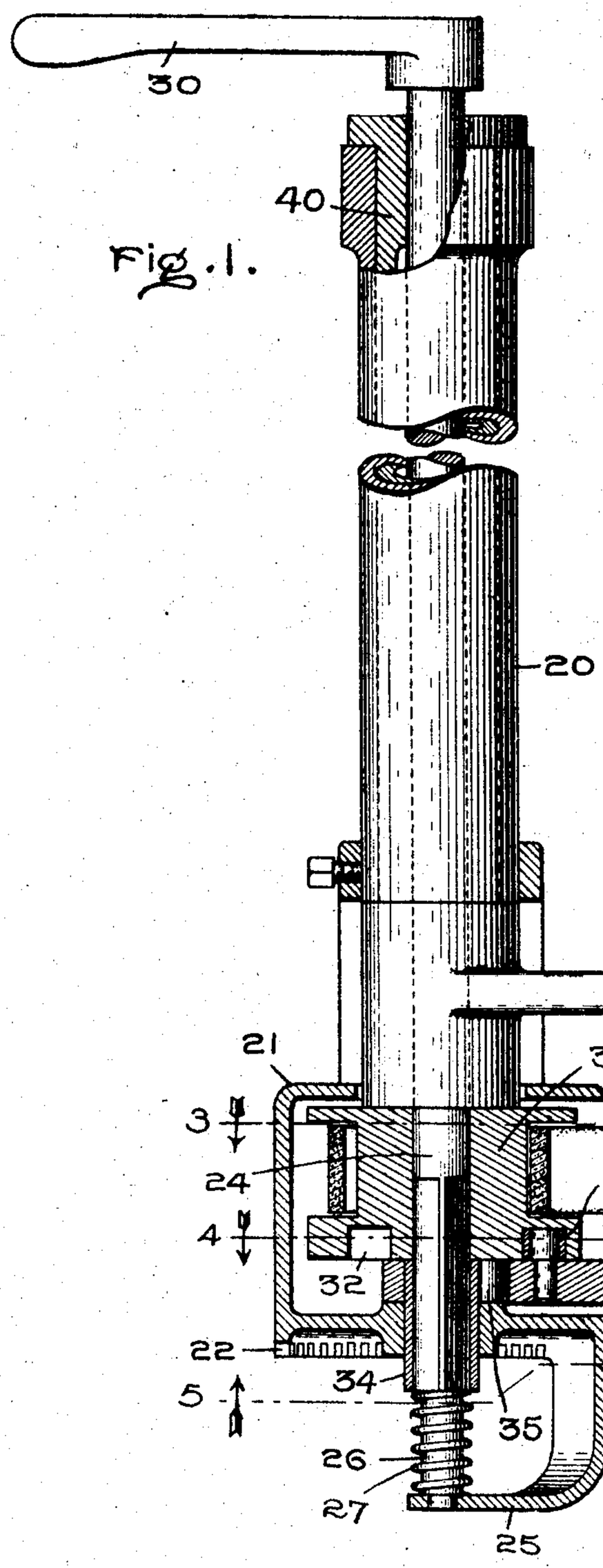
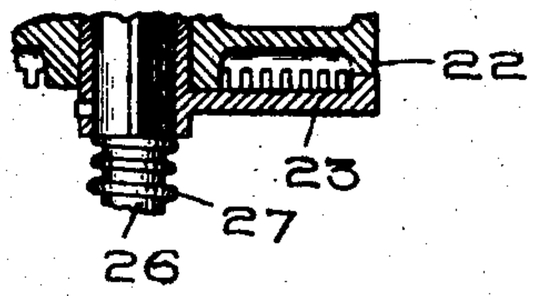


Fig. 2.



Witnesses:
Marcus L. Byng.
Alex. F. Macdonald.

Inventor:
Hermann Lemp,
By Albert G. Davis
Atty.

No. 772,419. PATENTED OCT. 18, 1904.

H. LEMP.

CONTROLLING MECHANISM FOR FLASH BOILER SYSTEMS.

APPLICATION FILED OCT. 2, 1902.

NO MODEL. 4 SHEETS—SHEET 2.

Fig. 3.

