STEAM & HOT WATER BOILERS
1840-1930

Hot Water Boilers

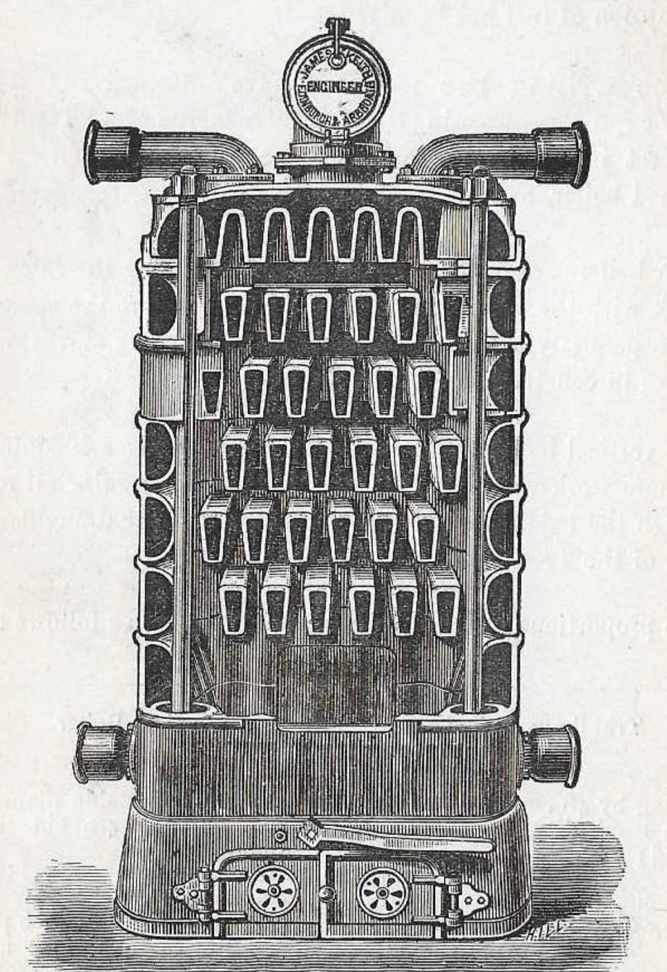

Fig. 18.
Self-contained Boiler (cast iron) section.

FROM UK TEXTBOOKS BY WALTER JONES 1890, 1894 & 1904

HEATING BY HOT WATER:

WITH

INFORMATION AND SUGGESTIONS

ON THE BEST METHODS OF

HEATING

PUBLIC, PRIVATE, & HORTICULTURAL BUILDINGS.

TREATING ON THE HIGH AND LOW PRESSURE SYSTEMS, BATH APPARATUS, &c., GIVING CAUSES OF, AND HINTS TO PREVENT FAILURE;

BY

WALTER JONES.

OVER 50 ILLUSTRATIONS.

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HEAT

LONDON

CROSBY LOCKWOOD AND SON

7, STATIONERS' HALL COURT, LUDGATE HILL.

1890.

CHAPTER VI.

BOILERS.

IT is not my intention to puff up any one boiler to the exclusion of all others; the variety, size, shape, design, and construction is almost endless. I cannot pretend to mention, much less to illustrate, a tithe of them; a few of the best known forms and designs only are illustrated, so as to make the description clear.

WROUGHT WELDED BOILERS.

