G. C. G. GRAY.

AUTOMATIC BALANCE DRAFT APPLIANCE.

APPLICATION FILED MAY 6, 1907. RENEWED AUG. 27, 1910.

988,935.

Patented Apr. 4, 1911.

3 SHEETS—SHEET 1.

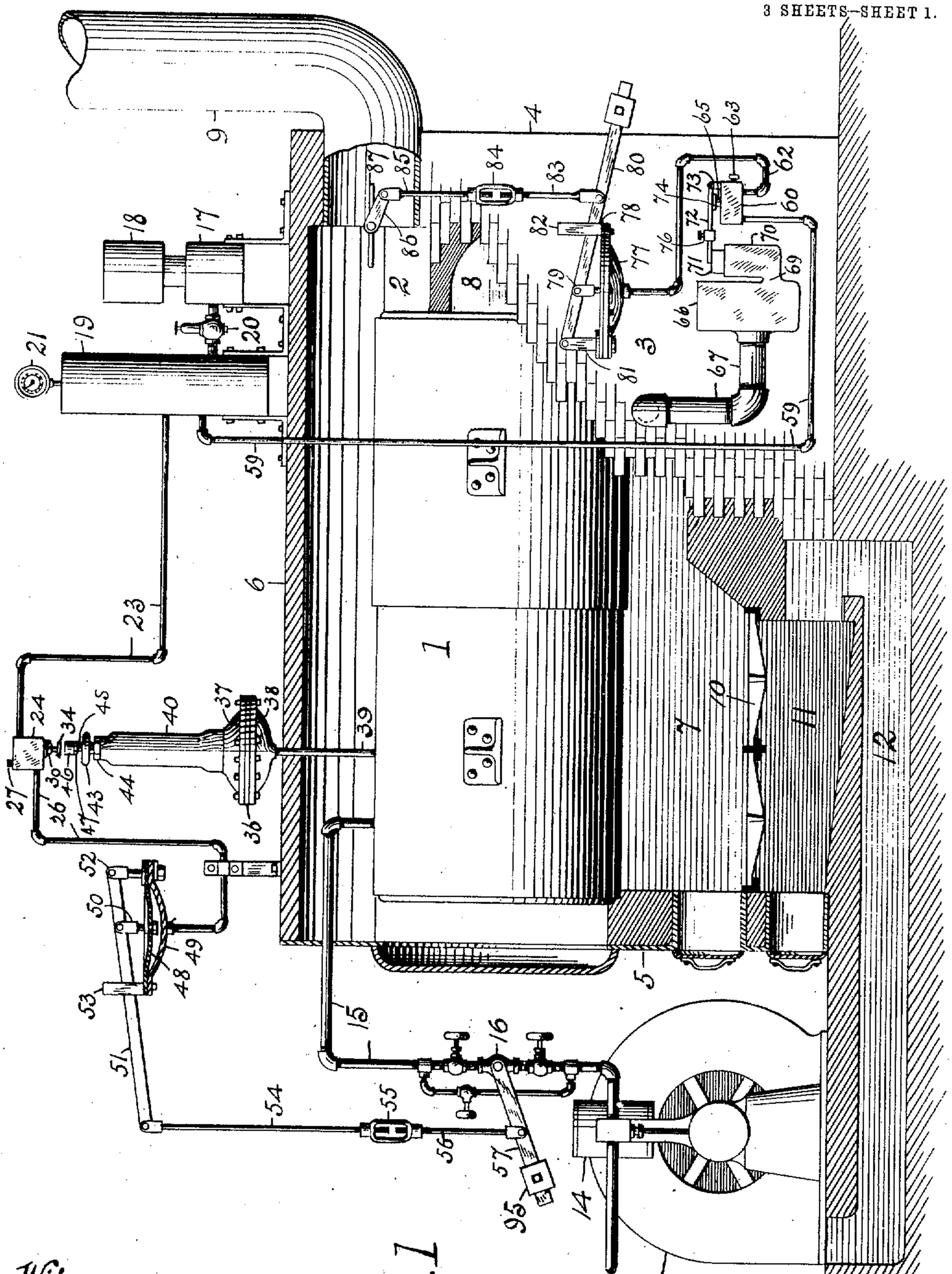

Fig. 1.