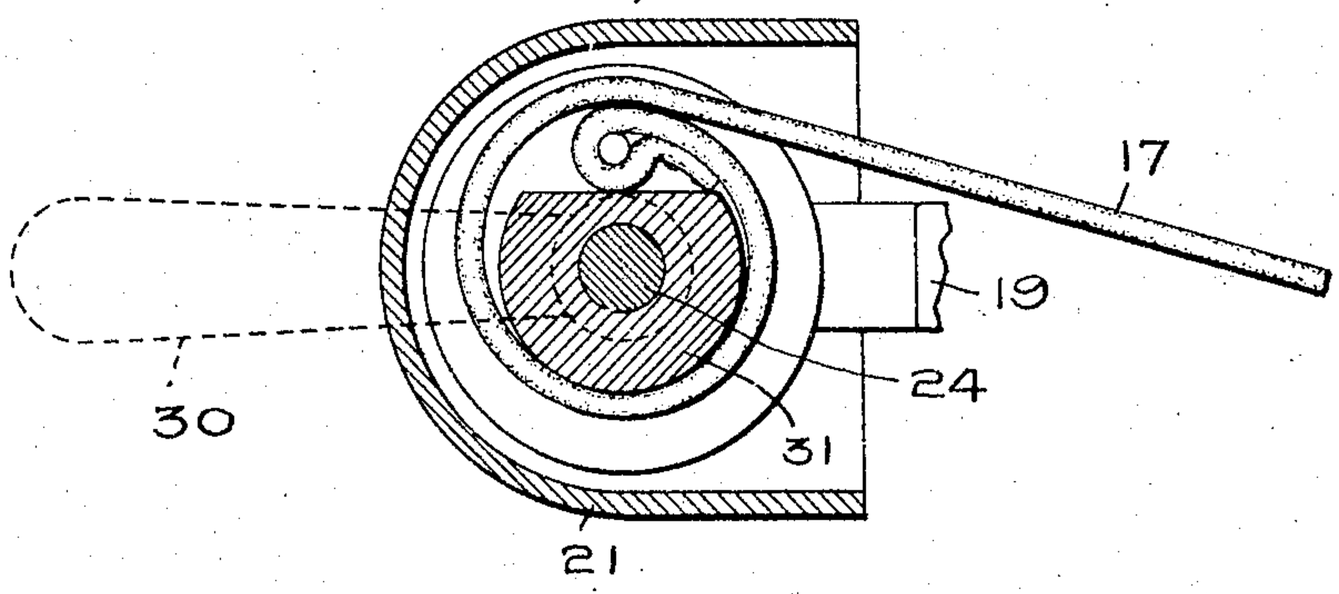


Fig. 4.

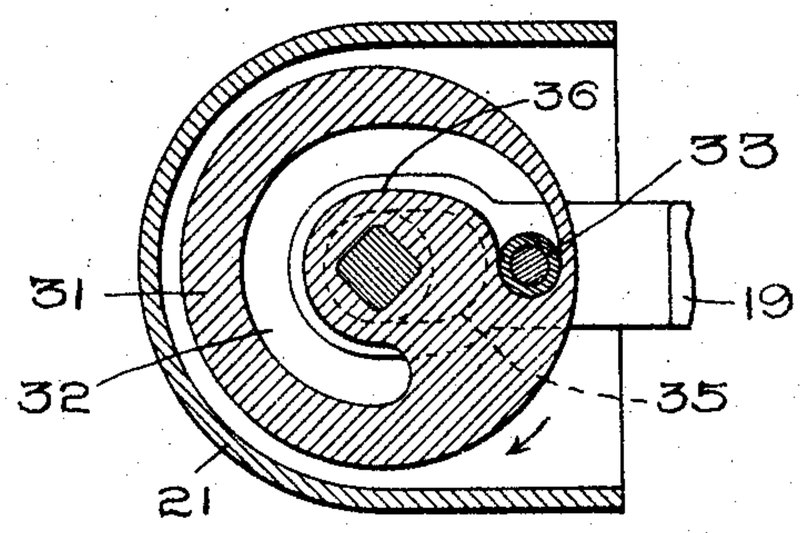
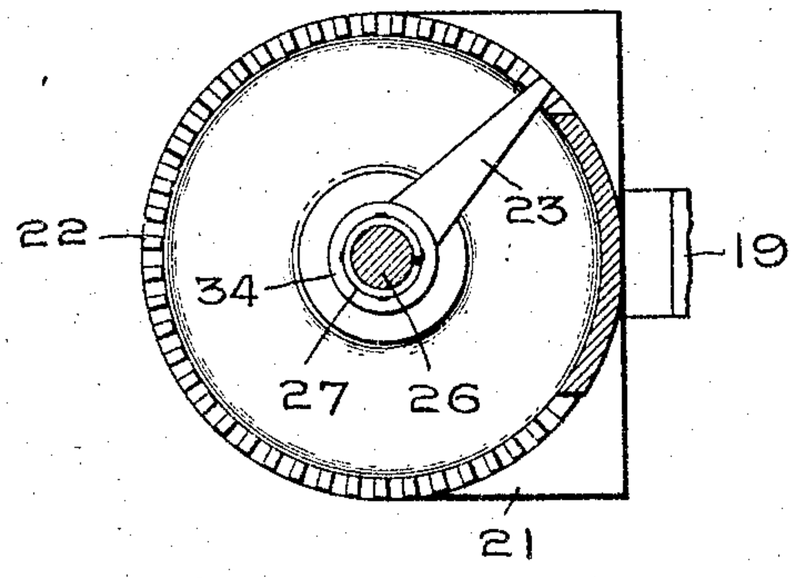