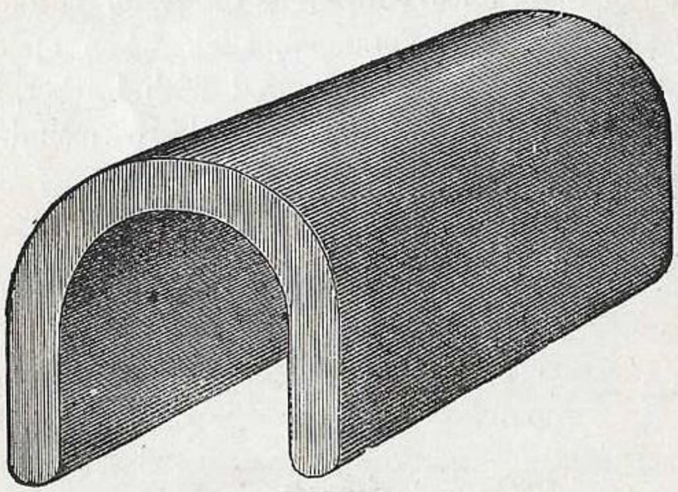

Fig. 13.
Plain Saddle Boiler.

The plain saddle-boiler (Fig. 13) has long been in popular favour, and will doubtless hold its own for many years. It has many points to commend it. Its first cost is low, it is simple in form and has no complications; it presents a good amount of heating-surface, and, when properly set, is about as good a boiler as you can get for quantities of, say, 100 to 800 feet of 4-inch pipes, and, with a small water space (2 inches to 3 inches), may be considered a fairly economic boiler. It has ample fuel-space, so that the fire may be raked to last through the night (an essential feature for horticultural work). With saddle-boilers, or in fact any boilers that have to be built in brickwork, it is important that as much as possible of the boiler surface should be exposed to the flame, and not buried in brickwork. It is frequently the case that an apparatus with the pipes properly fixed, and the various parts of the apparatus well proportioned, proves a complete failure from this cause. Several instances have come under my own personal supervision where, with forced firing and good fuel the pipes could not be warmed, and after the boiler has been reset, a good temperature could be maintained with the commonest fuel.

Boilers are made of cast iron, wrought iron riveted, wrought welded, and sometimes of copper. The wrought welded, being lower in price, have almost superseded the riveted boilers, especially the smaller sizes, from two feet to five feet long, but when exceeding five feet in length I should give riveted boilers the preference, as they are stronger, more durable, and can be repaired in case of waste, wear, or fracture.

For a large head of water, say forty feet and upwards, boilers circular in form, such as "Vertical," "Trentham," "Excelsior," &c., are best; they stand the strain better than boilers with large flat surfaces, and when subject to pressure of this kind riveted boilers are more reliable than welded.

CAST BOILERS.

are not so liable to corrosion or incrustation, and, under favourable conditions, will last longer than a wrought boiler. They are liable to fracture by sudden contraction of the metal, which may be caused by a sudden draught of cold air on some portion of the boiler when working, or, if sediment deposit is lodged in places acted on by the flame. When made with good metal, and of uniform thickness, fractures are exceedingly rare. The life of a wrought boiler is from ten to twenty years, and of a cast one from fifteen to thirty years. If there is an excessive amount of deposit, either wrought or cast boilers will give out in a much shorter time. Cast boilers cannot be made in the same variety of forms as wrought. Their principal forms are saddle, conical, tubular, or built up in sections.

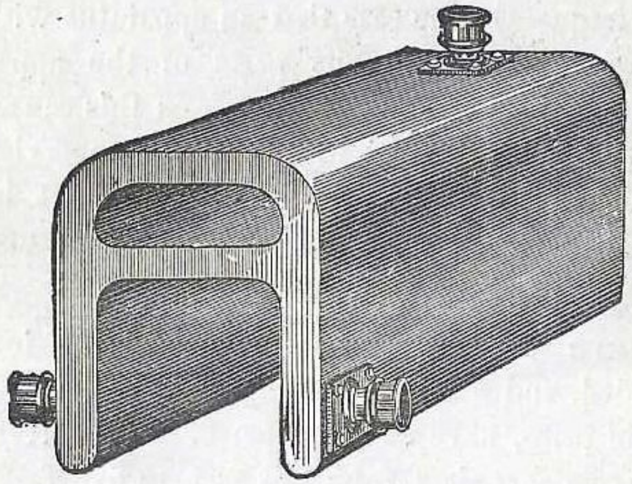

Fig. 14.
Chambered Boiler with Terminal End and Return-flue.

