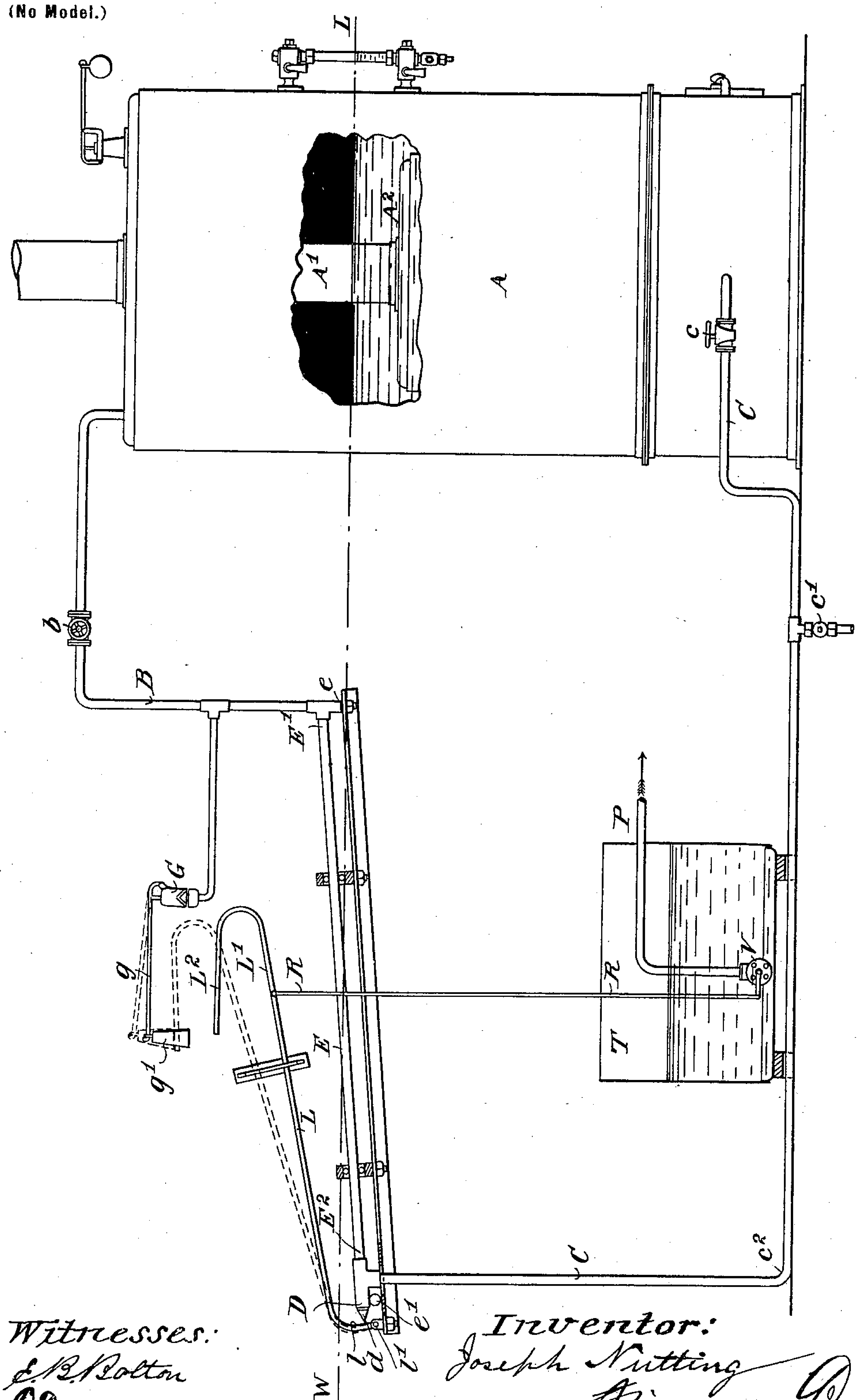
No. 627,760. Patented June 27, 1899.

J. NUTTING.

FEED WATER REGULATOR.

(Application filed Nov. 29, 1898.)

(No Model.)



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UNITED STATES PATENT OFFICE.

JOSEPH NUTTING, OF LONDON, ENGLAND.

FEED-WATER REGULATOR.

SPECIFICATION forming part of Letters Patent No. 627,760, dated June 27, 1899.

Application filed November 29, 1898. Serial No. 697,793. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH NUTTING, a subject of the Queen of Great Britain and Ireland, and a resident of Balham Grove, Balham, London, England, have invented a certain new and useful Feed-Water Regulator, (for which I have made application for a patent in Great Britain, No. 13,514, dated June 17, 1898,) of which the following is a specification.

The object of my invention is to provide simple and reliable self-acting apparatus by which the feed-water supply to steam-boilers will be automatically regulated in accordance with the rate of evaporation and consequent variations of the water-level within the boiler.