Fig. 5.



Witnesses:

Marcus L. Byng.

Alex. D. Macdonald

Inventor,
Hermann Lemp,
By Albert G. Davis
Att'y.

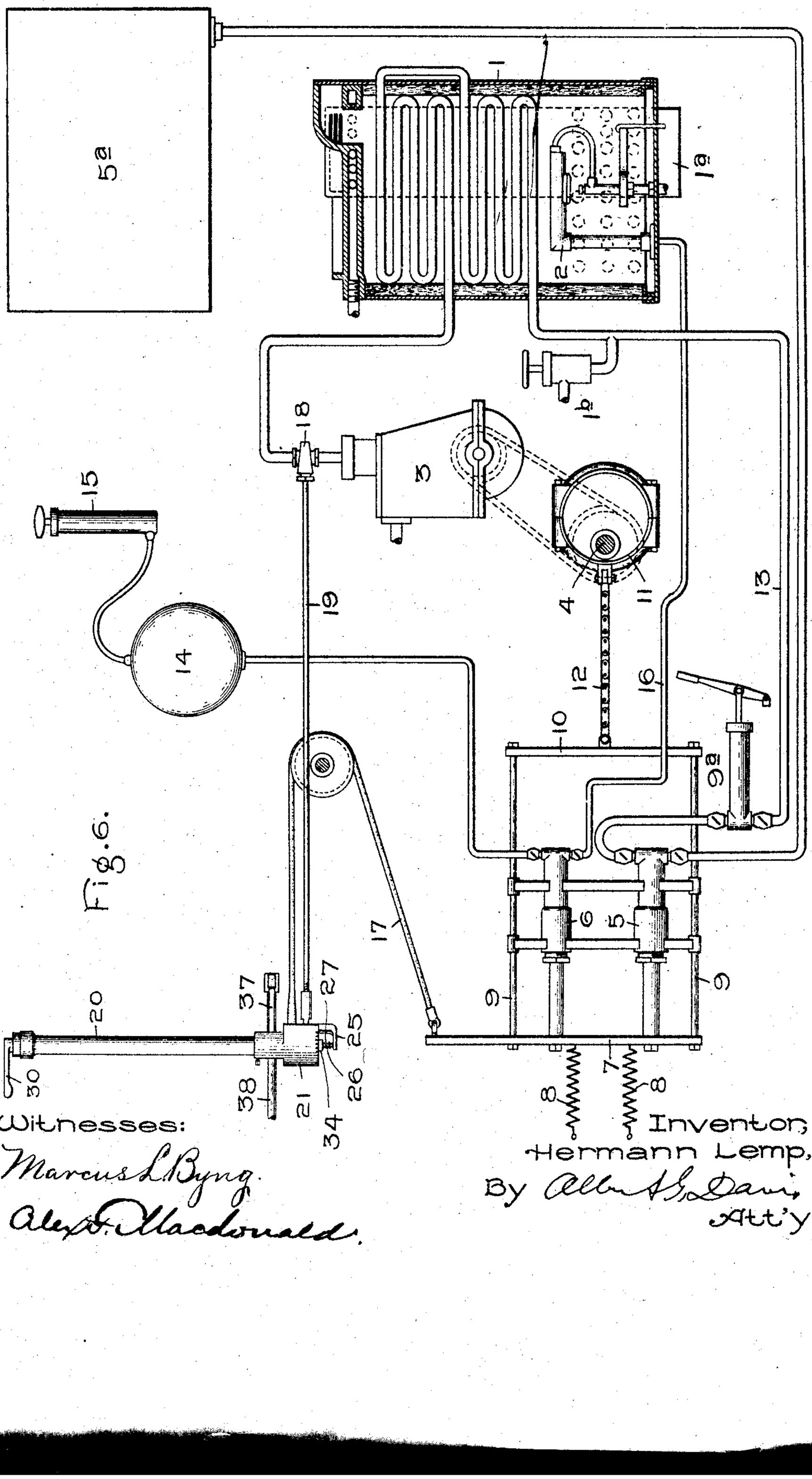
No. 772,419. PATENTED OCT. 18, 1904.

