(No Model.) 2 Sheets—Sheet 1.

C. B. BOSWORTH.

DEVICE FOR AUTOMATICALLY REGULATING BOILER FEED WATER.

No. 442,098. Patented Dec. 9, 1890.

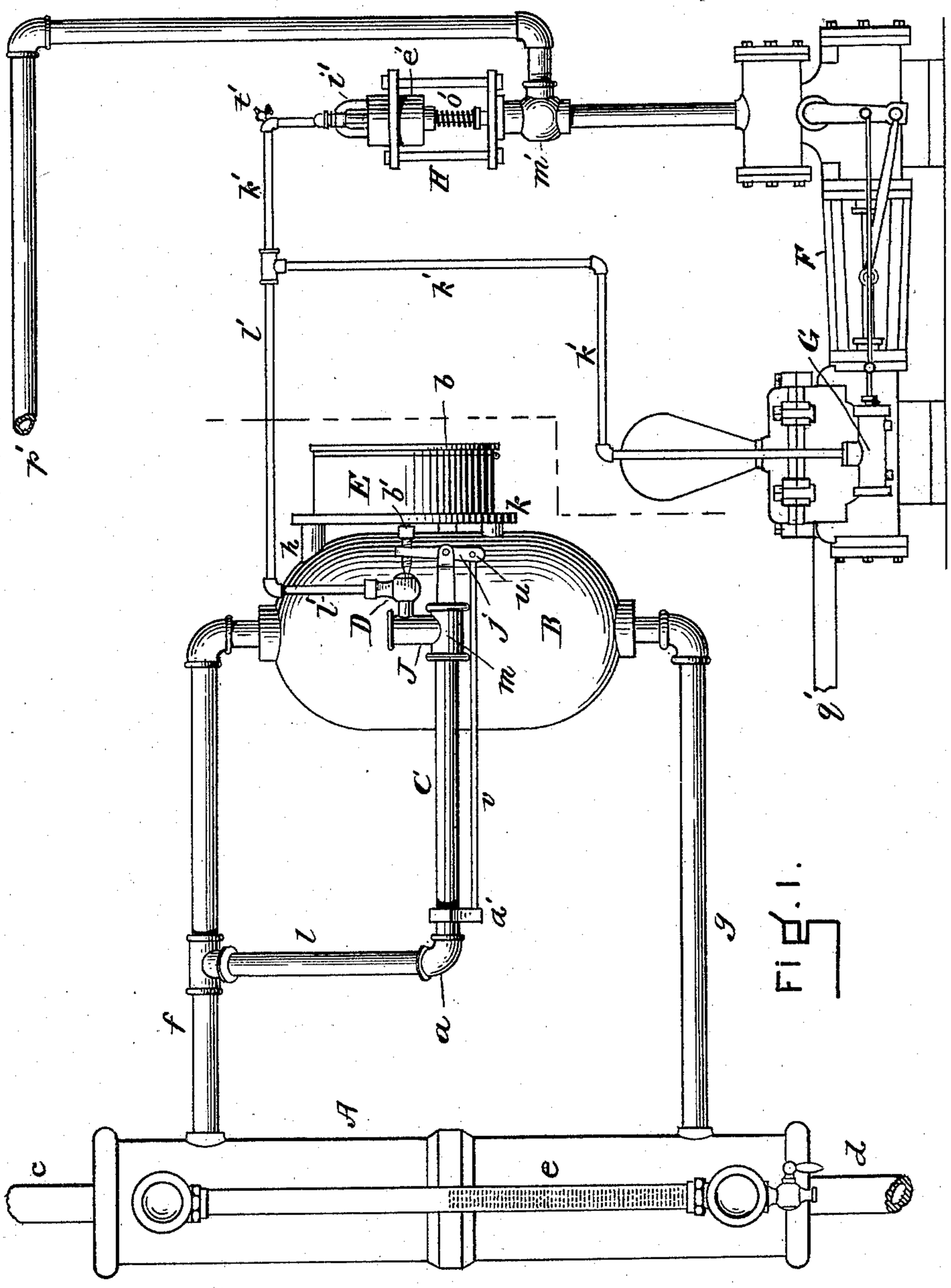

FIG. 1.

