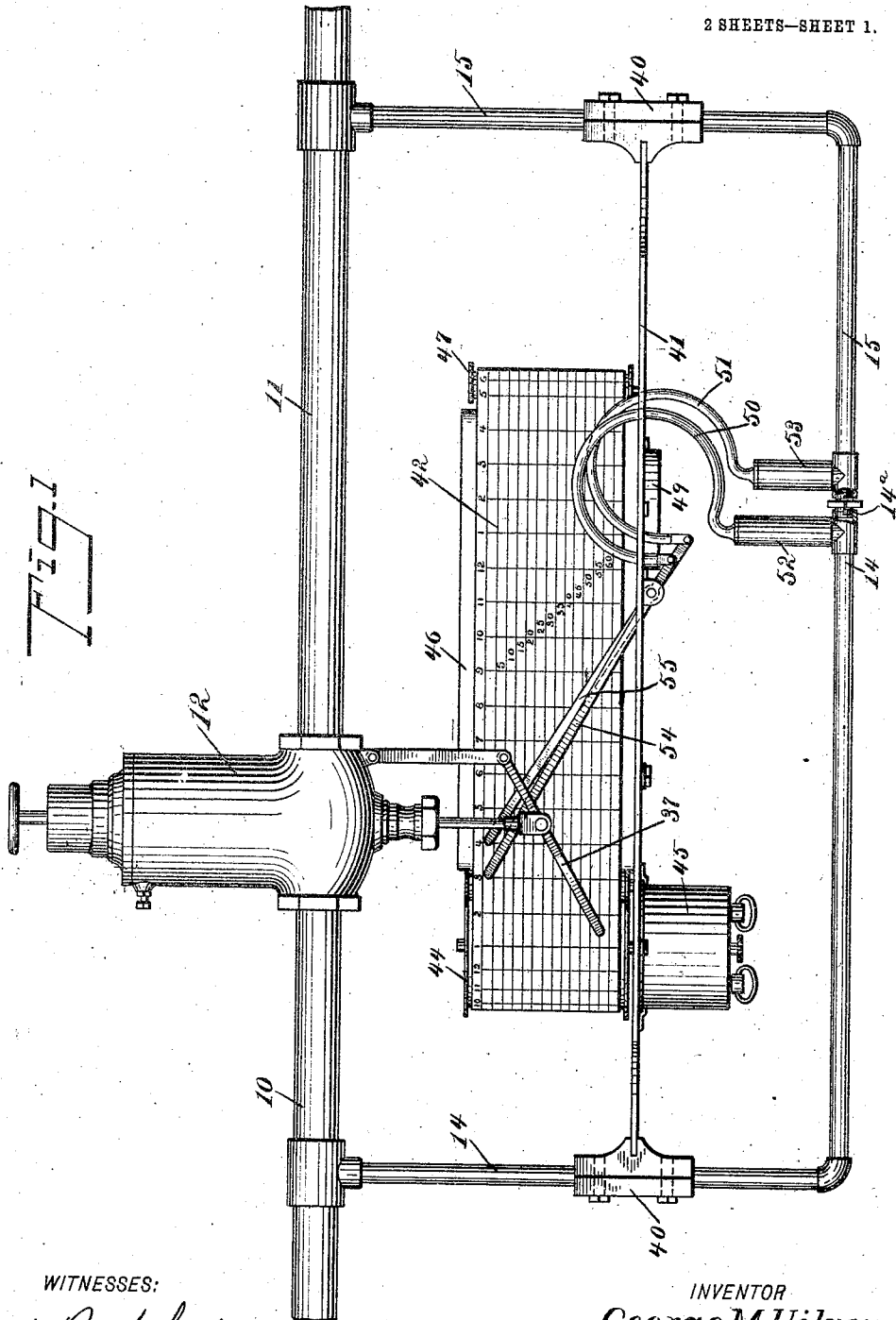


G. M. HILGER.
 STEAM SERVICE CONTROLLING AND RECORDING APPARATUS.
 APPLICATION FILED SEPT. 7, 1905

900,540.

Patented Oct. 6, 1908.