H. LEMP.

CONTROLLING MECHANISM FOR FLASH BOILER SYSTEMS.

APPLICATION FILED OCT. 2, 1902.

NO MODEL. 4 SHEETS—SHEET 3.



Witnesses:

Marcus L. Byng.

Alex. F. Macdonald.

Inventor,

Hermann Lemp,

By Allen A. Dame,

Att'y

No. 772,419. PATENTED OCT. 18, 1904.

H. LEMP.

CONTROLLING MECHANISM FOR FLASH BOILER SYSTEMS.

APPLICATION FILED OCT. 2, 1902.

NO MODEL. 4 SHEETS—SHEET 4.

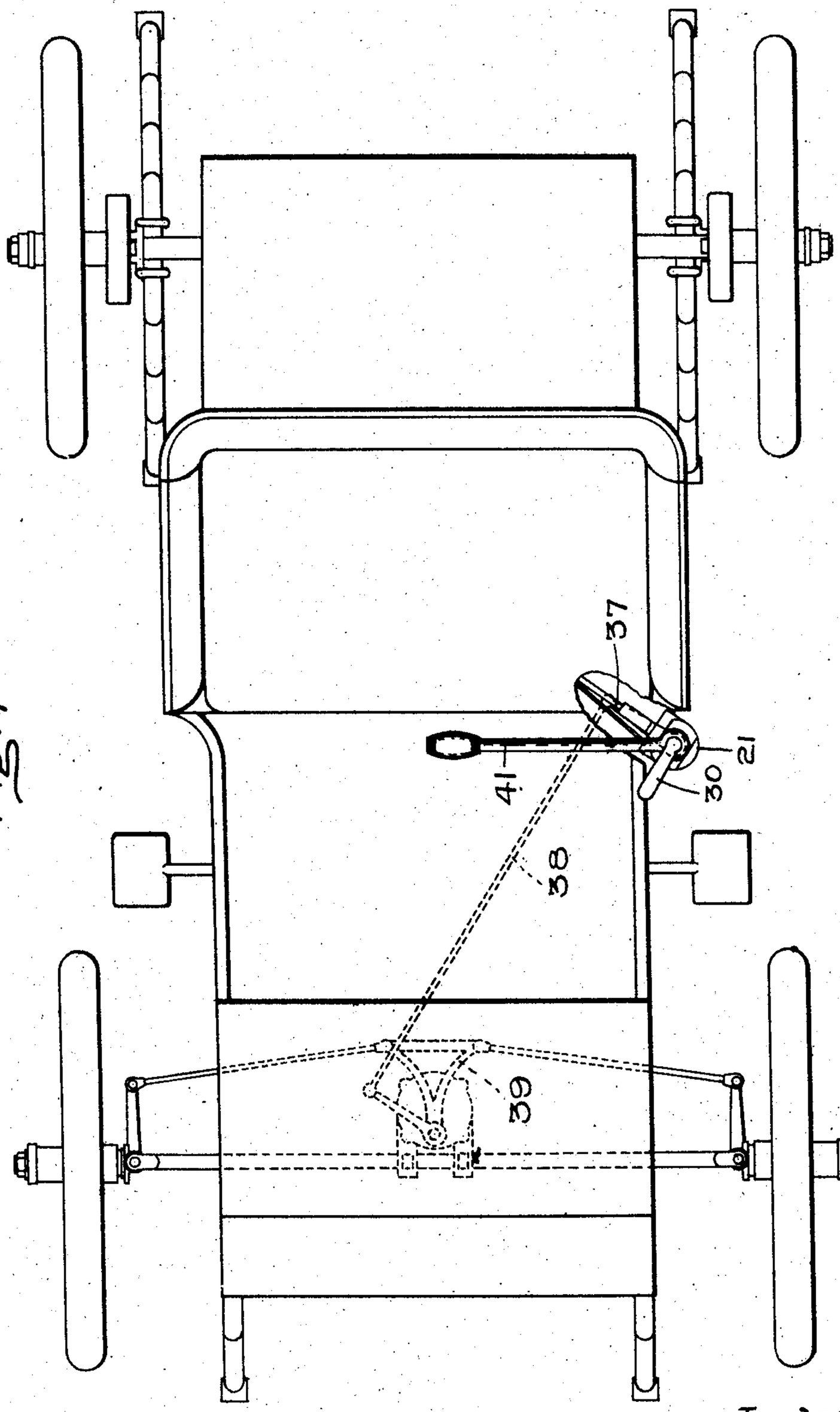


Fig. 7.

