W. G. HAY.

STEAM GENERATOR.

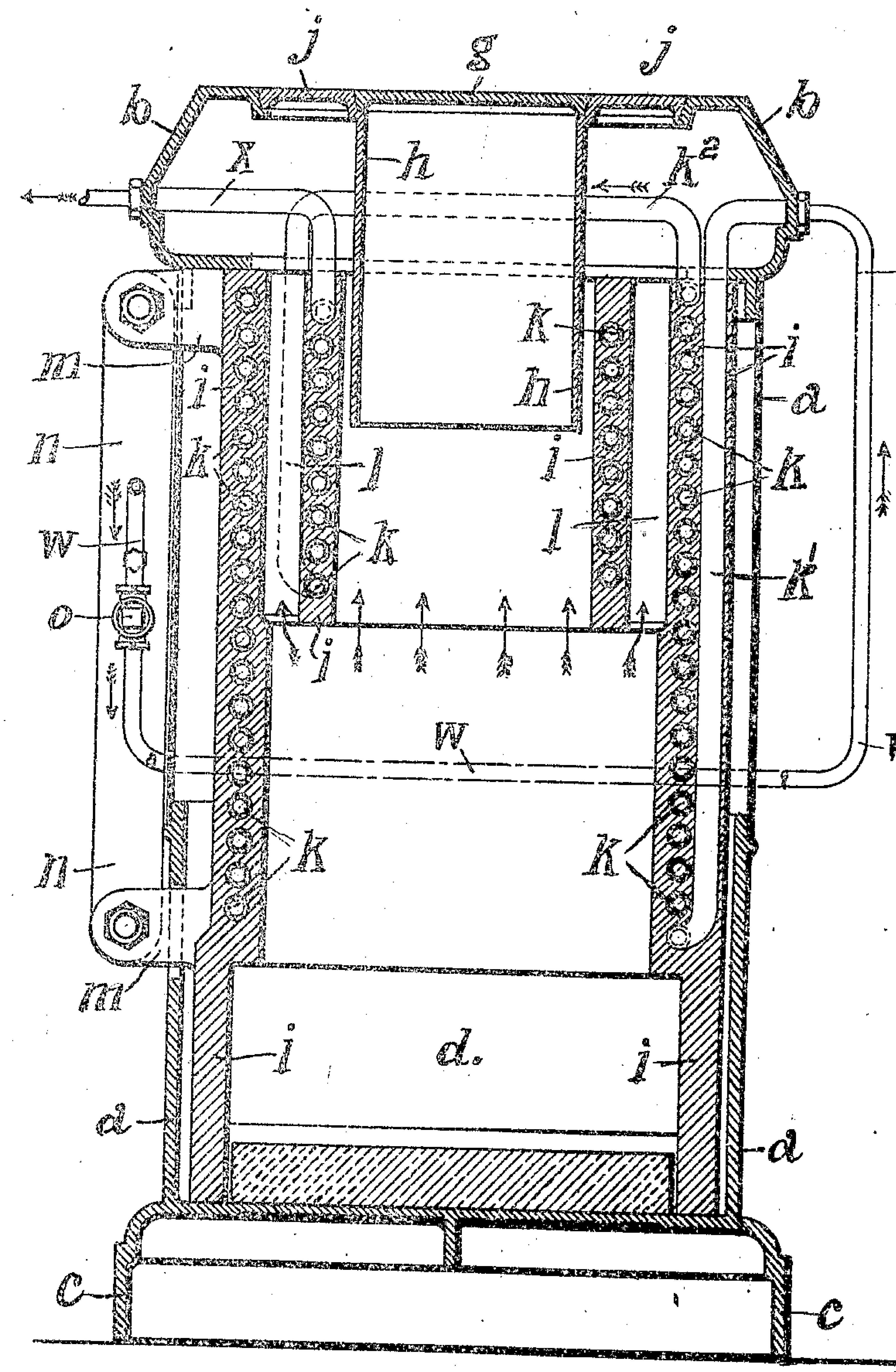
APPLICATION FILED APR. 14, 1910.

966,201.

Patented Aug. 2, 1910.