The operation of the apparatus depends upon the longitudinal expansion and contraction of a metallic tube when subjected to variations of temperature. The tube is disposed with a suitable inclination from the horizontal, and its upper end is immovably fixed and in free communication with the steam-space of the boiler and its lower end with the water-space thereof in such manner that the upper part of the expansion-tube always contains steam of a temperature corresponding to the pressure and the lower part contains water of or less than the temperature existing at or near the lower part of the boiler. Thus the water-level in the expansion-tube will vary exactly with that in the boiler, and hence it follows that as the water falls more steam will enter the tube, the high temperature of which will cause longitudinal expansion thereof, and vice versa. The motions of said tube are utilized either directly or indirectly through suitable multiplying gear to operate a lever, wheel, or other equivalent movable device which is connected to the steam-valve of the boiler-feed pump or injector or to a valve controlling the suction-pipe thereof or to some other moving part directly or indirectly controlling the feed-water supply to the boiler. Cocks are arranged wherever convenient in the system of pipes for the purposes of shutting off, blowing through, &c. With such apparatus I combine in some cases an automatically-operated alarm-whistle for the purpose of giving audible notice should any failure of the working parts occur. This may be considered a somewhat important element of the combination, since in its absence any failure might not be discovered until the water-level had become unduly lowered or an accident had actually occurred.

It will be obvious that the arrangement of the apparatus may take various forms to adapt it to different types of boilers, space at command, &c.; but I will fully describe one arrangement which experiment has proved to be useful, reliable, and efficient.

The figure is a general elevation showing the whole of the parts comprised in my invention as applied to a vertical steam-boiler A, fed by a pump the suction-pipe P of which is submerged in a water-tank T.

E is the metallic expansion-tube, which may be straight, as illustrated, or serpentine. It is disposed in an inclined position in such manner that when the water in the boiler is at normal working level the line thereof WL will pass through the tube E about its mid-length, as illustrated, or below same. The tube E is immovably fixed at its upper end E′ to a permanent bearing *e;* but its lower end E^2 is allowed free movements of expansion and contraction and is supported, preferably, on a roller or rollers at *e′*. The upper and fixed end E′ is connected to the steam-space A′ of the boiler A by the pipe B, fitted with stop-cock *b*, and the lower end E^2 is connected to the lower part of the water-space A^2 of the boiler by pipe C, which is fitted with stop-cock *c* and blow-out cock *c′*. The motions imparted to the pipe C by the expansion or contraction of the tube E may be taken up by the bend c^2, or an expansion-joint may be inserted. The expansion motion of the tube E at E^2 is imparted to a lever L directly or indirectly by any suitable kind of multiplying-gear, such as a rack and pinion or quadrant or the like. In the drawing a very simple direct arrangement is shown. The end E^2 is provided (outside its connection with pipe C) with an extension D, having a chisel-point *d*. This engages the inner side *l* of the curved lever L, which is pivoted at *l′* to a fixed bearing. The outer end L′ of the lever is coupled by a rigid rod R to a moving part controlling the feed-supply, such as a throt-

tle or steam valve. The drawing shows a rotary "hit-and-miss" valve V, mounted on a seating with corresponding apertures fixed to the foot of the suction-pipe P in the water-tank T of the feed-pump supplying the boiler.

If the water-level in the boiler and expansion-tube E fall, the high-temperature steam entering the latter causes expansion, and thus through the pressure of point *d* upon part *l* raises the lever L and through connection R opens the suction-valve V and allows of the inlet of more feed-water to the feed-pump. Conversely, if the water-level rises the expansion-tube E becomes cooled and contracts, closing the valve V and diminishing or completely shutting off the feed-supply. By closing cock *c* and opening cock *c'* the tube E and all the pipes can be blown through when required.

The alarm-whistle, in combination with the above-described arrangement, is shown at G, and its steam-valve is normally held closed by a lever *g*, pressed by a weight *g'*. This is so disposed as to be lifted by the lever L and then free the whistle-valve when the said lever has risen, as described, to the position shown in dotted lines, owing to continued fall of water in the boiler to a predetermined point consistent with safety of the boiler. The drawing shows the lever L bent over at L^2 for the purpose of conveniently engaging the weight; but any convenient arrangement may be adopted.

No parts are liable to derangement, and the arrangement is both simple, inxpensive, and reliable, and any failure is at once audibly indicated, so that it may be remedied without risk of serious accident.

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

In combination with a boiler, an inclined expansion-tube having one end fixed, pipes connecting the ends of said tube respectively with the steam and water spaces of the boiler, a lever having one end pivoted in proximity to the said tube and bearing thereagainst, said lever curving back above the tube and having its opposite end curved back upon the body thereof, a connection from said lever to a part controlling delivery to the boiler, and a signal-lever arranged to be operated by said backwardly-curved end, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JOSEPH NUTTING.

Witnesses:
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