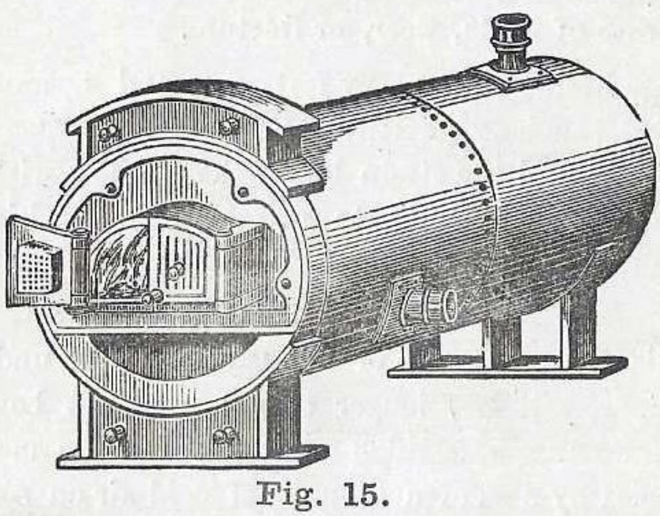

Fig. 15.
Trentham Cornish Boiler.

For heavy work a boiler that presents a large amount of direct heating-surface, in a manner that the flame impact can be so intercepted as to spend its force before it gets into the chimney, or flues leading to the chimney, will be found most economical.

It is a very common error to fix boilers with insufficient heating-surface, *i.e.*, under their work. The heating-powers of boilers are calculated by most makers on the basis given by Hood in his standard work on hot-water heating, viz., 50 feet of 4-inch pipe for each square foot of *direct* heating-surface, and one-third this quantity for indirect or flue-surface. It may be possible to get this work out of them by forced firing and a quick draught, which means an extravagant consumption of fuel. For economic working a moderate fire worked with a partially-closed damper is necessary. The working powers of boilers should be taken at about two-thirds the estimated power, *i.e.*, a boiler estimated to heat 900 feet of pipes should not have more than 600 feet attached if it is to work economically. Flat horizontal surfaces above the flame are most valuable, one square foot being equal to two square feet of vertical or side surface; horizonal surface beneath the flame is considered of little or no value.

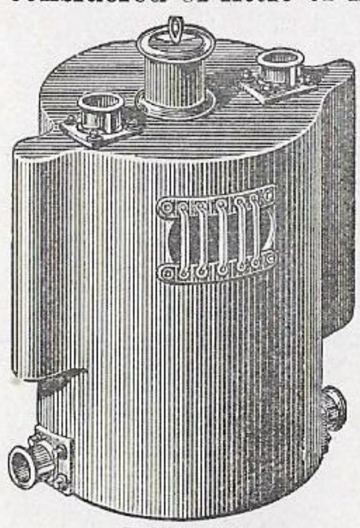

Fig. 16.
Excelsior Boiler.

A good deal of prejudice exists against independent or self-contained boilers with a straight draught direct to the chimney. The objection is urged that a great deal of waste heat is carried away to the chimney, but there is not so much force in this objection as is generally supposed, and a well constructed self-contained boiler properly coated with non-conducting material will be found to give good results. Many boilers have been constructed for building in brickwork, with return flues, the flame

ILLUSTRATIONS OF KEITH'S PATENT SECTIONAL CHALLENGE BOILERS.

