W. SCHMIDT.

QUICK ACTING STEAM GENERATOR.

APPLICATION FILED APR. 30, 1914.

1,166,007.

Patented Dec. 28, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

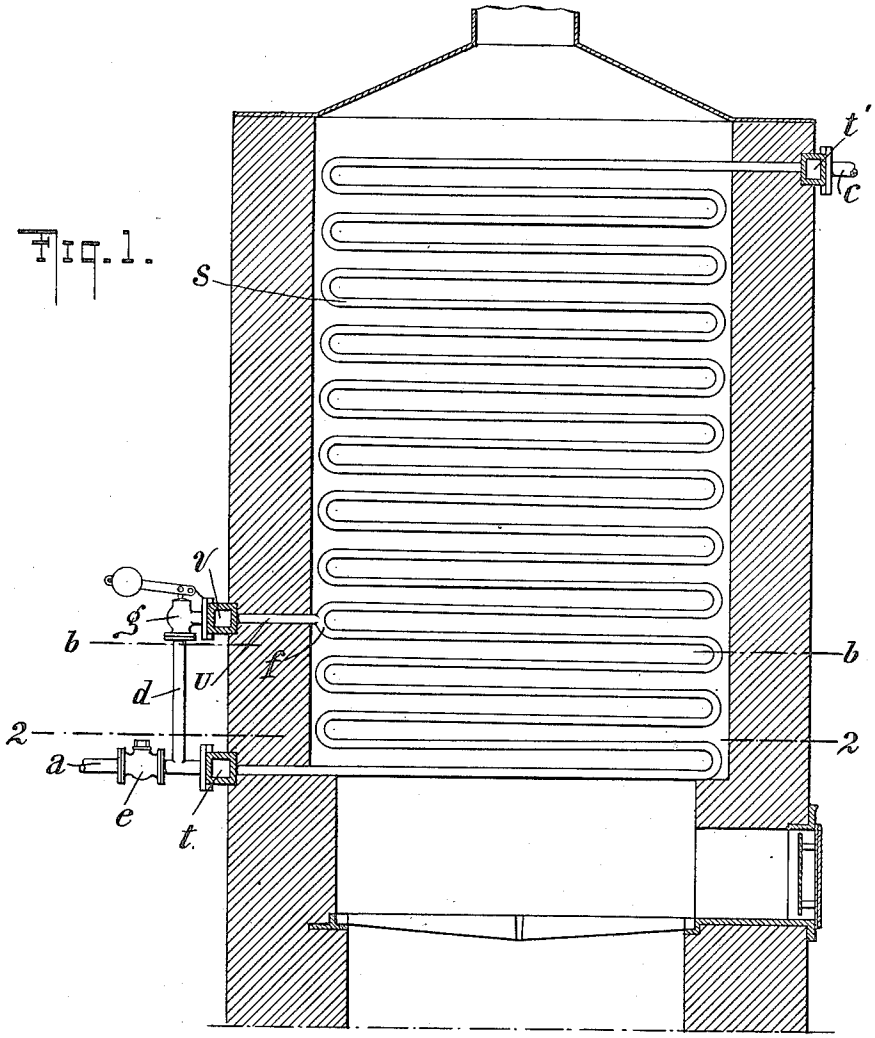


Fig. 2.