Witnesses.
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3 SHEETS—SHEET 2.

Fig. 3

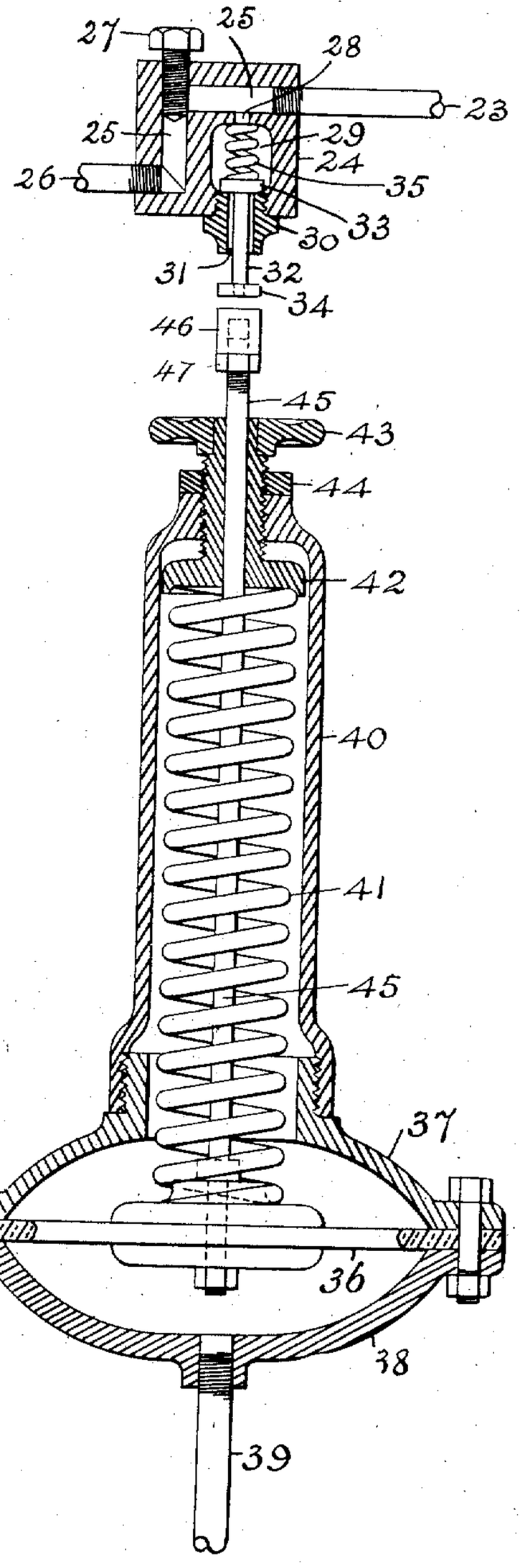

