H. H. CUTLER.

CIRCUIT CLOSER.

APPLICATION FILED JULY 2, 1904.

955,323.

Patented Apr. 19, 1910.

2 SHEETS—SHEET 1.

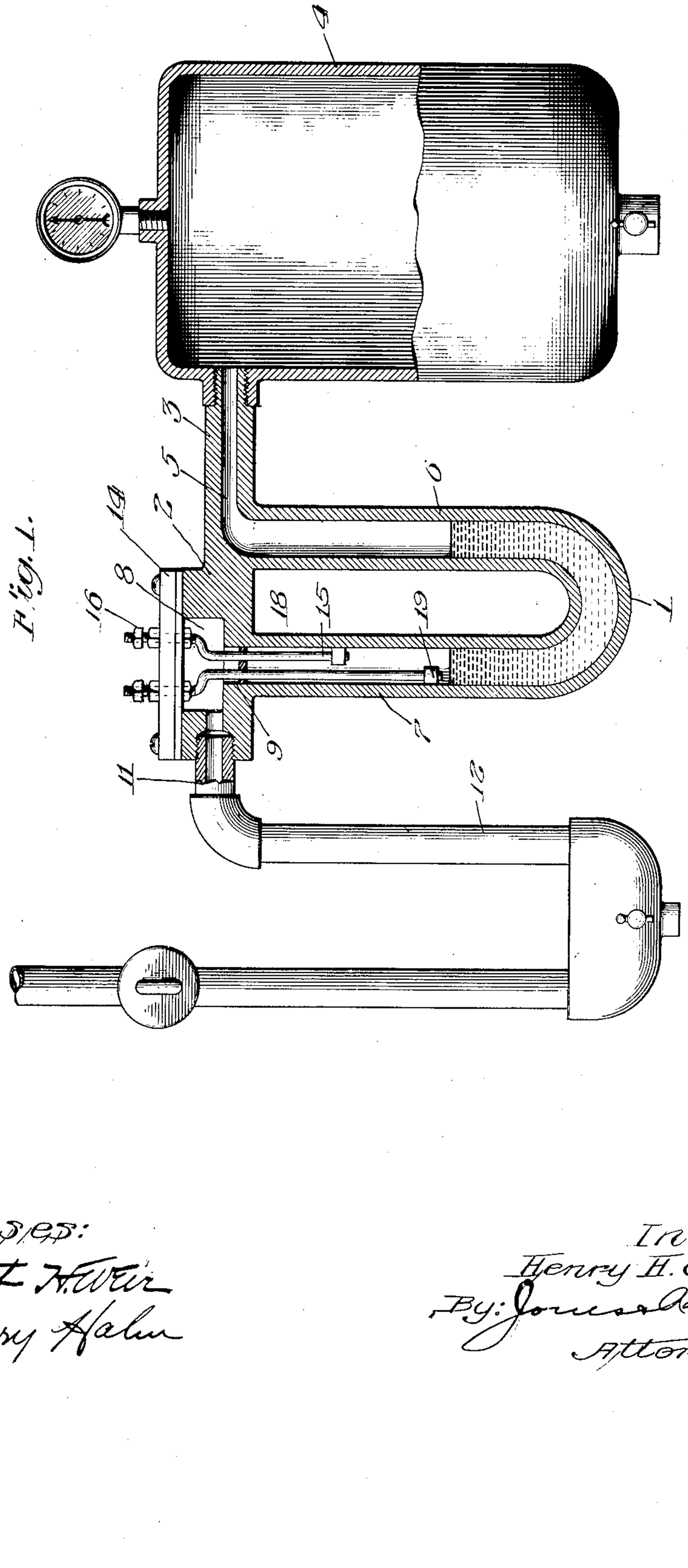

Fig. 1.