WITNESSES

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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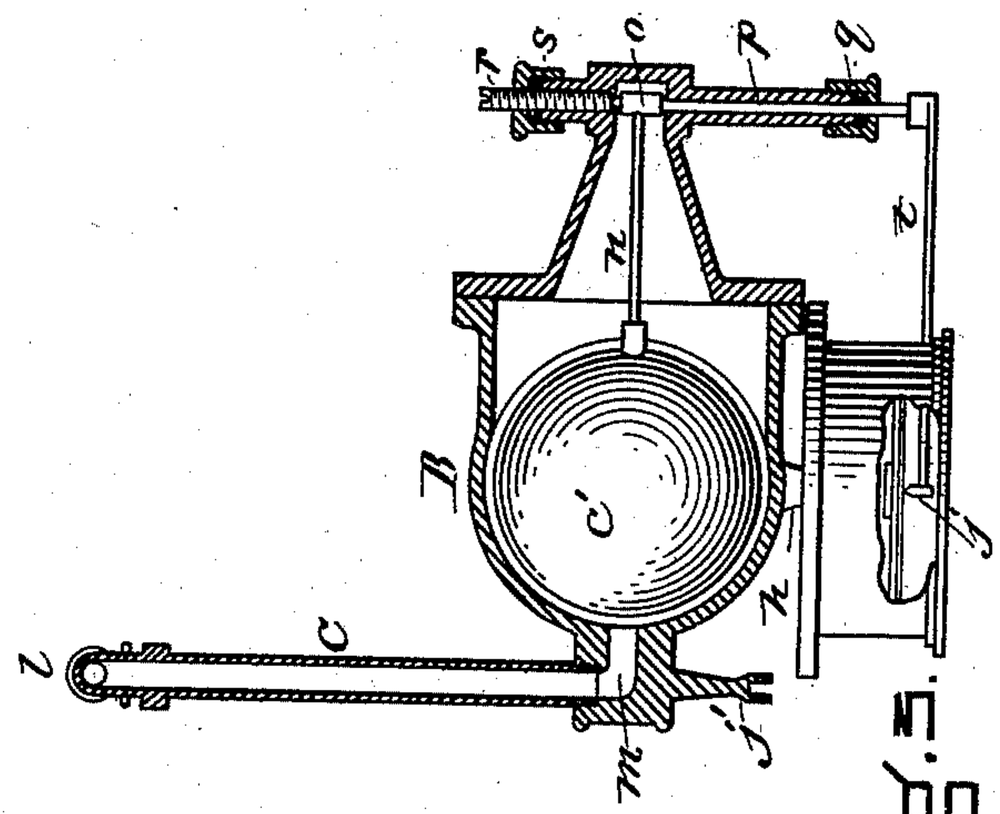

Fig. 5.

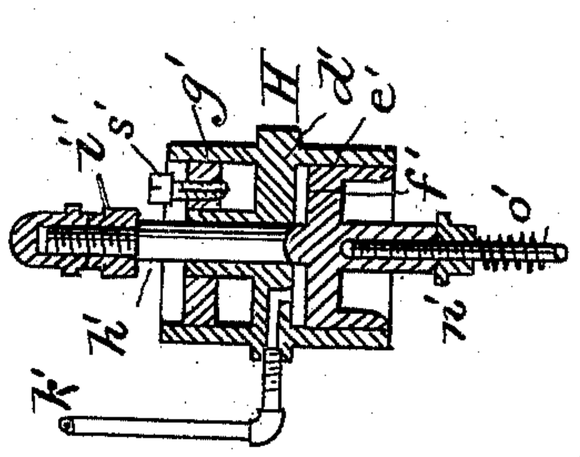

Fig. 4.