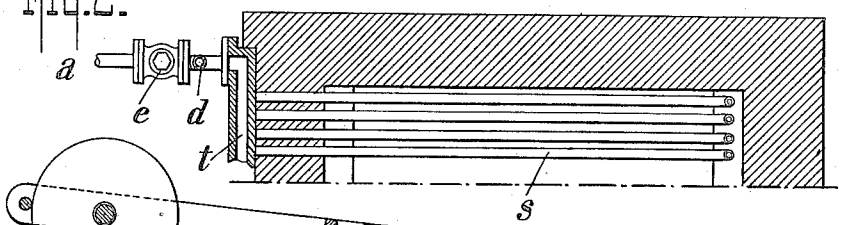
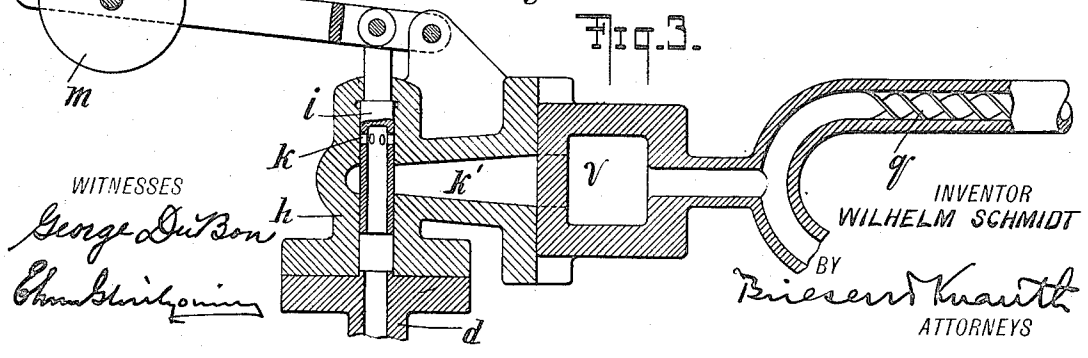


Fig. 3.



WITNESSES

George DuBois

INVENTOR

WILHELM SCHMIDT

BY

Briesen & Knauth

ATTORNEYS

W. SCHMIDT.

QUICK ACTING STEAM GENERATOR.

APPLICATION FILED APR. 30, 1914.

1,166,007.

Patented Dec. 28, 1915.

2 SHEETS—SHEET 2.

Fig. 4.

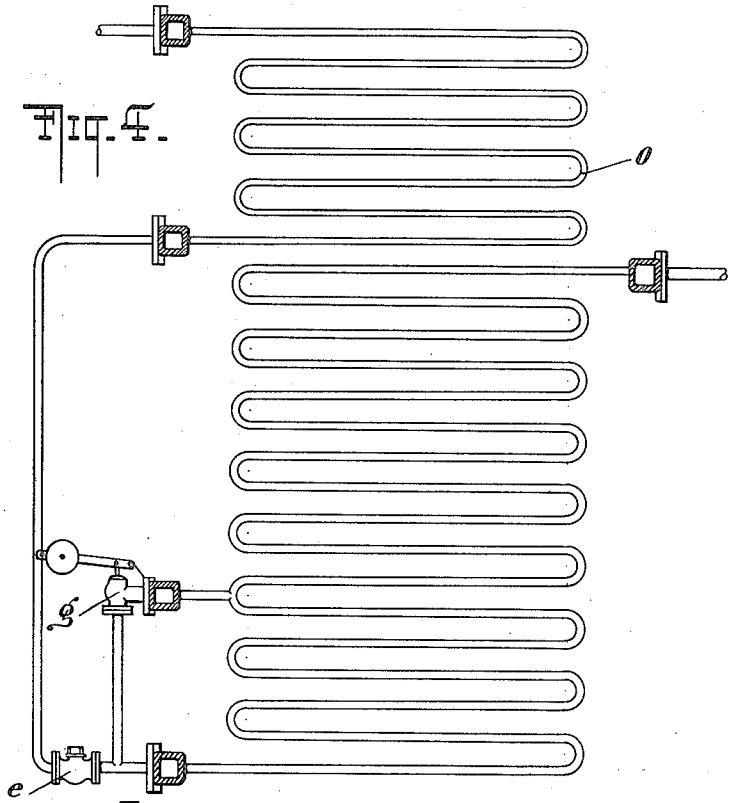
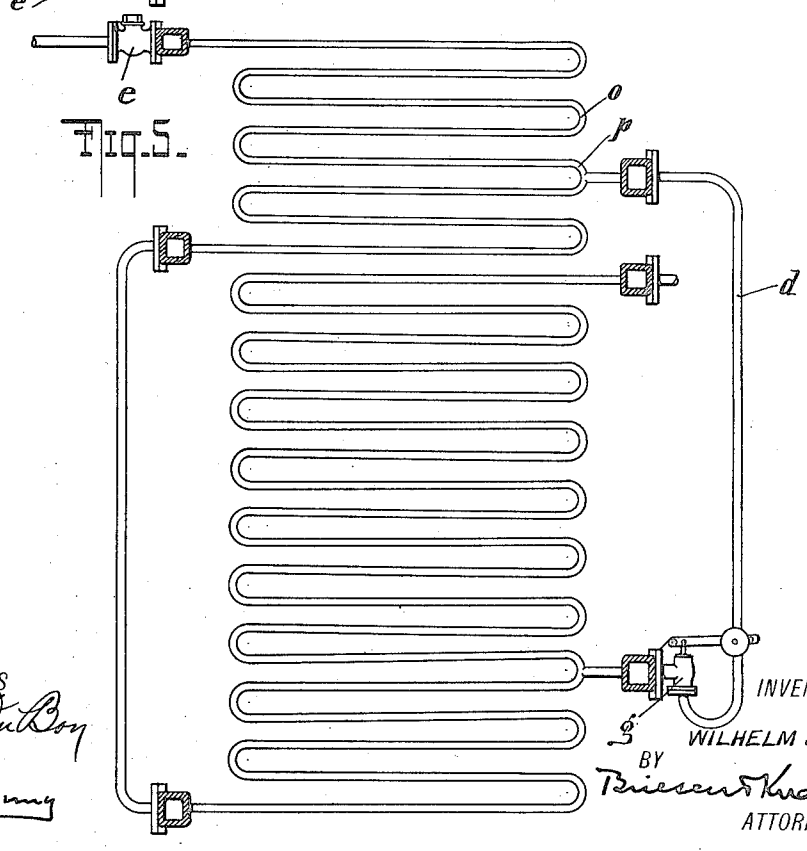