Fig 2

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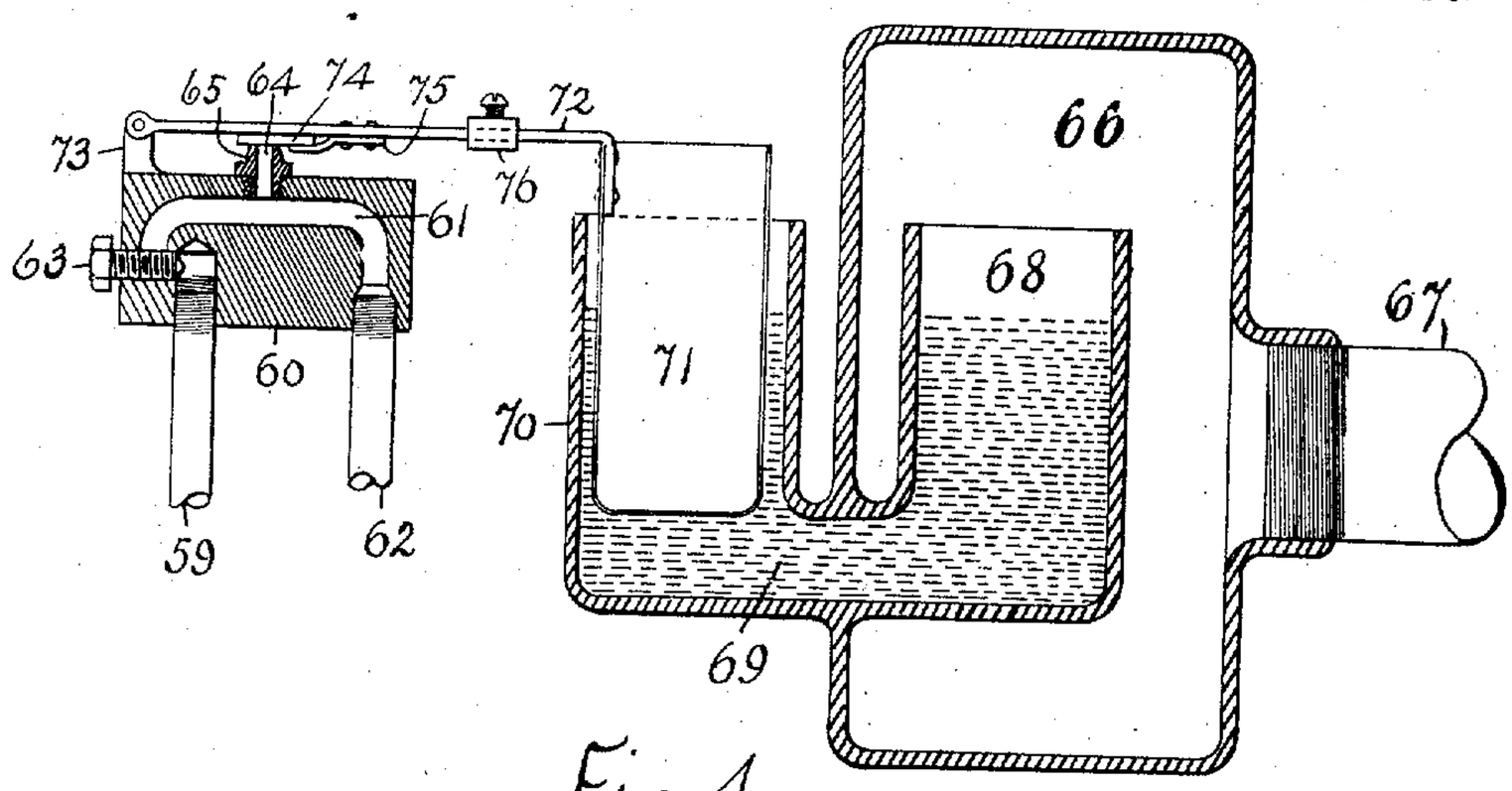