2 SHEETS—SHEET 1.



WITNESSES:

J. A. Brophy
Geo. B. Owens.

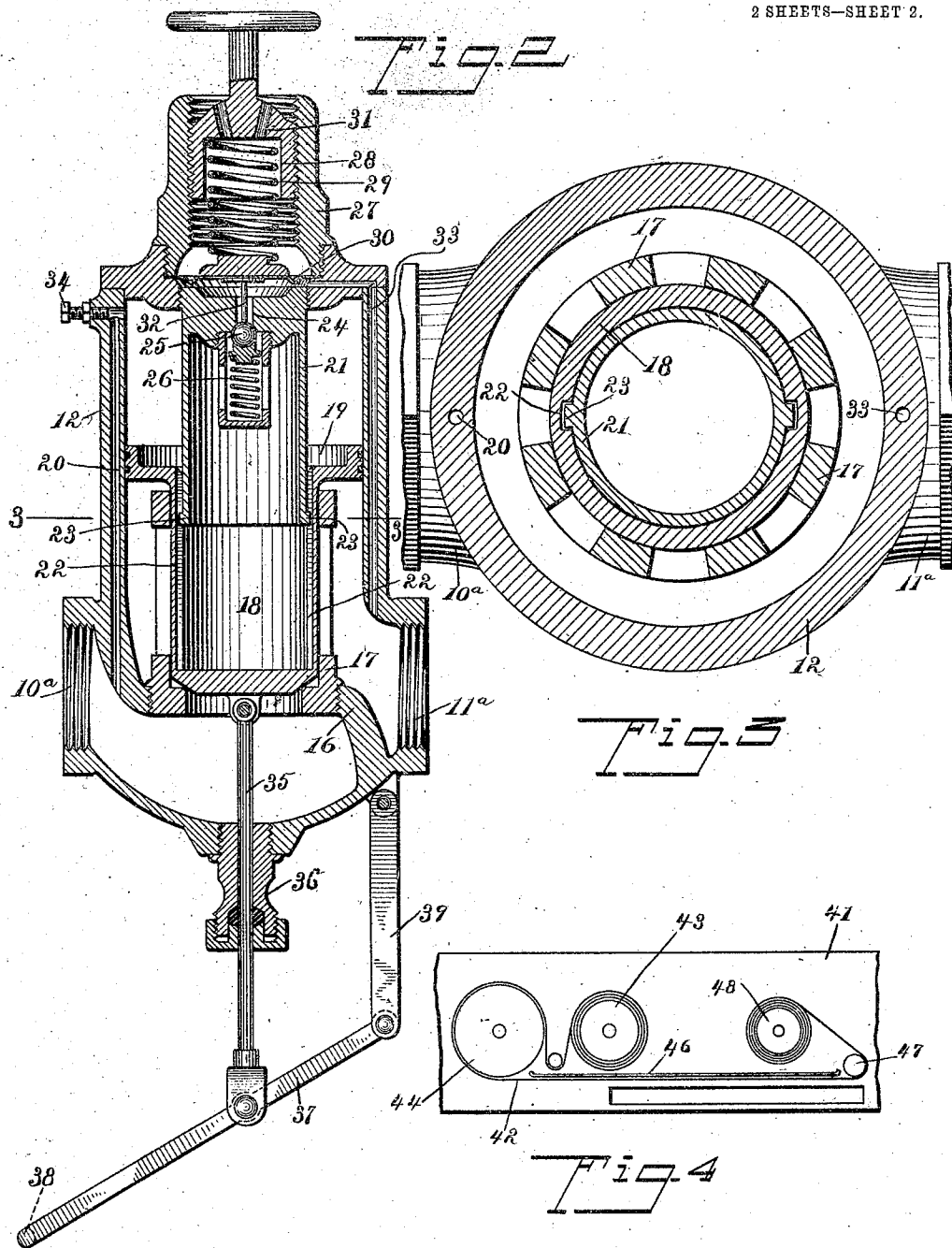
INVENTOR
 George M. Hilger.
 BY *Mumford*
 ATTORNEYS

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J. A. Brophy

Isaac B. Owens.

INVENTOR

George M. Hilger

BY

Munn
 ATTORNEYS

UNITED STATES PATENT OFFICE.

GEORGE MICHAEL HILGER, OF CHICAGO, ILLINOIS.

STEAM-SERVICE CONTROLLING AND RECORDING APPARATUS.

No. 900,540.

Specification of Letters Patent.

Patented Oct. 6, 1908.

Application filed September 7, 1905. Serial No. 277,383.

To all whom it may concern:

Be it known that I, GEORGE MICHAEL HILGER, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented a new and Improved Steam-Service Controlling and Recording Apparatus, of which the following is a full, clear, and exact description.