Fig. 5.



WITNESSES

George DuBoy

Chas. Shilgomy

INVENTOR

WILHELM SCHMIDT

BY

Briesen & Knauth

ATTORNEYS

UNITED STATES PATENT OFFICE.

WILHELM SCHMIDT, OF CASSEL-WILHELMSHÖHE, GERMANY, ASSIGNOR TO SCHMIDT'SCHE HEISSDAMPF GESELLSCHAFT M. B. H., OF CASSEL-WILHELMSHÖHE, GERMANY, A CORPORATION OF GERMANY.

QUICK-ACTING STEAM-GENERATOR.

1,166,007. Specification of Letters Patent. Patented Dec. 28, 1915.

Application filed April 30, 1914. Serial No. 835,398.

To all whom it may concern:

Be it known that I, WILHELM SCHMIDT, a subject of the Emperor of Germany, residing at Cassel-Wilhelmshöhe, Germany, have invented a certain new and useful Improvement in Quick-Acting Steam-Generators, of which the following is a specification.

My invention relates to a quick acting steam generator comprising a system of continuous pipes into one end of which water is fed, while from the other end steam is taken off.

Steam generators of the character specified are old and have, as is well known, a very small cubic content, so that, in effect only so much water can be fed into the generator in a given time as is to be converted into steam in the same time. As a consequence any increased or decreased steam consumption will require a corresponding increase or decrease in the amount of feed water and perhaps, also, in the amount of fuel. Although, for such increased or decreased steam consumption, the amount of feed water as well as the fuel supply may be adapted to the new load very quickly, there is nevertheless a certain time which must always elapse before the change in the quantity of steam generated corresponds to the change in the quantity required. Where solid fuel is used, this time is apt to be particularly large, because of the fact that this solid condition prevents rapid increase or decrease in the heat value of the fire. Steam generators of the described type will, therefore, show great variations of pressure under changing conditions of steam consumption and such pressure variations will, when the change in load is great and abrupt, be too large for satisfactory practice.

It is the object of my present invention to restrict any decrease of pressure caused by an increased steam consumption, within the permissible and reasonable limits of good commercial practice.

I attain the object of my invention by providing an auxiliary feed water inlet at a point in the pipe (boiler) system between the main feed water inlet and the steam outlet. Preferably, this auxiliary inlet should be located at a point where the pipe walls have a temperature substantially greater than the temperature of evaporation corresponding to the normal boiler pressure. Such a point is to be found wherever, in the boiler system, evaporation has been completed and steam is being superheated, since here the temperature of the pipe walls may exceed the temperature of evaporation by a very considerable amount, say, by as much as 100° C. Since, however, experience shows that superheating of the steam often begins, unless artificially retarded, in steam generators of the type specified, while evaporation is still going on, it is obvious that other points in the boiler system may be selected for the auxiliary feed water inlet.