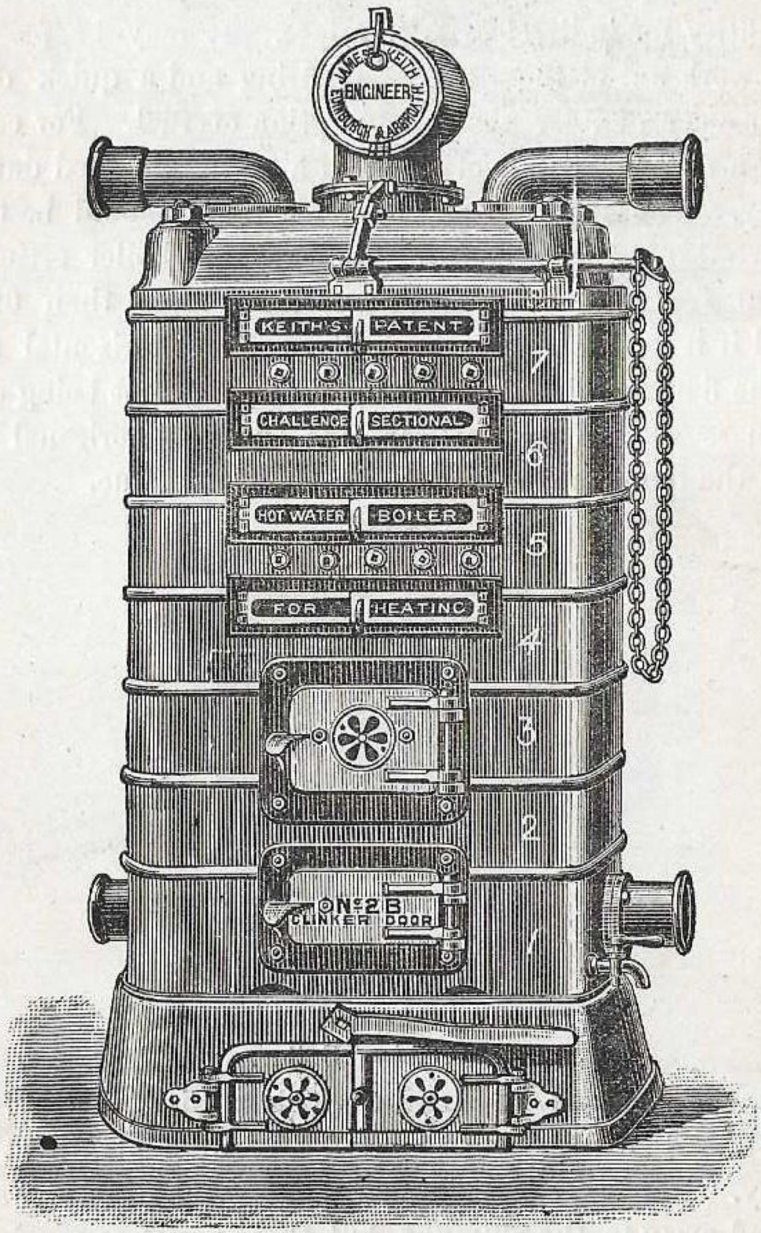

Fig. 17.
Self-contained Boiler (cast iron).

being carried backwards and forwards two, three, or four times the length of the boiler, so as to abstract all the heat possible before passing it into the chimney. After watching closely the working of boilers of almost every conceivable shape, I venture the opinion that a moderately high temperature in the chimney