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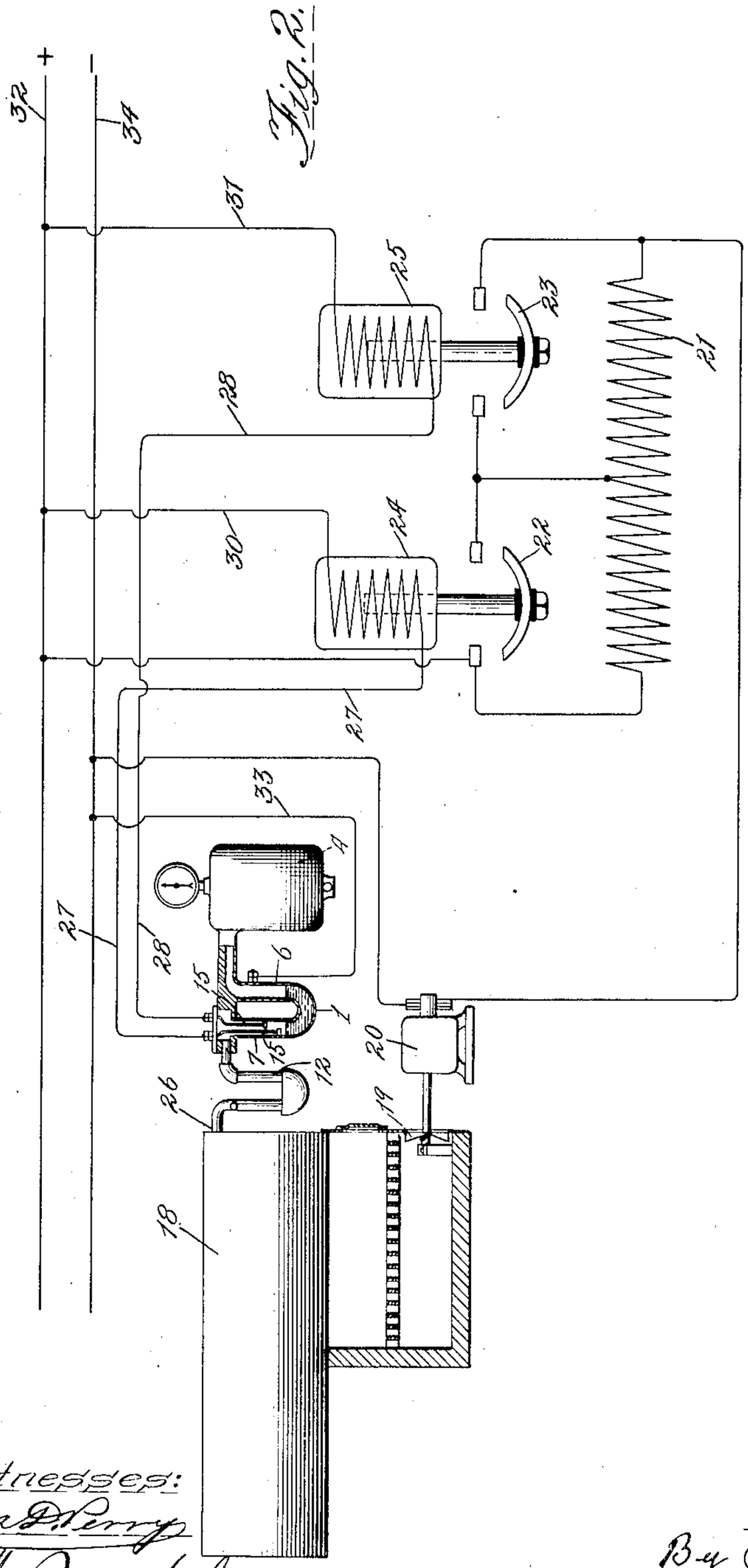
2 SHEETS—SHEET 2.

Fig. 2.



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UNITED STATES PATENT OFFICE.

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CIRCUIT-CLOSER.

955,323. Specification of Letters Patent. **Patented Apr. 19, 1910.**

Application filed July 2, 1904. Serial No. 215,083.

To all whom it may concern:

Be it known that I, HENRY H. CUTLER, a citizen of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented new and useful Improvements in Circuit-Closers, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to circuit closers and is particularly adapted for use in connection with electrically operated pressure regulating devices.

One of the objects of my invention is to provide an instrument which will respond accurately to differences in pressure which are so small as to inappreciably affect the ordinary type of pressure controlled circuit closers.