My invention will be better understood by referring to the drawings, in which—

Figures 1 and 2 represent, respectively, a vertical section in the plane of the pipes, of a generator embodying my invention, and of a section taken along the line 2—2 of Fig. 1; Fig. 3 is a detailed view, on an enlarged scale, of the auxiliary feed water inlet and its controlling valve; Fig. 4 represents the boiler system proper of a modified form of my invention; and Fig. 5 represents a view, similar to Fig. 4, of another modification of my invention.

Referring to Figs. 1, 2 and 3 a number of flat serpentine pipes *s*, arranged in parallel vertical planes, constitute the pipe system of the boiler. The lower ends of each set of pipes open from a common chamber, *t*, itself connected with a pipe, *a*, controlled by a back pressure valve *e* which constitutes the main feed water inlet. The upper ends of each set of pipes, similarly, discharge into and enter a common chamber or steam collector *t'*. The line *b*—*b* indicates the level at which evaporation of the feed water is substantially completed under conditions of normal load, *i. e.*, the space in the pipes above this level is occupied only by steam which, as it leaves the chamber *t'* by pipe *c*, is superheated to a greater or less extent. At the point *f*, preferably above the level *b*—*b*, the several sets of pipes *s*, are connected by pipes *u* to a third common chamber *v*, which is itself connected by a pipe *d* with the main feed pipe *a*, just inside of the back pressure valve *e*. In pipe *d*, between chamber *v* and the feed water pipe, is a control valve *g* (shown enlarged in Fig. 3), comprising a casing *h* with a piston *i* vertically movable therein. This piston *i* has circumferentially spaced holes *k* near its

upper end and is connected to an arm pivoted upon the casing and carrying a weight m, which tends to keep the piston in its lowest position. A passage k', opening from the chamber v, intersects and enlarges the bore (casing h) in which the hollow piston i is arranged to move up and down. A spirally formed strip of sheet iron q may preferably be inserted in each pipe system s just above the pipe u.

The operation of my invention is as follows: Suppose the load to be uniform and the boiler system, as a whole, in equilibrium. If, now, the load is substantially increased, the pressure in the generator and at the main feed water inlet, will be decreased. The piston i, the position of which is dependent upon the difference between the steam pressure below it and the pressure due to the weight m above it, will accordingly descend until the holes k register with the enlargement of passage k', thereby permitting feed water to ascend pipe d, through the piston i, holes k, passage k' and pipe u, into the pipe system at f. The holes k are, preferably, substantially longer lengthwise of the piston than transversely thereto, so that the greater the drop of the piston, the greater will be the amount of water admitted at the auxiliary inlet f. Water passes over through the pipe d to the auxiliary inlet, of course, by reason of the fact that the pressure at f is less than that at the main feed water inlet by an amount due to the throttling caused by that portion of the pipe system below the level b—b. As the feed water enters the pipe system at f, it is seized by the rapidly moving steam generated below the point f, the action being much like that of an injector, and thrown upon the spiral strip q which gives it a whirling motion sufficient to throw every part of it upon the heated pipe walls and thus hasten evaporation. As the amount of steam generated is thus increased by the use of the auxiliary feed inlet, the steam pressure is correspondingly increased and the piston i raised so as to cut down the amount of water being fed through the auxiliary inlet and finally to cut off the water supply at this point altogether. The above described operation will repeat itself whenever the load is increased. If, instead of there being an increase of load, the heat supplied by the fire should be lessened by reason of cinders forming or otherwise, there will be a similar feeding of water at the auxiliary feed inlet, brought about as just described. That is to say, the boiler pressure at the main fuel inlet will fall because of the lowered heating and hence piston i will be depressed and admit water at f until the increased generation of steam brings about a new condition of equilibrium. Whenever the steam consumption is lessened, the pressure at the bottom of pipe d is correspondingly increased so that the piston i is maintained in its highest position and no water is able to pass into the boiler by the auxiliary feed inlet.