Witnesses:
Marcus L. Byng.
Alex. F. Macdonald.

Inventor;
Hermann Lemp,
By Albert G. Davis
Att'y.

No. 772,419. Patented October 18, 1904.

UNITED STATES PATENT OFFICE.

HERMANN LEMP, OF LYNN, MASSACHUSETTS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

CONTROLLING MECHANISM FOR FLASH-BOILER SYSTEMS.

SPECIFICATION forming part of Letters Patent No. 772,419, dated October 18, 1904.

Application filed October 2, 1902. Serial No. 125,668. (No model.)

To all whom it may concern:

Be it known that I, HERMANN LEMP, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Controlling Mechanisms for Flash-Boiler Systems, of which the following is a specification.

It has been proposed to operate flash-boiler systems employing hydrocarbon-burners with automatic water and fuel pumps the deliveries of which bear a definite relation to each other. In such systems hand-controlled means are sometimes provided to simultaneously regulate the effective deliveries of the pumps to compensate for changes in load on the automobile or other system with which the apparatus is used, and the speed of the engine is controlled by an independent and separately-acting throttle. From the foregoing it is evident that such an arrangement calls for two separate and distinct operations on the part of the operator. This is objectionable because the operator frequently forgets to adjust the apparatus to meet the new condition. For example, the throttle may be closed, or virtually so, as in coasting, and hence the engine will consume little or no steam, and with the pumps working at full stroke, or any material portion thereof, the supplies of water and fuel will be greatly in excess of the requirements. Ordinarily the boiler system is provided with a relief-valve which discharges back to the water-tank; but such an arrangement is unsatisfactory because it empties the boiler, and again the relief-valve is not intended as a regulator, and the continued action thereof or of any regulator similarly located causes the same to wear unnecessarily. Another objection is the disagreeable noise which is occasioned by the said action. Another great objection is the large amount of fuel which is wasted. If the operator was very careful to regulate the pumps each time the throttle was moved or at such times as was necessary, the above objection would not be so great; but unfortunately the average automobile is placed in the hands of relatively unskilled persons. Hence anything which tends to decrease the amount of thought required by the operator and the number of necessary actions in maneuvering is of great importance. Moreover, the system referred to calls for a separate operation either by the hand or foot, and in connection therewith it must be remembered that the operator is supposed to steer with one hand, actuate the throttle with the other, and apply the brake when necessary with one foot and possibly work a foot-pump with the other on special occasions.

The object of the present invention is to provide a controlling mechanism for the pumps and the engine which is so organized and arranged that both devices can be controlled by one handle, and this without thought on the part of the operator other than that required to control the speed of the engine.

A further object of my invention is to provide an organization wherein the power required to drive the fuel or water pumps, or both, is automatically varied as the demand for fuel and water changes.

The features which I consider to be novel and my invention will be more fully described and claimed hereinafter.

In the accompanying drawings, which illustrate one embodiment of my invention, Figure 1 is a side elevation of a controlling-stand with certain of the parts in section. Fig. 2 is a detail view showing the means for locking the actuating-lever in a given position. Fig. 3 is a section taken on line 3 3 of Fig. 1 looking in the direction of the arrow. Fig. 4 is a sectional view taken on line 4 4 of Fig. 1 looking in the direction of the arrow and showing the cam for operating the throttle-valve. Fig. 5 is a sectional view taken on line 5 5 of Fig. 1 and shows the means for locking the various parts in a given position. Fig. 6 is a diagrammatic illustration of a flash-boiler system arranged for operation with the controlling mechanism previously referred to, and Fig. 7 is a plan view of a vehicle.