Fig. 4

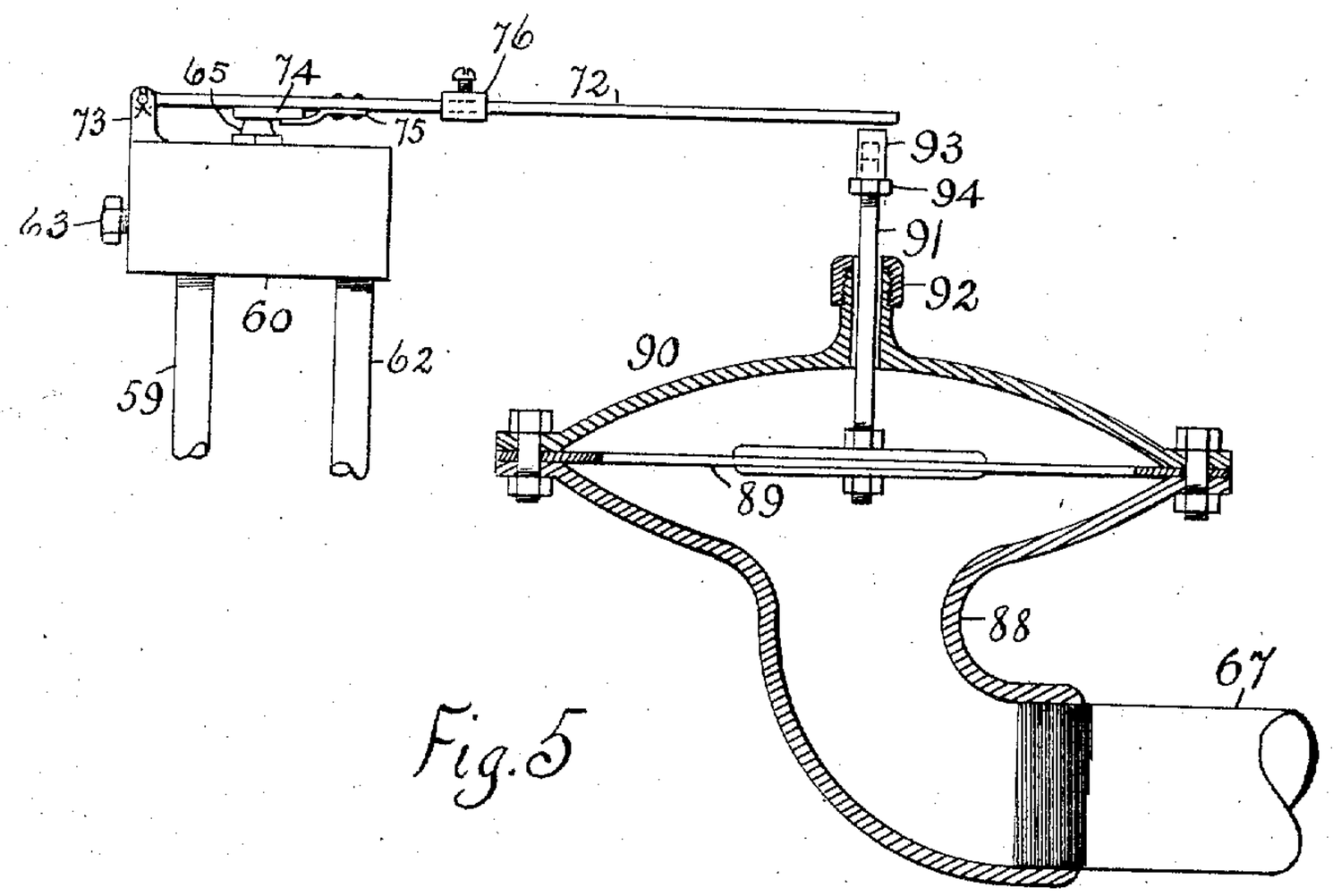

Fig. 5

Witnesses.
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UNITED STATES PATENT OFFICE.

GEORGE C. G. GRAY, OF BRYN MAWR, PENNSYLVANIA.

AUTOMATIC BALANCE-DRAFT APPLIANCE.

988,935. Specification of Letters Patent. **Patented Apr. 4, 1911.**

Application filed May 6, 1907, Serial No. 371,958. Renewed August 27, 1910. Serial No. 579,345.

To all whom it may concern:

Be it known that I, GEORGE C. G. GRAY, a subject of the King of Great Britain, residing at Bryn Mawr, in the county of Montgomery and State of Pennsylvania, have invented certain new and useful Improvements in Automatic Balance-Draft Appliances; of which the following is a specification.

The object of this invention is to automatically maintain a balanced draft for steam generators, such as boilers and heating plants; to automatically regulate a forced draft for a steam plant which shall be uniform in pressure, to thereby get the maximum efficiency of the fuel used, to prevent undue expansion and contraction of the boiler due to variations of temperature, and in general, to prolong the durability of the boiler and reduce to a minimum the employment of manual labor required for the production of an adequate and regular amount of power.