2 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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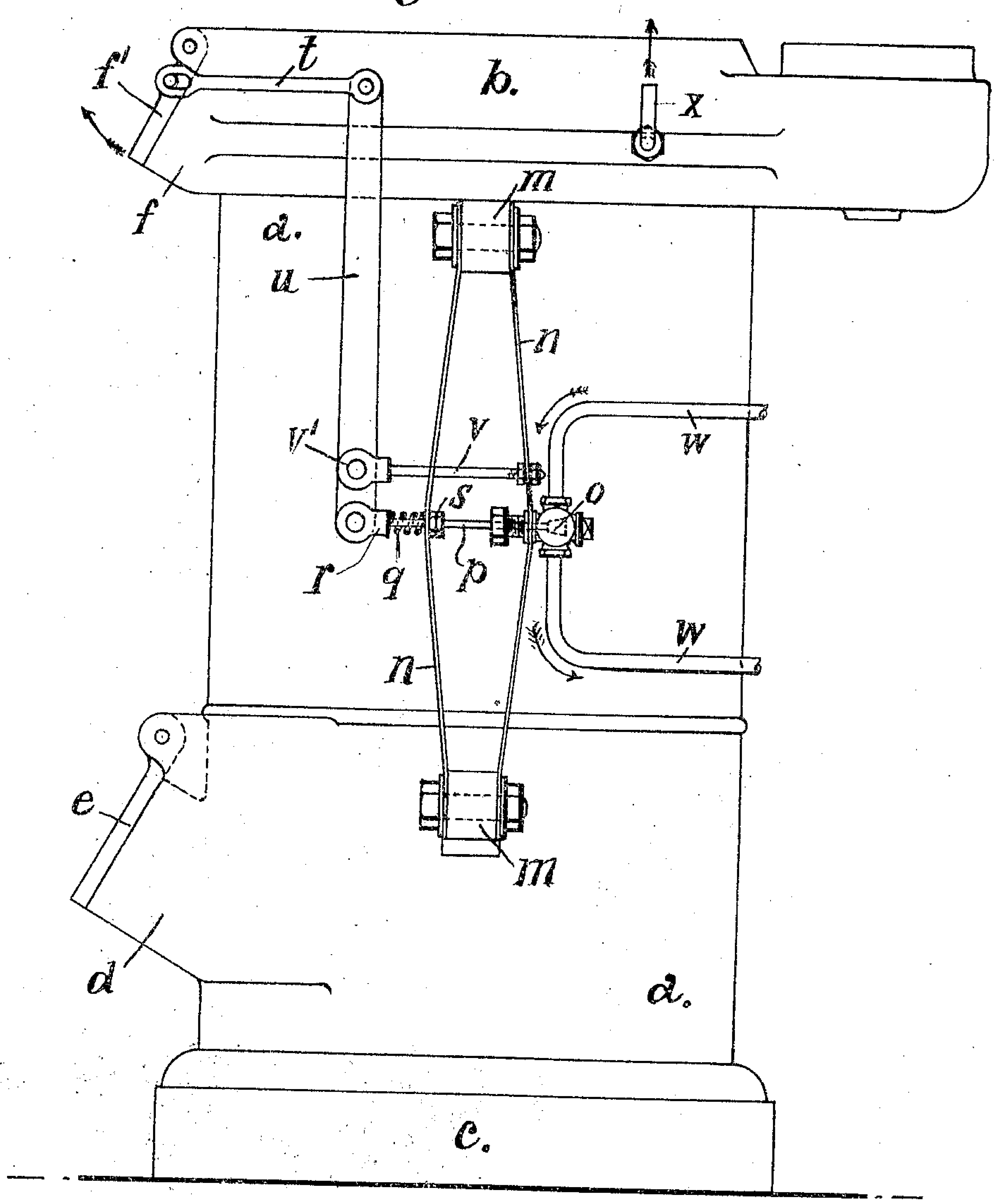
Fig. 2.



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UNITED STATES PATENT OFFICE.

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STEAM-GENERATOR.

966,201. Specification of Letters Patent. Patented Aug. 2, 1910.

Application filed April 14, 1910. Serial No. 555,499.

To all whom it may concern:

Be it known that I, WILLIAM GEORGE HAY, a subject of the King of England, residing at Tuebrook, Liverpool, in the county of Lancaster, England, have invented new and useful Improvements Relating to Steam-Generators, of which the following is a specification.

The present invention has reference to tubular steam generators of the type generally called "flash" or "semi-flash" steam generators, that is, the kind in which a small quantity of water is contained in the steam generating portions, and the water supplied or delivered to it is rapidly generated, and the steam is superheated or dried prior to leaving; and it further relates to that type in which the quantity of steam made and supplied is automatically controlled by the expansion and contraction of a part of the steam generator, and a thermostatic device.

The object of the present invention has been to provide a steam generator of this type which is simple and inexpensive, and in which the automatic control of the generation of steam, and general working, are reliably effected, so that it is capable of being used without attention, beyond keeping it supplied with fuel.