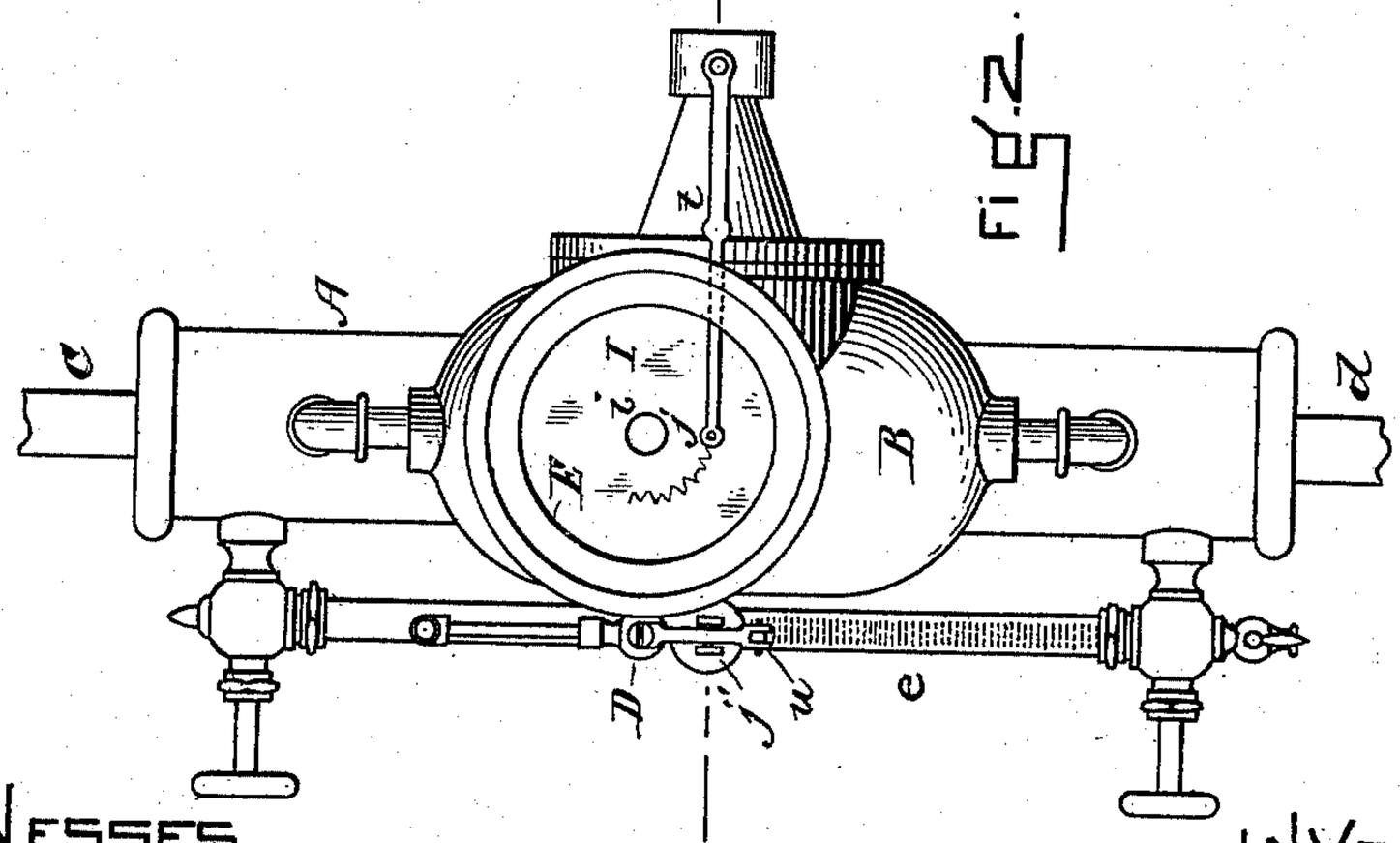

Fig. 2.

WITNESSES

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UNITED STATES PATENT OFFICE.

CHARLES B. BOSWORTH, OF EVERETT, ASSIGNOR TO THE CROSBY STEAM GAGE AND VALVE COMPANY, OF BOSTON, MASSACHUSETTS.

DEVICE FOR AUTOMATICALLY REGULATING BOILER FEED-WATER.

SPECIFICATION forming part of Letters Patent No. 442,098, dated December 9, 1890.

Application filed April 4, 1890. Serial No. 346,620. (No model.)

To all whom it may concern:

Be it known that I, CHARLES B. BOSWORTH, a citizen of the United States, residing at Everett, in the county of Middlesex and State of Massachusetts, have invented certain new and useful devices or combinations of devices by means of which the height of the water in a steam-boiler is automatically regulated and recorded, of which the following is a specification.

To enable others skilled in the art to make and use my invention, I will proceed to describe the same by reference to the accompanying drawings, making a part of this specification, and to letters of reference marked thereon.

Similar letters refer to similar parts throughout the several views.