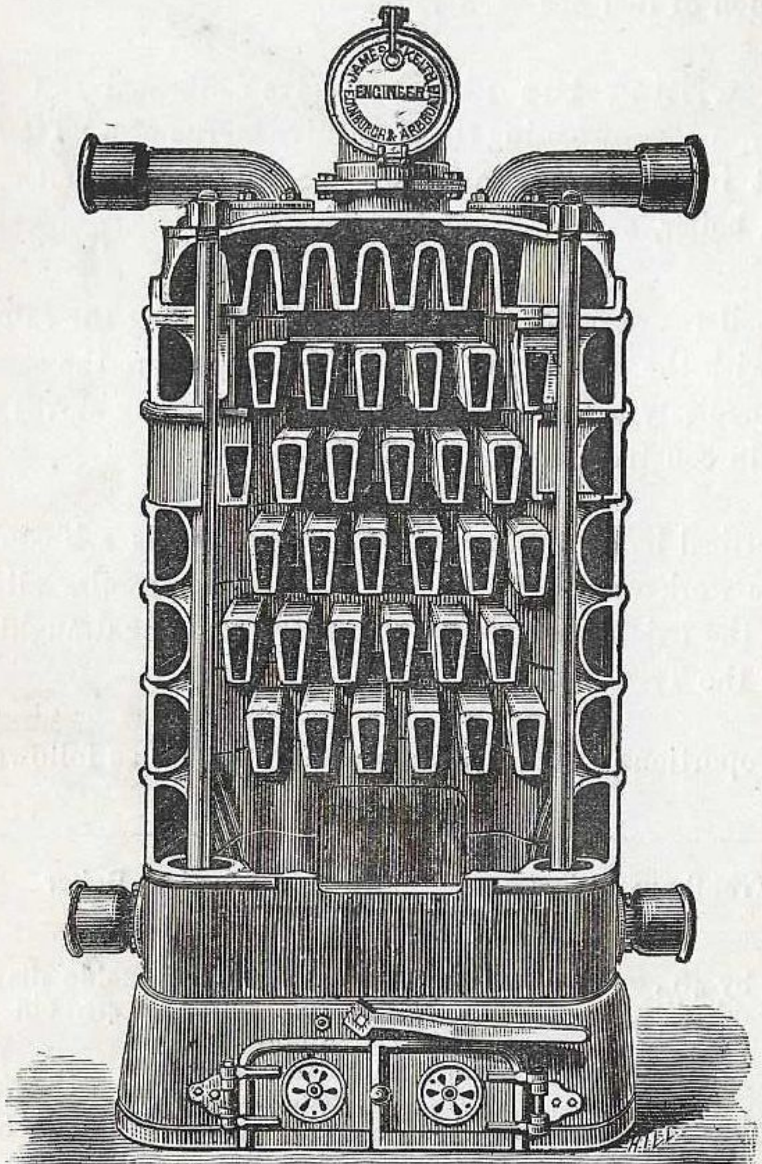

Fig. 18.
Self-contained Boiler (cast iron) section.

does not necessarily mean greater waste, or a low temperature increased economy of fuel, and I could give scores of instances where, after dispensing with the winding flues of a plain saddle boiler, and substituting a straight draught as shown in Figs. 23 to 26, the effective power of the boiler has increased, while the consumption of fuel has been reduced.

Since writing the above I have confirmed the opinion already expressed by testing the respective merits of a "Trentham" boiler set in brickwork, and a wrought riveted vertical self-contained boiler, as illustrated Fig. 19.

Both boilers are fixed at the same factory, doing the same class of work with the same kind of fuel; the pipes are the same size, fixed in precisely the same manner, in two drying stoves which are alike in construction.

The vertical boiler has less heating surface, is self-contained, does more work with less fuel, and gives better results all round, although the height and area of chimney, and the draught are in favour of the Trentham.

The proportions of both boilers and pipes are as follows :—

Trentham Boiler.	Vertical Boiler.
12ft. long by 4ft., outside diameter, 3ft. 6in. inside diameter, with check end;	6ft. high by 5ft. outside diameter, 5ft. 8in. high by 4ft. 6in. inside diameter;
3 Gallaway tubes, 7in. diameter;	4 cross tubes and 2 vertical tubes;
Plates $\frac{3}{8}$in. thick;	Plates, $\frac{3}{8}$in. thick.
Heating 6,060 feet of 2-inch pipes	Heating 7,400 feet of 2-inch pipes
,, 180 feet of 4-inch mains.	,, 250 feet of 4-inch mains.
Slack consumption per week, $3\frac{1}{4}$ tons	Slack consumption per week, 3 tons.