The invention relates to an apparatus intended for use in connection with steam service plants, by means of which to automatically reduce steam pressure according to the degree desired; and to record the differences in pressure and the volumes of steam delivered whereby to admit of convenient computation of the horse power and other conditions concerned with the steam service. In attaining this end I employ a means for automatically reducing the steam pressure and supplying steam at said pressure according to the demand. Said reducing device is in connection with a recorder by means of which the volume of steam passing to the consumer, or in other words the degree of opening of the controlling valve, may be recorded; and the high and low pressure pipes are also in connection with the peculiar recording devices, which simultaneously with the operation of the device for recording the volume of steam supplied, act to record the pressure of the steam supply and the pressure of the low pressure steam delivered to the consumer. In this way it is possible readily to determine all of the conditions essential to an accurate account of the horse power furnished the consumer or subscriber to the plant. The computations to determine the horse power do not actually concern my invention, and may be made in any way, but I prefer to employ in connection therewith tables made by actual tests on the engines to which the steam is supplied, so that a comparison of the results of the recording device and the said tables will give the horse power furnished.

The invention resides in certain special features of construction and combinations of parts which will be fully set forth hereinafter and particularly pointed out in the claims.

Reference is had to the accompanying drawings which illustrate as an example the preferred embodiment of my invention, in which drawings

Figure 1 is an elevational view of the apparatus in working adjustment; Fig. 2 is an enlarged section of the reducing and record-

ing valve; Fig. 3 is a section on the line 3—3 of Fig. 2; and Fig. 4 is a fragmentary plan view showing the manner of carrying the ribbon on which the results are recorded.

Referring to Fig. 1, 10 indicates the high pressure steam supply pipe, and 11 the low pressure pipe conducting the steam to the point of consumption. Interposed between these pipes is the automatic reducing and recording valve, the casing 12 of which is shown in Fig. 1. Communicating with the high and low pressure pipes 10 and 11 are branch pipes 14 and 15 respectively which pass down into mechanical connection with each other, as Fig. 1 shows, but which are closed from intercommunication by means of a plug 14^a, as shown. This construction is preferable, though two entirely distinct branch pipes may be employed, if desired. Devices connected with the branch pipes 14 and 15, which will be hereinafter described, are influenced directly by the high and low pressures, and serve to actuate means for recording said pressures, and it may be seen from this that the apparatus provides means for automatically recording the volume of steam delivered and the pressures concerned, thus allowing for accurate calculation of the horse power delivered.

As shown best in Figs. 2 and 3, the automatic reducing and recording valve comprises a shell or casing 12 having a nipple 10^a for connection with the high pressure pipe 10, and a nipple 11^a for connection with the low pressure pipe 11. In said casing is arranged a divisional wall 16, which separates the high and low pressure sides of the valve. Screwed or otherwise fastened in an opening in said divisional wall 16 is a cage 17 which is preferably cylindric in form, as shown in Fig. 2, and has vertically elongated openings extending through its sides. Operating in the cage 17 is a piston valve 18 which is in the form of a hollow cylinder having an enlarged piston-like part or flange 19 at its upper end. Said piston valve has its cylindric portion operating in the cage, while the piston like extension 19 is extended into engagement with the cylindric inner wall of the casing 12. The lower end of the cylindric part 18 is in communication with the high pressure side of the valve, and the lower side of the piston like extension 19 is in communication with the low pressure side of the valve. The valve 18 when in the position shown in Fig. 1 closes the steam pas-

sage through the openings in the cage 17, but as said valve is raised it uncovers the opening in the cage to a greater or less extent and allows a certain amount of steam to pass from the high to the low pressure side, or in other words, from the pipe 10 to the pipe 11. By the movement of this piston valve the steam supply is automatically controlled. Formed in the walls of the shell 12 is a passage 20 which leads from the high pressure side upward into the shell above the piston 19, so that the high pressure steam normally pervades the chamber above said piston.