In steam boilers, especially those provided with a mechanically forced draft, it has been customary to use an electric motor drive in connection with blowers which produce the forced draft. In order to keep the steam pressure constant, it is essential that the variations in the speed of the motor operating the blowers, be brought about before pressure in the boilers has changed materially. Otherwise if a change, even no greater than one pound, were allowed to occur, it would take considerable time to bring the pressure back to normal on account of the large mass of water contained in the boilers. A practical instrument, therefore, for controlling the speed of the motor must be constructed to respond to such slight changes in the boiler pressure, as to almost anticipate any change in pressure which is about to occur in the boiler.

Figure 1 is a side elevation of my invention, parts of the same being shown in section; Fig. 2 is a diagrammatic view of an application of my invention for regulating the pressure in boilers.

In the preferred construction of my invention I preferably provide a U-shaped tube 1, which may be of iron or of any other electrically conducting material having formed therewith a block or support 2, which block or support is provided with a projection 3 brazed air-tight to a compression tank 4. A port or opening 5 in said projection connects the tank 4 with the leg 6 of the tube, while the opposite leg 7 thereof communicates with a small chamber 8 formed in the block 2, by a port 9.

Connected to a projection 10 on the block 2 by means of a fiber tube 11, is a siphon tube 12, which communicates with the leg 7 of the tube 1, through the tube 11, the chamber 8 and the port 9. The opposite end of the siphon tube 12 is connected with the boiler and the tube is preferably filled with oil to electrically insulate the tube 1 from the ground.

Secured upon the top of the block 2 by suitable screws is an insulating block 14, which serves to close the chamber 8, and supports a series of iron rods or conductors 15, extending through the port 9, and into the leg 7 of the tube 1. The upper ends of these rods are provided with suitable screws 16, whereby electrical conductors may be connected therewith. Insulating washers 18 and 19 serve to keep the rods 15 properly spaced apart and prevent the same from contacting with the sides of the tube 1. Said rods 15 are of different lengths and project different distances into the leg 7 of the tube 1, and while I have only shown two of these rods, there may be provided as many as desired.

In Fig. 2 is illustrated diagrammatically the application of my device as a regulator for pressure in steam boilers. In said figure, I have illustrated diagrammatically a boiler 18, the draft of which is controlled by a fan or blower 19 operated by means of an electric motor. Arranged in the circuit of the motor 20 is a resistance 21 which is cut in and out of circuit by means of the switches 22 and 23, operated by means of the solenoid magnets 24 and 25. One end of the siphon tube 12 is connected at 26 with the boiler and the long and short rods 15 thereof are connected respectively by the conductors 27 and 28 with the windings of the solenoids 24 and 25, the opposite end of these windings being connected by conductors 30 and 31, respectively, with one side 32 of the supply main. The leg 6 of the pressure regulator is connected by the conductor 33 with the opposite side 34 of the supply main.

In operation, the tube 1 of the pressure regulator is partially filled with mercury and the tank 4 is supplied with compressed air under a pressure of, say, one pound less the desired boiler pressure, this tank pressure