To the end sought there are coöperative devices employed to govern the incoming draft and the outgoing of the products of combustion which are fully set forth in the specification and pointed out in the claims.

The invention is illustrated in the accompanying drawings where similar reference characters indicate similar parts wherever employed, in which—

Figure 1 is a general view of one type of boiler with the coöperative devices in relative position, some of the parts being in section. Fig. 2 is a central vertical section of the steam pressure regulating valve. Fig. 3 is a central section of the bleeder valve for controlling the blower engine. Fig. 4 is a section of the fluid (oil) seal and float operative by the products of combustion within the boiler's inclosure, and by the atmospheric pressure exterior to the said inclosure; and also a section of the bleeder valve for controlling the damper. Fig. 5 is a central vertical section of a diaphragm and attachments, as a modification which may be employed instead of the liquid seal shown in Fig. 4, to control the damper bleeder valve.

The appliances herein described are adapted for employment with any form of steam generator having forced draft, but for the purposes of illustration there is shown the simple type of return flue boiler 1, inclosed by walls 2, 3, 4, 5 and an arch 6, forming an inclosed combustion chamber of which the fire space 7 and flue 8 are a part, a stack 9 forming the outlet therefrom to the atmosphere.

Below grate 10 there is an ash pit 11 into which a flue 12 leads from blower 13 operated by engine 14. A pipe 15 supplies steam to the engine from boiler 1, and a throttle valve 16 gauges the flow, the engine having the usual by-pass and stop valves for use if the throttle valve requires to be removed.

Located above the boiler there is an air compressor 17 of any suitable construction and driven by a motor 18 which may be of any form suited to the most available power. The compressed air is delivered to and stored in a reservoir 19 through a reducing valve 20 which maintains a constant pressure in the reservoir, indicated by gauge 21. From the reservoir a pipe 23 delivers the compressed air to case 24 of the blower bleeder valve, shown in detail in Fig. 3; where a passage 25 connects supply pipe 23 and delivery pipe 26, the passage being controlled by limit screw 27. A port 28 connects passage 25 to a valve chamber 29 which has at its lower part a valve seat 30 with a passage 31 therethrough, in which is a stem 32 of less diameter than the passage, to permit air to escape when the valve is raised. A valve 33 is attached to the stem, a flange 34 is also attached at the opposite end, and a spring 35 in chamber 29 holds the valve normally closed over passage 31.

Below the bleeder valve just described there is a steam pressure regulating valve, shown in detail in Fig. 2, where a diaphragm 36 is in case formed by parts 37, 38 with a pipe 39 connecting the under side of the diaphragm to boiler 1; above case part 37 there is a spring case 40 covering a long flexible and sensitive spring 41, mounted on diaphragm 36 and with its upper end resting in an adjustable seat 42 screw threaded to case 40, adjusted by hand wheel 43 to regulate the spring's tension, and secured by lock nut 44. A stem 45 is attached to dia-

phragm 36 and passes upward and outward through seat 42 and has at its upper end a push button 46 screw threaded to stem 45, for adjustment, locked by a nut 47, and adapted to abut and push up flange 34.

Pipe 26 leads to the underside of a diaphragm 48 having a semi-case 49, and a central stud 50 carrying a lever 51 fulcrumed to case 49 at 52 and guided at 53, and at its outer end it is attached to a rod 54 having a turnbuckle 55 connecting it to rod 56 which is attached to lever 57 of throttle 16. Pipe 59 forms a connection from reservoir 19 to the damper bleeder valve 60 shown in detail in Fig. 4, the pipe 59 being in communication with a passage 61 leading to a pipe 62. A screw 63 intercepts and regulates the flow through passage 61. From passage 61 there is an outlet 64 to the atmosphere, through a nipple 65 screwed to the valve. Located adjacent to valve 60 there is a liquid seal, also shown in detail in Fig. 4, and preferably using oil as a seal, on account of its non-evaporation, and comprising a gas compartment 66 in communication with the combustion chamber surrounding the boiler 1, by a pipe 67; within the compartment there is a liquid receptacle 68 connected by a passage 69 to another liquid receptacle 70 with an exposed top. Within receptacle 70 there is an open top float 71, and attached thereto is a bar 72 which at its opposite end is fulcrumed to a lug 73 on valve 60. At a point above outlet 64 a seat 74 of soft material is removably secured by a spring clip 75 secured to bar 72, and an adjustable counterpoise 76 is placed on the bar. Pipe 62 is in communication with a diaphragm case 77 having a diaphragm 78 with a central stud 79 carrying a lever 80 fulcrumed at one end to a lug 81 of the diaphragm case, guided at 82 and its outer end attached to a rod 83 having a turnbuckle 84 which adjustably secures it to a rod 85 attached to an arm 86 which operates damper 87 in stack 9.