Figure 1 is a side elevation showing the several devices in combination, embracing the water-balance chamber A, the ball-float chamber B, the thermostatic tube C, with its air-relief valve D, the cylindrical case E, inclosing the recording mechanism, the steam-pump F, air-pump G, and air-pressure governor H. Fig. 2 is an end elevation showing the face of the recording-dial and the tracing-point for registering the changes of water-level within the boiler; Fig. 3, a horizontal section through *a b*, Fig. 1; Fig. 4, a vertical section through the axis of the air-pressure governor, showing its air-pressure piston and dash-pot.

A is a cylindrical water-balance chamber capped at either end and having at its upper end a pipe *c*, connecting it with the steam-space of the boiler, and at its lower end a pipe *d*, connecting it with the water-space of the boiler. This chamber has mounted upon it a glass water-gage *e* of the kind usually employed to show the level of the water in steam-boilers, so that when the top of the water shows at the middle of the glass it is at the proper working-height, both in the chamber A and in the steam-boiler.

The ball-float chamber B is connected to the water-balance chamber A by pipes *f* and *g* in the same manner substantially as chamber A is connected to the steam-boiler, so that the water-level in the boiler and in chambers A and B is in all cases nearly alike, and the prescribed proper working-level of the water will be on the plane *a b*, Fig. 1, which passes horizontally through the axis of the thermostatic tube C. The chamber B has within it a hollow ball-float *c'*, of copper or other suitable material, which rises and falls with changes of the water-level therein, which movements are automatically conveyed through suitable mechanism to the recording-instrument.

Two or more studs, as at *h*, are cast on the side of the float-chamber for the attachment of the recording apparatus, which consists of a flat cylindrical case E, containing a disk I, mounted upon an axial spindle, which is slowly revolved by suitable clock-work. A card conforming to the size of the disk is secured upon its face by the thumb-screw nut *i*, and the tracing-point, which is made to bear lightly on the card as it revolves, is shown at *j*. An interposed shield of wood *k* is employed to prevent the heat of the float-chamber from being readily communicated to the recording apparatus, which is placed under glass, so that its operations are at all times open to observation. By means of the rod *n* the ball-float is rigidly secured to the solid collar *o* on the transverse rock-shaft *p*, which has a slight oscillatory movement derived from the upward and downward movements of the float.

The casing of the rock-shaft *p* is provided with a packing-box *q* at its outer end. At the inner end of the rock-shaft is formed thereon a conical point to receive the correspondingly-formed end of a set-screw *r*, which in line with the shaft passes through the metal of the casing and is made steam-tight by means of a packing-box at *s*.

Upon the outer end of the rock-shaft *p* is fixed the tracing-bar *t*, which passes through a slot in the case E and carries the tracing-point, as shown at *j*.

The circular registering-cards employed are divided by radial lines, the spaces between which represent the hours of a day, the days of a month, &c., as may be determined with reference to the clock-movement employed. In the rotation of the disk the tracing-point must pass over the radial lines of the card, leaving its track on record. The registering-card is also printed with a concentric circle

representing the prescribed water-line, and it will be evident that when the tracing-point goes above or below this line the water in chamber B is varying from its proper level correspondingly, which variations are recorded both as to their extent and time of duration.

The thermostatic tube C, which is of brass, is mounted upon the float-chamber B at the proper water-line, and at its outer end is connected with the steam-pipe *f* by the pipe *l*. The fixed point of this thermostat is at *m*, where there is a free opening into the interior of the float-chamber for the discharge or the induction of water, as may be required in the operation of the instrument.

Through the top and right-hand branches of the T-piece J there is no opening, the top branch being solid and the other closed by a plug having a forked standard *j'* projecting outward from it, providing a fulcrum for the lever *u*, the lower end of which is connected by the rod *v*, which is of iron, to a fixed collar *a'* at the outer end of the tube C, the upper end of the lever bearing a set-screw *b'* to regulate the operation of the valve D under the action of the expansion-tube.