remaining substantially constant. The pressure in the tank 4 will remain substantially constant irrespective of the movement of the mercury in the chamber 6, due to the fact that the pressure on the fluid in the tank is so great that the slight compression or expansion caused by the movement of the mercury in the chamber 6 will not cause any appreciable difference in the pressure in said tank. Assuming that the pressure in the boiler lowers, then the pressure in the compression tank 4 will become greater than that of the boiler, causing the mercury in the leg 6 to rise and make connection with the longest of the rods 15. Circuit will then be closed through the winding of the solenoid 24, this circuit being traced from the main 32 by the conductor 30, through the winding of the solenoid 24 by conductor 27, to the longest of the rods 15, through the mercury contained in the tube 1, to the leg 6 of said tube, and thence by conductor 33 to the opposite side 34 of the supply main. The closing of the circuit through the winding of the solenoid 24 causes the same to operate to close the switch 22, thereby cutting out a section of the resistance 21 from the motor circuit, and causing the motor to increase in speed driving the blowers at a higher rate of speed, and increasing the draft to the furnace. An increased lowering of the pressure in the boiler will permit the mercury to reach the next rod which will close the circuit through the solenoid 25, this circuit being traced from the supply main 32 to the conductor 31 through the winding of the solenoid 25 by conductor 28, to the shortest of the rods 15, thence through the mercury contained in the tube 1 to the leg 6 of said tube, and by conductor 33 to the opposite side of the main 34. The closing of the circuit through the winding of the solenoid 25 causes the same to operate to close the switch 23, cutting out the remaining resistance in the motor circuit, causing the motor to still further build up in speed and drive the blowers at a higher rate of speed, thereby increasing the draft to the furnace. As the pressure in the boiler rises, it will predominate over the pressure in the tank 4, and cause the mercury in the tube 1 to lower and break connection first with the shortest of the rods 15, opening the circuit through the solenoid 25, which will insert one portion of the resistance 21 in circuit with the motor, and decrease the speed thereof. If the pressure in the boiler still continues to rise, the mercury will fall lower in the tube 1, breaking the circuit of the solenoid 24 which will permit the switch 22 to open, and insert more of the resistance 21 in circuit with the motor 20, thereby decreasing the speed thereof, and consequently decreasing the draft of the furnace.

It will thus be seen that my device is responsive to extremely small changes in the boiler pressure and by using a device of this character the boiler pressure is maintained practically uniform.

If desired, the compression tank 24 may be provided with a standard steam gage, in order that the pressure in the tank may be watched and also with suitable means for renewing any air which may possibly leak out of the tank.

It will be understood, of course, that I have merely illustrated in Fig. 2 the diagrammatic arrangements of my invention in connection with a boiler, and that various modifications may be made, as, for instance, the number of rods 15 may be increased, and accordingly, the number of switches controlling the sections of resistance may also be increased, whereby the variations of speed of the motor may be increased. Also it will be understood that the arrangement of the blowers and the manner in which they are driven by the motor may be changed from that illustrated in the drawing, as this portion is merely diagrammatic, and is not intended to show more than is necessary for an understanding of the invention.

I have described my invention as being applicable to maintain a constant pressure in boilers, but it will be understood that I do not wish to limit myself to this particular use, as there are various other fields in which the device may be utilized.

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

1. In a device of the character described, the combination with a receptacle, of a relatively stationary contact arranged therein, a reservoir having fluid under substantially constant pressure therein connected with said receptacle, the opposite side of said receptacle being connected with a reservoir in which the pressure varies, and a movable contact coöperating with said stationary contact moved by the pressure in said reservoirs and responding when a predetermined difference between the pressures of said reservoirs occurs.

2. In a device of the character described, the combination with a receptacle, of a plurality of relatively stationary contacts arranged therein, a reservoir having fluid under a substantially constant pressure therein connected with one side of said receptacle, the opposite side of said chamber being connected with a reservoir in which the pressure varies, and a movable contact adapted to successively engage said stationary contacts moved by the pressures in said reservoirs and responding when a predetermined difference between the pressures in said reservoirs occurs.

3. In a device of the character described, the combination with a receptacle having a

U-shaped chamber, of a relatively stationary contact arranged therein, a compression tank having fluid under a substantially constant pressure connected with one leg of said chamber, the other leg of said chamber being connected with a reservoir in which the pressure varies, a current conducting liquid arranged in said chamber and moved by the pressures in said reservoirs, said liquid responding when a predetermined difference between the pressures in said reservoirs occurs.

4. In a device of the character described, the combination with a receptacle having a U-shaped chamber, of a plurality of contacts of different lengths extending into one leg of said receptacle, an electrical conducting liquid arranged in said receptacle, a reservoir having fluid under substantially constant pressure therein connected with one leg of the chamber, the other leg of the chamber being connected with a reservoir in which the pressure varies, the fluid in said receptacle being adapted to be moved into one leg by the pressure in one of said reservoirs and adapted to be moved into the other leg by the pressure in the other reservoir, said fluid responding when a predetermined difference between the pressures of the reservoirs occurs.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

HENRY H. CUTLER.

Witnesses:
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