In Fig. 5 there is shown a modification for the operation of valve 60, in lieu of the liquid seal heretofore described. Pipe 67 as heretofore described, is attached to a lower half 88 of a case having a diaphragm 89 covered by a top case 90. A rod 91 is attached to the diaphragm, extends upward and is guided through cap 92. At its top it has an adjustable push button 93 locked by a nut 94 and adapted to operate bar 72.

The operation of the mechanism set forth is as follows; a constant pressure of air is maintained in reservoir 19 by compressor 17 and its motor 18 through reducing valve 20, and is supplied through pipes 23, bleeder valve case 24 and pipe 26 to diaphragm 48 which controls throttle valve 16 of motor 14 for operating blower 13 at a uniform speed while a fixed maximum steam pressure is maintained in boiler 1, and at all times the gas pressure in the combustion chamber will be maintained to suit the nature of the fuel in use. With an accumulation of excessive steam pressure the diaphragm 36 will operate push button 46 to raise bleeder valve 33; the air pressure will then be released, through the valve, from diaphragm 48 and weight 95 will cause throttle 16 to slow the blower 13. Meantime the pressure of the gases in the combustion chamber will decrease on account of the pull of the stack, and this will cause a partial vacuum in compartment 66 and a decreased pressure on the liquid in receptacle 68 causing it to rise, and the liquid in receptacle 70 and its float to descend and close bleeder valve 60 so that air pressure will be exerted on diaphragm 78 to close damper 87. As the draft of stack 9 decreases the pressure on the liquid in receptacle 68 will increase until the working pressure of the gases is reached. Then as the steam pressure decreases the diaphragm 36 will descend and bleeder valve 33 be closed. Compressed air will again operate diaphragm 48 to open throttle 16 to start blower 13. Thus an excess of steam pressure or any variation between the gas pressure in the combustion chamber, and atmospheric pressure, automatically regulates the blower and the damper to again restore the equilibrium between the gases in the combustion chamber and the atmospheric pressure exterior to the boiler's inclosure. It has been found by exhaustive tests and experiments that a very slight variation of pressures between the gases due to combustion and the exterior atmospheric pressure is sufficient to operate these appliances, and that any maximum or minimum variation of allowed steam pressure is of very rare occurrence.

I claim.

1. The combination with a furnace, of a smoke stack having a damper; an air reservoir and a compressor for supplying compressed air to the reservoir; mechanism actuated by fluid pressure and embracing a bleeder valve for controlling the movement of the damper; and supplemental means embracing a liquid seal actuated by gas pressure from the furnace to control the bleeder valve.

2. The combination with a boiler and furnace, of a smoke stack having a damper; a blower in connection with the furnace; a motor for operating the blower; means for compressing air; a storage reservoir for the compressed air; an air actuated diaphragm having means in connection therewith to control the motor; a connection leading from the diaphragm to the air storage reservoir; a bleeder valve intermediate the diaphragm and reservoir; steam actuated means in con-

nection with the boiler to operate the bleeder valve; mechanism actuated by fluid pressure for controlling the movement of the damper; and means actuated by the gas pressure in the furnace for controlling the said mechanism actuated by fluid pressure.

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

GEORGE C. G. GRAY.

Witnesses:
R. C. WRIGHT,
WILLIAM C. STOEVER.