The modification shown in Fig. 4 differs from that shown in Figs. 1 and 2 mainly in that a feed water heater o, arranged to be heated by the hot gases used in heating the main boiler, is located outside of back pressure valve e. Warm water, is, therefore, fed into the boiler system at the auxiliary feed inlet and evaporation of this auxiliary feed water is, therefore, hastened.

In Fig. 5 the back pressure valve, in contradistinction to the arrangement in Fig. 4, is placed at the beginning of the feed water heater and the auxiliary feed inlet pipe d is connected to a point p on the pipe system of said feed water heater. The mode of operation of this modification and the advantages accruing therefrom, are substantially the same as those referred to in connection with Figs. 1 and 2.

While water is being admitted at the auxiliary inlet, the steam generated is, possibly, not superheated as much as under ordinary conditions of constant load; but inasmuch as the auxiliary feeding is only temporary and ceases as soon as the supply of water fed at the main inlet, as well as the fuel supply, is adjusted to the increased steam requirements, the heat abstracted from the pipe system at and in the neighborhood of the auxiliary inlet will quickly be replaced by the fire gases and the steam will as quickly regain its normal degree of superheat.

The heat required for the evaporation of the water fed at the auxiliary inlet is, of course, that stored in the pipe system at and near said inlet where, as previously stated, the temperature of the pipes may be substantially greater than the temperature of evaporation corresponding to normal boiler pressure.

As before stated, any one of several points upon the pipe system may be chosen for the auxiliary inlet; care need only be taken that at the point selected, the permanent decrease of pressure, due to the increased steam consumption, is not sufficient to keep the control valve g permanently open. The desired end may always be brought about because the permanent decrease of pressure is always less than the temporary drop which starts the auxiliary feed.

The auxiliary feed could be started and stopped by hand, if desired, instead of automatically as above described.

The quantity of water fed at the auxiliary inlet may be entirely independent of the quantity required on account of the increased load. In other words, the entire quantity of water necessitated by the increased steam consumption, may be fed at the main inlet and, in addition thereto, a further supply

may be fed at the auxiliary inlet. In such case more water will enter the boiler than is required for the new condition of equilibrium so that there is an excess supply to be compensated for in some way. It is preferable, therefore, to so regulate the supply at the two feed inlets that the total quantity fed at both may be just equal to that required for the new state of equilibrium.

While I have described a preferred and certain modified form of apparatus embodying my invention, I do not restrict myself thereto, as other forms may readily be devised to embody the principles set forth in the following claims.

I claim:

1. In a steam generator, the combination with a continuous pipe having a main water inlet at one end and a steam outlet at the other, of an auxiliary water inlet between said main inlet and the steam outlet.

2. In a steam generator, the combination with a continuous pipe having a main water inlet at one end and a steam outlet at the other of means for feeding an auxiliary supply of water to a part of the pipe between said main inlet and the steam outlet whenever the steam consumption is increased.

3. In a steam generator, the combination with a continuous pipe having a main water inlet at one end and a steam outlet at the other, of means controlled by the boiler pressure for feeding an auxiliary supply of water to a part of the pipe between said main inlet and the steam outlet.

4. In a steam generator, the combination with a continuous pipe having a main water inlet at one end and a steam outlet at the other, of an auxiliary feed pipe leading from a point near said main inlet to a point nearer said steam outlet, and a valve in said pipe adapted to open and permit the passage of auxiliary feed water when the steam consumption is suddenly increased.

5. In a steam generator, the combination with a continuous pipe having a main water inlet at one end and a steam outlet at the other, of an auxiliary feed pipe leading from a point near said main inlet to a point nearer said steam outlet, a valve in said pipe operatively acted upon by the boiler pressure and tending to keep said valve closed and means exerting a constant force acting upon said valve to open it.

6. In a steam generator, a source of feed water, a continuous pipe leading from the feed water source and having a steam outlet at the other end, a feed pipe having one end connected with the feed water source and the other end connected with the continuous pipe between the ends thereof, a valve in said feed pipe adapted to be moved to its closed position by pressure at that end of the feed pipe which is joined to the feed water source, and means exerting a constant force upon said valve to move it in the opposite direction.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILHELM SCHMIDT.

Witnesses:

EGMONT DOETTLOFF,

GUSTAV RETTIG.