Referring first to Fig. 6, a general idea will be given of the necessary requirements for the controlling mechanism. 1 represents a flash-boiler of any suitable construction wherein the water received from the pumps is converted into vapor and said vapor superheated to the desired degree. I may, however, operate my system with steam having no superheat or the steam may be superheated to a high degree. 2 represents a hydrocarbon-burner for heating the boiler, which is situated in a fire-chamber formed by the boiler-casing. Water enters the boiler-tube at the lower end, and after passing through a part of the coils enters a coil adjacent to the top of the boiler, and from this point the course of the water, saturated steam, or superheated steam is downward. Such an arrangement serves to protect the boiler-tubes and also furnishes steam at the required temperature and pressure. In the water-supply pipe is a relief-valve 1^b, which is preferably piped to the water-tank. Air is admitted to the fire-chamber through suitable openings. (Shown in dotted lines.) Connected to the boiler is an engine 3, of any approved construction, which is connected by a chain or other suitable driving mechanism with the power-shaft 4. The exhaust from the engine is conveyed to the chamber formed in the top of the boiler-casing, where it is reheated and employed to create a forced draft in the downwardly-opening flue 1^a. I have shown an engine as the motor; but my invention in its broadest aspects embraces other forms of motive devices. The power-shaft may be the shaft that propels the vehicle or it may be a counter-shaft employed only to actuate the pumps. In certain broad aspects my invention contemplates the use of a motor and a pump which are not mutually dependent upon each other, with a single controlling device for regulating the speed of the motor and the effective delivery of the pump. In order to supply water to the boiler and fuel to the burner, power-pumps 5 and 6 are provided. These pumps are so proportioned that their deliveries bear a fixed relation to each other. Hence any change in the stroke of one of them produces a corresponding change in stroke of the other. The pistons are connected together by a cross-head 7, which cross-head is connected to springs 8, that normally tend to withdraw the pistons from the cylinder. The cross-head is connected to the side rods 9, and the rods are connected at the opposite end by a cross-head 10. This cross-head 10 is connected with an eccentric-strap 11 by a flexible connection 12—such as a leather strap or a sprocket-chain, for example. The eccentric-strap is driven by an eccentric that is mounted on the driving-shaft 4. As the eccentric rotates it tends to move the pistons into the pump-cylinders, and the springs 8 tend to pull them out. The water-pump 5 is connected to the tank 5^a, and water is conveyed from the pump to the boiler by the pipe 13. Attention is particularly called to the fact that when the outward movement of the pump-pistons is limited by any means there will be a portion of each stroke of the eccentric which is doing no useful work. Hence the engine or other power-driven shaft is relieved of its load for a certain portion of each revolution. The shorter the movement of the pistons the greater will be the idle angular movement of the power-shaft, and the saving in energy is correspondingly increased.

The fuel-pump 6 is connected to the fuel-tank 14, which tank can be placed under an initial air-pressure by the air-pump 15. It is desirable to place the tank above the burner, so that fuel will flow to the latter by gravity. Fuel from the pump is delivered to the burner under increased pressure by the pipe 16. In the present illustration the pistons are the moving parts of the pumps and are adjustable; but it is obvious that this condition can be reversed and the pistons held stationary and the cylinders moved.

In order to vary the strokes of the pumps to compensate for changes in load on the engine or to compensate for changes in steam consumption due to variations in the grade or load on the vehicle, an adjustable abutment or back-stop 17 is provided for the pumps. I may employ separate abutments for the pump-pistons instead of one if for any reason it is desirable. In the present illustration the back-stop or abutment takes the form of a leather strap, one end of which is connected to the cross-head 7 and the other end to the controller, as will hereinafter appear. I have found it desirable to make this back-stop out of some flexible material, not only on account of its flexibility, but because it forms a yielding abutment, and thereby dispenses with the hammer-like blow which would be occasioned if the abutment was rigidly held in position. Winding up this strap decreases the length of the pump-stroke, and unwinding it increases the length of the stroke. The supply of steam to the engine is controlled by a throttle-valve 18, and to this valve is connected a rod 19, which is actuated by a cam on the controller, as will hereinafter appear.

For starting purposes or for assisting the power-pump on excessive overloads a manually-actuated water-pump 9^a is provided, which is connected into the water-service and is provided with suitable suction and delivery valves. The power-actuated and manually-actuated pumps are so arranged that they can be operated separately or simultaneously.

Referring now to Fig. 1, 20 represents a controller-casing which is suitably supported in the frame 21. The latter is designed to be bolted to a suitable part of the vehicle-body. The lower portion of the support is provided with a toothed ring-like projection 22, that is

arranged to receive the finger or arm 23, Figs. 2 and 5, that is carried by the actuating-shaft 24. In addition to this the support is provided with a curved arm 25, which forms the lower support for the vertically-extending stud 26. The stud enters the shaft 24 of the controller and forms a guide or bearing for the lower end. Situated between the arm 25 and the lower end of the shaft 24 is a coiled extension-spring 27, which tends at all times to raise the shaft 24 and force the locking-arm 23 into one of the notches formed in the ring 22. In order to release the finger 23 from the notches, it is necessary to force the shaft 24 as a whole downward, after which it can be moved to the right or left, as the occasion demands. Secured to the back of the curved arm is a lug 28, and to this lug is pivotally secured a stay-rod 29, the latter being connected to the throttle-valve to hold it at a fixed distance from the controlling-stand.