Secured in the top of the shell 12 is a valve casing 21 which extends downwardly centrally in the shell of the valve, and has its lower portion fitted within the cylindric valve 18 so as to serve as a guide therefor. Said valve is formed interiorly with longitudinal slots 22 which receive studs 23 formed on the valve casing 21. Said studs prevent the turning of the valve 18, but allow its free longitudinal movement. The valve casing 21 has an opening 24 in its upper end, and this opening is commanded by a ball valve 25 pressed to its seat by a spring 26. In the upper part of the casing 12 a cap 27 is screwed, this cap being interiorly threaded to receive a plug 28 provided to adjust the tension of the spring 29. Said spring bears on top of a diaphragm 30 which is placed in the upper head of the shell 12 above the valve 25 and casing 21. The upper side of the diaphragm is open to the atmosphere through opening 31 formed in the plug 28. On its lower side the diaphragm 30 carries a stem 32 which normally bears on the valve 25 holding the same in open position. From the space between the diaphragm and valve 25 a duct 33 passes. Said duct is formed in the walls of the shell, and extends downward into communication with the low pressure side of the device. The duct 20 before described may be provided with a valve or plug 34. In order to record the volume of steam passing through the valve, or in other words, the degree of opening thereof, I attach to the valve 18 a stem 35 which passes through a stuffing box 36 in the bottom of the shell 12, and is connected to a lever 37 which carries at one end a pencil or marker 38, and at the other end is pivoted to the link 39, in turn pivoted to the shell 12.

Normally the parts assume the position shown in Fig. 2, excepting that the valve 25 is normally open owing to the pressure of the spring 29 acting through the diaphragm 30 and stem 32, this pressure being sufficient to overcome the spring 26. As the high pressure steam is turned on through the pipe 10 into the high pressure side of the valve, the steam pressure will bear on the under side of the piston valve 18 and will raise the same, uncovering the openings in the cage 17 and permitting the steam to pass into the low pressure pipe. Simultaneously, the high pressure steam will pass through the duct 20 into the upper part of the shell of the valve, and will pass through the grooves 22 around the studs 23 and into the valve casing 21, it being here explained that the studs 23 have a loose engagement with the walls of the grooves 22 so as to permit this movement of the steam. The valve 25 being normally open, as explained, the steam upon entering the casing 21 will pass through the port 24 and duct 33 into the low pressure side of the system. As this steam movement both through the cage 17 and duct 33 continues, the pressure in the pipe 11 and its connections will rise and when this pressure reaches a predetermined point the steam pressure acting against the lower side of the diaphragm 30 will lift the same, relieving the valve 25 of the pressure of the stem 32 and permitting the spring 36 to seat said valve. The high pressure steam will then back up in the upper part of the shell, and will exert its pressure not only on the piston-like extension 19 of the valve, but also on the upper side of the lower end of the valve. Since this pressure easily preponderates the pressure of the steam tending to open the valve, it follows that the valve will be instantly closed, and the steam movement to the low pressure side of the system will cease until the pressure in the pipe 11 and its connections drop below the predetermined point whereupon the diaphragm 30 will be permitted to return and open the valve 25 thus allowing the steam to pass through the duct 33; also relieving back pressure in the valve 18 and allowing pressure on the bottom of said valve to raise the valve again to open position. The movement of the valve 18 determines the amount of steam permitted to pass, and as the valve moves the lever 37 is correspondingly moved and through its pencil or marker 38 the degree of opening of the valve may be automatically and accurately recorded, as will hereinafter fully appear.

Connected by clamps 40 to the branch pipes 14 and 15 or to other suitable supports is a table plate 41. This plate carries an apron or ribbon 42 on which the records are made. Said ribbon, as shown best in Fig. 4, is wound around a roll 43 from which it is adapted to be taken during the operation of the machine. From this roll the ribbon passes around a roll 44, which is in connection with a clock mechanism 45, the clock mechanism serving to permit of the unwinding of the ribbon from the roll 43 at a fixed rate of speed. Said ribbon passes in front of a backing wall 46 which is secured in a perpendicular position on the table plate 41, the roll or drum 44 being located at one end of the wall, and at the opposite end of the wall is located an idler roller 47 around

which the apron passes to a roll 48 on which the apron is rewound. This roll is in connection with a spring tending to turn the roll so as to wind the apron thereon. In Fig. 1 49 indicates a case which is secured to the under side of the table plate 41, and which serves to contain the said spring. The spring actuated roll 48 exerts a constant tension on the apron tending to unwind it from the roll 43 and wind it on the roll 48, and the drum or roll 44 turning at a fixed rate of speed under the control of the clock 45 and having sufficient frictional engagement with the ribbon service to prevent too rapid movement of the apron and to cause the apron to move in a fixed ratio to the speed of the clock driving the drum 44, or in other words, in fixed ratio to the actual time.