As shown in Fig. 4, the upper part of the air-pressure governor H is divided by a horizontal partition *d'* into two chambers, the lower one *e'* being occupied by a cylindrical piston *f'* and the upper one by an annular piston *g'*. These two pistons are connected together by the central stem *h'* and yoke *i'*. The upper cylinder contains oil and acts as a dash-pot to prevent a too rapid movement of the working parts when called into action. The space between the under side of partition *d'* and the top of the cylindrical piston *f'* contains compressed air, supplied by the air-pump G, which is mounted upon the steam-pump F and from it receives its motion. The compressed air is conveyed to cylinder *e'* by the pipe *k' k' k'*, and by a branch of this pipe (shown at *l' l'*) it is conveyed to the air-relief valve D of the thermostat.

The air-pressure governor H is mounted on the top of the throttle-valve casing *m'* of the steam-pump and governs the opening and closing of that valve, which is connected with the piston *f'* by a screw-ended rod which is inclosed in a strong spiral spring *o'*, the tension of which may be modified by means of the screw-nut *n'*. At its lower end the spiral spring rests on top of the packing-box of the throttle-valve spindle. It will be understood that the pressure on the piston of cylinder *e'* and the force exerted by the spring *o'* are in opposition. The pipe *p'* conveys steam from the boiler to the steam-pump, and the pipe *q'* conveys the feed-water from the steam-pump to the boiler. The set-screw *s'* is to modify the passage of oil by the piston *g'* and the petcock *t'* on the pipe *k'* is to modify the air-pressure within the air-pipes in certain cases.

The operation of the improved devices herein described by me is as follows: The steam-pump F having been put in motion, the air-pump G, connected therewith, begins to force air into the pipes *k'* and *l'* and into the chamber *e'* above the piston *f'*. As the air-pressure accumulates in the chamber *e'*, the piston *f'* is pressed downward against the expansive force of the spiral spring *o'*, and the throttle-valve of the steam-pump being thereby partly closed, the movement of the steam and air pump pistons is correspondingly retarded. If the steam-pump is working too slow, the water-line of the boiler will be lowered, so that the water in the expansion-tube C will run into the chamber B, permitting the steam from pipe *l* to enter tube C, expanding it longitudinally from the fixed point *m*, so that the rod *v* being engaged to the solid collar *a'* at one end and at *u* to the lower arm of the lever *j'* at the other, the longitudinal movement of this rod by the expansion of the tube C is conveyed through the lever *j'* to the regulating-screw *b'* at its upper end, which now permits valve D to open, letting air escape from pipes *l'* and *k'* and chamber *e'* into the atmosphere when under the resilient action of the spiral spring the piston *f'* will rise, opening the throttle-valve of the steam-pump and accelerating its motion. If the steam-pump is working too fast, the water-line of the boiler will rise, so that steam contained in the expansion-tube C will be expelled therefrom by the incoming water, which will be cooled by radiation from the metal of the pipe, which will be contracted longitudinally toward the fixed point *m*, so that the rod *v* being engaged to the solid collar *a'* at one end and at *u* to the lower arm of the lever *j'* at the other the longitudinal movement of this rod, by the contraction of the tube C, is conveyed through the lever *j'* to the regulating-screw *b* at its upper end, closing the valve D and preventing the escape of air therefrom. The air accumulation in chamber *e'* will now press down the piston *f'* against the resilient force of the spiral spring, partly closing the throttle-valve of the steam-pump and retarding its motion.

The chamber B has within it a ball-float, which is subject to an upward and downward movement by the rising and falling of the water-surface, which is capable of light mechanical work, and I have attached the said ball-float by a suitable mechanism in connection with clock-work to show and register the changes of water-level which take place within the said chamber B in connection with the operations of the thermostat.

The combination herein set forth of the register and the thermostatic tube provides such a device that the variations in the height of the water controlled by the thermostatic tube are registered and preserved. Hence this device indicates with certainty whether and how the thermostatic tube is operating to control the governor.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In combination with a steam-boiler, the water-balance chamber A and float-chamber B, the latter having a horizontal thermostatic tube C, one end of which enters the float-chamber at *m*, while the other communicates with the vertical steam-pipe *l*, which at its upper end enters the steam-pipe *f*, connecting the said chambers, substantially as and for the purpose set forth.

2. The combination of the float *c* and chamber B with the thermostatic and recording devices and the pumping machinery, substantially as and for the purpose set forth.

3. The combination of the thermostat, the float-chamber, and the recording device, as set forth.

CHARLES B. BOSWORTH.

Witnesses:
JOSHUA H. MILLETT,
DUDLEY P. BAILEY.