The controlling stand or cylinder 20 is bored centrally to receive the shaft 24, the latter being squared at its lower end in order to prevent the locking arm or finger from turning thereon. The upper end of the shaft is provided with a controller handle or lever 30, which when the finger 23 is released can be swung to and fro as occasion demands to vary the steam admission to the engine. Mounted on the lower end of the shaft and prevented from turning thereon by the square surfaces is a winding-drum 31, and to this drum is secured one end of the flexible connection 17, that forms the adjustable abutment for the pumps. This is best shown in Fig. 3. On the lower face of the winding-drum is a cam-slot 32, Fig. 4, and with the slot engages a roller 33, that is carried by the throttle-actuating rod 19. The end of the rod has a loop which encircles the sleeve 34 and is guided in its longitudinal movements thereby, the slot 35 being of sufficient length to permit thereof.

Referring to Fig. 4, it will be seen that when the cam is rotated in the direction of the arrow it will, until the point 36 reaches the cam-roller, impart longitudinal movement to the rod 19, that actuates the throttle-valve, after which the working surface of the cam is concentric with its center of motion. Hence the throttle-valve will remain in a fixed position during this portion of the movement of the cam. In other words, the flexible connection 17 is directly connected to the controller, while the rod 19 is connected through a lost-motion device. As the parts are arranged the throttle-valve 18 on the engine is closed, and between the time the cam leaves the position shown and the time the point 36 engages with the roller the throttle-valve is moving from "off" to "full on." When the throttle-valve is closed, the pump-pistons are moved by the adjustable abutment 17 to a point where they are inoperative. As the controlling-lever is moved from off to the full on position of the throttle-lever they begin to move with short stroke at first, but gradually increasing in length as the handle is rotated. After the cam-roller engages with the concentric portion of the cam the throttle-valve no longer operates; but the continued movement of the controlling-lever causes the strokes of the pumps to be correspondingly and simultaneously increased. When the roller 33 reaches the end of the cam-slot, the pumps will be working at full stroke and the throttle will be admitting the maximum amount of steam to the engine.

From the foregoing it will be seen that the first movement of the controller-lever admits steam to the engine, after which it withdraws the back-stop from the pump-pistons so that the eccentric on the power-shaft 4 can operate them. On the other hand, when the controlling-lever is in the full-on position, the first portion of its movement toward the off position gradually cuts down the strokes of the pump and finally decreases the amount of steam being admitted to the engine. With a flash-boiler system the supply of steam is, so to speak, from hand to mouth, and the water that is delivered to the boiler is instantly flashed into steam and superheated to a greater or less degree. Hence any slight variation in the amount of water delivered to the boiler correspondingly affects the operation of the system. The supplies of water and fuel must be so correlated that steam under the proper pressure and temperature will be supplied at all times. Such a condition is fulfilled by the improved mechanism described.

It will be noted that the springs 8 are pulling to a greater or less extent upon the adjustable abutment 17 at all times, and it is on account of this feature that the locking devices pressing against the engine-spring 22 and the arm 23 is provided. In operating the lever the handle is first depressed by an amount sufficient to move the arm out of engagement with the notches, after which it can be turned to the right or left, as occasion demands. As soon as the downward pressure is relieved the coil compression-spring 26 will force the shaft 24 and the controlling-lever upward.

In order to steer the vehicle, a lever 37 is mounted on the controlling-stand, and to this are connected the wheels by means of a rod 38 and frame 39. The lever 37 is mounted on the lower end of the vertically-extending tube 40, and the latter is provided with a steering-lever 41, Fig. 7. The arrangement is such that the operations of the steering and speed controlling and regulating mechanism can take place without interfering with each other.

In accordance with the patent statutes I have described the apparatus which I now consider to be the best embodiment of my invention; but I do not desire to be understood as limiting myself to the precise construction shown, as it is merely illustrative, the inven-

tion being capable of being carried out by other and equivalent means.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In combination, a boiler, a motor, a pump, and a single controlling device which regulates the motor and also the effective delivery of the pump together at certain times and only the pump at other times.