Under this invention, the body of the steam generator has the water conduit embedded in it in the form of two or more concentric coils with passages between. The conduit occupies more or less the greater length of the body, and is connected with a suitable feed water pipe, having a controlling valve, which is automatically actuated through the medium of a heat regulating or thermostatic device attached to the body of the generator, and is caused to operate by the expansion or contraction of the generator body due to the varying temperature thereof. If desired, the thermostatic device may also be connected with one or more of the dampers of the generator furnace, and thus provide means of regulating the same by the admission of air to the furnace, and by controlling the admission of feed water.

The thermostatic device is carried on the body, having the embedded water conduit by means of spaced lugs or other means attached thereto, and is so constructed that as the generator body expands, the connection tends to become straight or flat, and in so doing, actuates the water valve, and may be the damper or dampers.

In the drawings, Figure 1 is an elevation showing a steam generator in section; and Fig. 2 is an elevation, showing the generator in outside view, but at a point removed 90° from that at which Fig. 1 is taken.

In the drawings, the body of the steam generator is of a vertical cylindrical type, such as is commonly employed in what are known as "slow combustion" stoves for burning solid fuel, and it comprises a cylindrical body or casing *a*, a hood *b*, and base *c*. The body *a* is provided at the bottom with an entrance *d* for cleaning and lighting the furnace, or other purpose, and has connected with it a door *e* which serves as a means of having access to the interior of the furnace portion of the generator, and for regulating the amount of air admitted in the well known way; while the hood *b* is provided with an air inlet *f*, having upon it a door or damper f^1 for regulating the quantity of air admitted to the hood *b*, which is automatically controlled, and serves to regulate and control the draft.

Within the body or casing *a* there is employed a cast metal—say cast iron—cylindrical casting *i*, in which is embedded a coil or coils of metal tubing *k*, through which the water to be converted into steam, and the steam produced from it, are passed; and the fuel which is burned lies and burns within this cylinder. The upper part of the cylindrical casting *i* is thicker than the lower part, and the annular thicker portion overhangs the lower part, and tubular passages *l* are provided—cast—in it, and extend through it, and serve as heating surface, and as passages for the exit of the combustion gases. The heat of combustion has also access to the interior surface of this upper part of the cylinder *i*; the gases having access to it by a small annular passage between it and the depending tube *h*, leading into the hood *b*; into which also lead the tubular passages *l*. The depending tube *h* has a cover or door *g* at the top, and extends down from the upper part of the hood *b*; and is at the top provided with an annular flange *j*, which fits and rests in the hood, and it serves to conduct the fuel down into the furnace below.

The thermo governing device or regulator is connected with the cylinder *i*. and is so arranged and adapted that according to the temperature of it—*i. e.*, the cylinder—, and

its consequent length between certain points, at any given temperature, so will be the amount of opening given to the water supply regulating cock *o*; and as this length varies, as the temperature which is in it varies, so will this amount of opening of the water cock be varied by the action of the thermo regulator. The thermo regulator also operates in connection with the means of regulating the combustion by the fuel, namely, it is connected with an air valve or damper *f* which is opened and closed by it: and should the temperature within the furnace become very excessive, the valve or damper *f* will be opened more or less (it being normally closed when the apparatus is working; and water is being supplied to the steam generating tubes), and the quantity of air supplied to the fuel through the inlet *d* (due to the greater or less opening of the damper or valve f^1) will be regulated. That is, it will be less when the valve *f* is opened, and normal when closed. In the case shown, the contraction and expansion of the cylindrical casting *i* is transmitted to the thermo regulator from different points in its length, by lugs *m* cast upon it at different points in its height; and by connecting to these lugs two metal strips *n*, bowed wider apart at the center than the ends, and coupled up with the water cock *o* (and the damper f^1), the longitudinal expansion and contraction of the cylinder *i* is conveyed to the strips *n*, and they are brought nearer together or pressed farther apart in the one, than in the other case, respectively.

The body or case of the feed water regulating valve or cock *o*—which may be of any suitable kind—is fixed to one of the strips *n*, and its spindle *p* is connected with the other strip *n* through a spring *q* outside it—which acts at one end on the jaw *r* on the spindle—and adjustable supporting nuts *s* within the strip. When, therefore, the strips *n* move inward, due to increase of heat in the cylinder *i*, the valve spindle *p* is pressed in, and the plug of the valve opens more or less the bore of the water passage through the valve, and, vice-versa, so that water is supplied to the generator in a greater quantity, and upon the cylinder being cooled by this water, it causes the valve *o* to be closed more or less, and prevents too much water being supplied; and so the action is carried on automatically in pulsations of water supply. When the apparatus is cold, the valve *o* will be closed.