As shown in Fig. 1 the lever 37 is located in front of the device above described, and its marker 38 bears on the face of the ribbon so as to produce thereon a "curve" indicating the extent of opening of the valve at any time during the operation of the mechanism. The ribbon may be provided with graduations and numbers, as shown in the drawing or otherwise, so as to facilitate the correct interpretation of the marks or "curves" produced thereon.

The high and low pressures of the pipes 10 and 11 are recorded respectively by Bourdon tubes 50 and 51, which tubes communicate by unions 52 and 53 respectively with the branch pipes 14 and 15, at opposite sides of the plug 14. The Bourdon tubes 50 and 51 are connected with levers 54 and 55 respectively, and these levers are provided at their free ends with markers arranged to lie over the surface of the ribbon 42, so in this way there will be produced on the ribbon "curves" showing the pressures respectively in the high and low pressure sides of the frame. The pencils or markers of the recording levers may be of different colors so that the different lines produced on the recording surface can be readily distinguished.

In the use of the device the parts are adjusted as shown, and the steam pressure drawn into the pipe 10. The pressure will be reduced by the valve according to the set of the spring 29, and the degree of opening of the valve 18 will at all times be recorded on the ribbon. At the same time the Bourdon tubes or other pressure recording devices in connection with the high and low pressure sides of the frame will record the two pressures involved, and in this way the service to the subscriber or customer may be readily and accurately calculated, all of which has been explained hereinbefore.

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

1. The combination of a shell or casing having high and low pressure sides, a valve

moving therein to control fluid movement through said casing, a recording device in connection with the valve, and recording devices respectively in communication with the high and low pressure sides of the shell or casing.

2. The combination of a shell or casing having a high and low pressure side, high and low pressure pipes communicating respectively with the said sides of the casing, a valve operating in the shell or casing to control fluid movement, a recording device in connection with said valve, and recording devices respectively in connection with the high and low pressure pipes.

3. The combination of a shell or casing having high and low pressure sides, high and low pressure pipes respectively in connection with said sides of the casing, a valve operating in the casing to control fluid movement through the same, a recording device having connection with the valve, branch pipes communicating with the high and low pressure pipes, and pressure recording devices communicating respectively with the branch pipes.

4. The combination of a shell or casing having high and low pressure sides, high and low pressure pipes respectively in connection with said sides of the casing, a valve operating in the casing to control fluid movement through the same, a recording device having connection with the valve, branch pipes communicating with the high and low pressure pipes, pressure recording devices communicating respectively with the branch pipes, and means for holding a ribbon or the like in position to receive the records of all of said recording devices.

5. The combination of a shell or casing having a high and low pressure side, high and low pressure pipes communicating respectively with the said sides of the casing, a valve operating in the shell or casing to control fluid movement, a recording device in connection with said valve, recording devices respectively in connection with the high and low pressure pipes, and means for holding a ribbon or the like in position to receive the records of all of the said recording devices.

6. The combination of a shell or casing having high and low pressure sides, a valve moving therein to control fluid movement through said casing, a recording device in connection with the valve, recording devices respectively in communication with the high and low pressure sides of the shell or casing, and means for holding a ribbon or the like in position to receive the records of all of said recording devices.

7. The combination of a shell or casing having high and low pressure sides, high and low pressure pipes respectively in connection with said sides of the casing, a valve

operating in the casing to control fluid movement through the same, a recording device having connection with the valve, branch pipes communicating with the high and low pressure pipes, pressure recording devices communicating respectively with the branch pipes, a frame member supported by said branch pipes, and means on said frame member for carrying a ribbon or the like in position to receive the records of all of the said recording devices.

8. The combination of a shell or casing having high and low pressure sides, high and low pressure pipes communicating respectively with said sides, a valve movable in the casing to control fluid movement, a recording device in connection with said valve, and Bourdon tube recorders respectively in communication with the high and low pressure sides of said shell or casing adapted to record the pressures thereof.

9. The combination of a reducing valve, a recording device connected therewith, and pressure recording devices adapted to be actuated respectively by the high and low pressures.

10. The combination of a reducing valve, a recording device connected therewith, pressure recording devices adapted to be actuated respectively by the high and low pressures, and means for holding a ribbon or the like in position to receive the records of all of said recording devices.