2. In combination, a boiler, an engine, a throttle-valve, a pump, a controlling device, and means connecting the controlling device with the valve and pump for regulating both in unison at certain times and only the pump at other times.

3. In combination, a boiler, an engine, a pump driven thereby, a throttle-valve for the engine, means for regulating the effective delivery of the pump, and a single controlling device which actuates the valve and said means whereby the delivery of the pump varies directly as the valve varies the delivery of steam within a limited range and independently of the valve beyond said limited range.

4. In combination, an engine, a boiler for supplying vapor thereto, a pump for supplying liquid to the boiler, a valve for admitting vapor to the engine, a regulator for varying the effective delivery of the pump, and a manually-actuated device for regulating the action of the valve and the regulator within different ranges of regulation.

5. In combination, a motor, a pump driven thereby, a regulator for the motor, a regulator for the pump, and a single lever for operating the regulators simultaneously within a certain range of movement and for operating the pump-regulator independently beyond said range.

6. In combination, an engine, a throttle-valve therefor, a boiler for supplying vapor to the engine, a pump, a single operating-lever, and connections between the valve and pump and lever which are so arranged that the valve is relatively neutral during a certain range of regulation of the pump by the lever.

7. In combination, a boiler, a fire-chamber therefor, pumps for delivering liquid and fuel respectively to the boiler and fire-chamber in proportionate amounts, an engine, a throttle-valve, and a single-handle controller which actuates the throttle-valve and varies the action of the pumps in definite relation to the action of the throttle-valve under normal conditions of operation, and varies the action of the pumps independently of the throttle under abnormal conditions.

8. In combination, a boiler, a fire-chamber therefor, pumps for supplying liquid and fuel respectively to the boiler and fire-chamber, means whereby variable strokes can be imparted to the pumps, a throttle-valve, and a single controlling-lever connected with the valve and said means which is neutral in its action relative to the valve during a portion of its movement and operates said means throughout its entire movement.

9. In a motive device, a pump, a flexible driving connection between the pump and its driving-shaft, an adjustable stop for the moving part of the pump, and a single controlling mechanism for the motive device and the back-stop.

10. In combination, a boiler, a burner, pumps for water and fuel, an adjustable stop for the moving part of the pump, an engine, a throttle-valve, a cam for operating the valve, and a single lever for moving the stop and the cam.

11. In combination, a boiler, a pump, a means whereby the output of the pump can be adjusted, an engine, a throttle-valve therefor, a single handle for actuating the said means and the throttle-valve through their respective ranges of regulation in unequal intervals of time, and a lock for the handle.

12. In combination, a boiler, a pump, a spring tending to separate the piston and cylinder, an adjustable stop for the moving part of the pump, an engine, a throttle-valve, a single handle for operating the stop and throttle, and a lock for the said handle.

13. In a controller, a shaft, means for moving the shaft in one direction or the other, a drum carried thereby, a cam formed on the drum, and separate regulating devices connected with the cam and drum.

14. In a controlling-stand, the combination of a longitudinally-movable shaft, a revolving controlling member supporting the same, and a lock which is moved into and out of operation by the movements of said shaft.

15. In a controller, the combination of a shaft, a support therefor, a winding-drum, a cam formed thereon, a lever which is actuated by the cam, and a lock for holding the parts in a given position.

16. In a controller, the combination of a shaft, a support therefor, a winding-drum sleeved thereon, a connection movable independently of the shaft, a lever operated thereby, a notched plate, an arm carried by the shaft and arranged to be moved into and out of engagement with the notches in the plate as the shaft is moved longitudinally.

17. In combination, a pump, a valve, a manually-actuated means for varying the stroke of the pump, a tension device acting against the same, means for actuating the valve, and a lock which is common to both of said means.

18. In combination, a boiler, an engine, a throttle-valve, a pump, a regulator therefor, a single operating-handle for the valve and regulator, and a lost-motion connection between the handle and the valve.

19. In combination, a boiler, an engine, a

throttle-valve, a single-handle controller, a variable-stroke pump, a lost-motion connection between the valve and the handle, and a direct operative connection between the pump and the handle.

20. In combination, an engine, a boiler, a burner, fuel and water pumps, a controlling-stand, a flexible connection between the stand and the pumps, a throttle-valve for the engine, and a single handle which acts on the flexible connection and the valve.

In witness whereof I have hereunto set my hand this 26th day of September, 1902.

HERMANN LEMP.

Witnesses:
HENRY O. WESTENDARP,
DUGALD McK. McKILLOP.