The damper f^1 is connected with the strips *n* through a link *t*, a lever *u*, and a rod *v*; the rod having a jaw v^1 at one end, and connected to the lever *u*, and at the other connected to the strip *n*, to which the valve body *o* is fastened, and near it. The jaw v^1 thus acts as a fulcrum to the lever *u*, the short end of which is connected to the valve spindle jaw *r*; and, therefore, when the strips *n* move inward an abnormal amount, and the spindle *p* is pulled out, the jaw *r* presses the short end of the lever *n* inward, and so opens the damper f^1, causing thereby the amount of air entering the furnace below to decrease. The link *t* is slotted at the damper end, so that it will only press the damper open, when the heat, and consequently the movement of the strips *n* are very excessive.

In the arrangement shown, the water is conducted from the regulating cock *o* by a pipe *w*, to the descending part k^1 of the pipe embedded in the casting *i*; and from the top of that coil in the outer part of the casting, the water or steam to which it has been converted, is carried by a connecting pipe k^2 to the hollow of the coil in the inner upper part of the casting, and thence by a pipe *x* to the place of use.

In some cases, liquid or gaseous fuel may be used as the heating medium, instead of solid fuel, in which case, the thermo regulating device may be adapted to regulate the quantity of fuel supplied to the generator.

What is claimed is:—

1. A steam generator comprising a casing adapted to contract and expand under the influence of heat, a water conduit embedded in the casing, a valve in the conduit, and a valve controlling device connected to the casing at spaced apart points, whereby when the casing expands the valve controlling device will operate to open the valve.

2. A steam generator comprising a metal casing, adapted to contract and expand under the influence of heat, a conduit connected with the metal casing, a valve in the conduit, valve controlling means including two spaced apart members connected with the casing at spaced apart points and adapted to operate the valve to control the flow of water through the conduit.

3. A steam generator comprising a body of metal, adapted to contract and expand under the influence of heat, a water conduit connected with the said body; a water supply valve for the conduit; valve controlling means including a pair of flexible strips connected to the body of metal at two different parts and means connected with the strips and the valve for actuating the latter according to the expansion and contraction of the body of metal due to the temperature.

4. A steam generator comprising a body of metal adapted to contract and expand under the influence of heat a water conduit embedded in the said body; a water supply valve, and a valve controlling device connected at two different parts to the body of metal, and to the water supply valve.

5. In a steam generator, the combination of a casting, having embedded in it a coil

or coils of tubes, and within which the fuel is burned; said casing adapted to contract and expand under the influence of heat a water supply valve; and a valve controlling device comprising flexible strips connected to the casting at different points, and connected with the water supply valve.

6. In a steam generator, the combination of an outer casing; a hollow casting, adapted to contract and expand under the influence of heat and mounted within the casing; coils of tubes embedded within the casting; a hood on the top of the outer casing; air regulating means to said casing and hood; a valve controlling device extending from the casting, a connection between the valve controlling device and the regulator for controlling the air inlet, and a connection between the valve controlling device and the valve to control the water supply; substantially as set forth.

7. A steam generator comprising an outer casing; a cylindrical hollow casting within the casing; adapted to contract and expand under the influence of heat, a water conduit embedded in the casting; a hood on the top of the outer casing; air regulating means attached to the hood; air regulating means attached to the casing; a water supply valve connected with the conduit; and a controlling device comprising flexible metal strips attached to the casing at two different points; and means connecting the strips to the valve and air regulating means.

8. In a steam generator, the combination of a casing, a hollow casting mounted in the casing, and adapted to contract and expand under the influence of heat, the said casting having openings for the passage of heat, a conduit embedded in the walls of the casting each side of the openings therein, a valve in the conduit, a flexible strip secured at its opposite ends to the casting, a connection between the flexible strip and the valve, whereby when the casting expands the flexible strip will yield and operate the valve.

9. In a steam generator the combination of a casing, a hollow casting mounted in the casing and having mounted in the walls thereof a conduit two spaced apart projections on the casting a valve in the conduit, two flexible strips secured to the projections, a draft regulator, and connections between the draft regulator the valve and the flexible strips whereby when the casting expands the flexible strips will operate the valve and the regulator.

10. In a steam regulator, the combination with a casing, a hollow casting supported in the casing and provided with a thickened portion formed with openings for the passage of heat, a conduit in the walls of the casting, the said conduit being arranged on opposite sides of the openings in the casting, a valve in the conduit and means supported on the outside of the casting for operating the valve when the casting contracts or expands.

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

WILLIAM GEORGE HAY.

Witnesses:

SOMERVILLE GOODALL,

DONALDSON COULTER.