11. The combination of a reducing valve, a recording device connected therewith, pressure recording devices adapted to be actuated respectively by the high and low pressures, and means for moving a ribbon at a constant speed past all of the said recording devices to receive the records thereof.

12. The combination of a reducing valve, a recording device connected therewith, pressure recording devices adapted to be actuated respectively by the high and low pressures, means for continuously moving a ribbon past all of the said recording devices to receive the records thereof, and a clock for regulating the time of movement of the said ribbon.

13. The combination of a shell or casing, a member controlling fluid movement through the same, means for recording the action of said member, means for recording the pressure at each side of said member, and devices for causing all of said recording means to act on a record surface common to all.

14. The combination of a pressure reducing device, means for recording the movement thereof, means for recording the change in pressure effected by said reducing device, and devices for causing all of the recording means to act on a record surface common to all.

15. The combination of a shell or casing

having high and low pressure sides, a valve moving therein to control fluid movement through said casing, a recording device in connection with the valve, recording devices in communication with the high and low pressure sides of the shell or casing, and devices for causing all of the recording devices to act on a record surface common to all.

16. The combination of a reducing valve, a recording device in connection therewith, Bourdon tubes respectively in communication with the high and low pressure sides of said valve, and recording levers respectively having connection with the Bourdon tubes.

17. The combination of a reducing valve, a recording device in connection therewith, Bourdon tubes respectively in communication with the high and low pressure sides of said valve, recording levers respectively having connection with the Bourdon tubes, and means for holding a ribbon or the like in position to receive the records of all of said recording devices.

18. The combination of a shell or casing having high and low pressure sides, a division wall separating the high and low pressure sides, and high and low pressure connections respectively at the sides of the said wall, a cage secured in an opening in the wall, a piston valve operating in the cage, said valve being exposed to the high pressure side of the shell or casing, the fluid pressure in said side tending to open the valve, means for admitting the high pressure to the opposite side of the valve, the said opposite side of the valve exposing a larger surface than the first mentioned side whereby to close the valve, devices actuated by the low pressure for controlling the application of the high pressure to said second side of the valve, and a recording device in connection with the piston valve.

19. The combination of a shell or casing having high and low pressure sides, a division wall separating the high and low pressure sides and high and low pressure connections respectively at the sides of the said wall, a cage secured in an opening in the wall, a piston valve operating in the cage and having one end exposed to the high pressure to be actuated thereby said valve having a piston like enlargement at its opposite end engaging the inner walls of the shell, means for admitting the high pressure to the side of the valve having the piston like enlargement, devices actuated by the low pressure for controlling the application of the high pressure to said last mentioned side of the valve, a stem having connection with the valve and extending beyond the casing, and a recording device connected to and actuated by said stem.

20. The combination of a shell or casing

having a high and a low pressure side, a valve for controlling fluid movement through the same and having one side exposed to the high pressure to be actuated thereby to open the valve, means for admitting the high pressure to the casing at the opposite side of the valve, the last mentioned side of the valve exposing a larger surface than the first mentioned side, means for permitting the steam to pass from the shell or casing at said opposite side of the valve to the low pressure side of the shell or casing, the said means including a passage and a second valve commanding the same, means for closing said second valve, means tending to normally hold said second valve open, the said means being controlled by the low pressure, and a recording device in connection with the first mentioned valve.

21. The combination with a main shell or casing having a division wall therein dividing the shell into high and low pressure sides, a cage secured in an opening in the division wall, a hollow piston valve operating in said cage and having a closed end exposed to the high pressure to be actuated thereby, the said valve being open at its other end and having an enlarged piston like part engaging the inner wall of the

shell, a cylindrical valve casing secured in the main shell and having an open end fitting in the open end of said valve to guide the latter, means for admitting the high pressure fluid to the main shell at the side of the valve having the enlarged piston like part, the said part of the main shell to which the high pressure fluid is admitted being in communication with the interior of the cylindrical valve casing, a second valve commanding a port in said cylindrical valve casing, the said port communicating with a passage leading to the low pressure side of said main shell, a spring tending to close said second valve, means tending to normally hold said second valve open against the tension of its spring, the said means being controlled by the low pressure, a stem connected with the closed end of the said piston valve, and a recording device connected to and actuated by the said stem.

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

GEORGE MICHAEL HILGER.

Witnesses:

JOHN CLEMES,
PAUL KRANTZ.