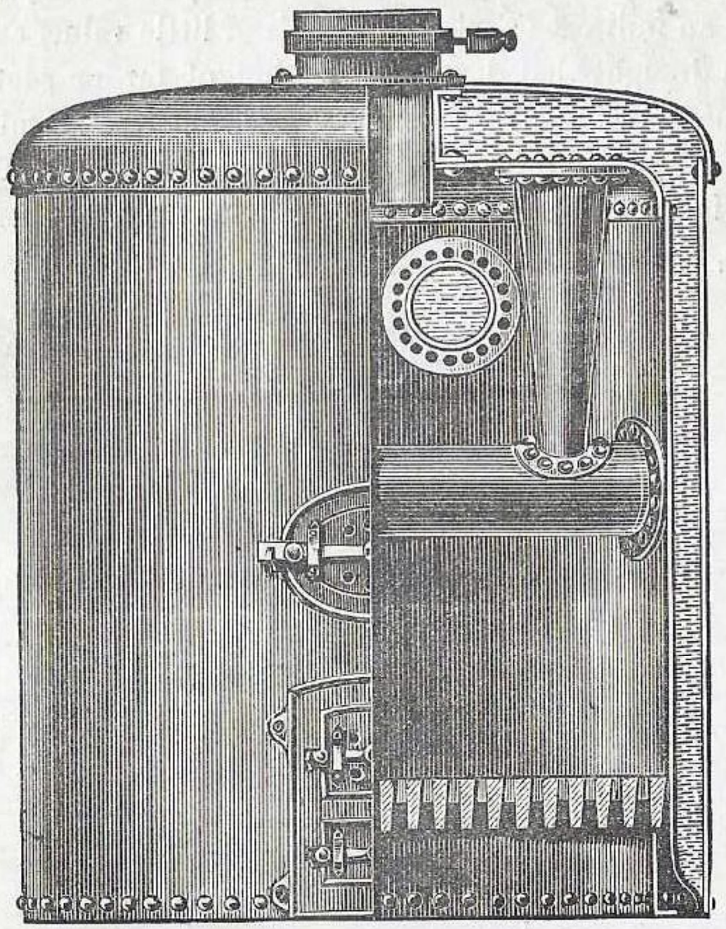

Fig. 19.

The heating surface *inside* the "Trentham" is greater, and the *total* surface is more than double that of the vertical; the results go to prove that the shape or construction of the vertical is better calculated to absorb the heat from the fuel; that the radiant heat from the fire is much more effective, and that the power of a boiler is not necessarily proportionate to the amount of heating surface it contains. The waste heat passing from the vertical boiler into the chimney is much greater than that of the "Trentham," which shews that lowering the temperature by winding flues does not necessarily mean economy.

The direct heat from a clear fire is very effective; the spent heat from an indirect or winding flue is of little value, and causes a sluggish draught that leaves a coating of tar or soot on the boiler, thus reducing the effect of the flue heat and minimising the direct heat inside the boiler at the same time. If a lofty chimney is available a winding draught may be used with advantage, but with a low chimney it is a very questionable saving.

INDEPENDENT BOILERS.

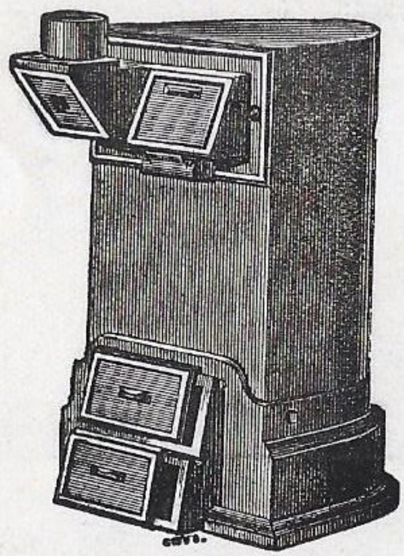

Fig. 20.

The "Finsbury" Boiler.

For small quantities of pipe—say, 40 to 400 feet of pipe—a self-contained or independent boiler, such as the "Finsbury" or "Desideratum," will be found useful and convenient, and owing to the water-way crown, which receives the flame impact, it is more economical than the "Slow-Combustion," "Star," and other similar boilers which lack this important feature.

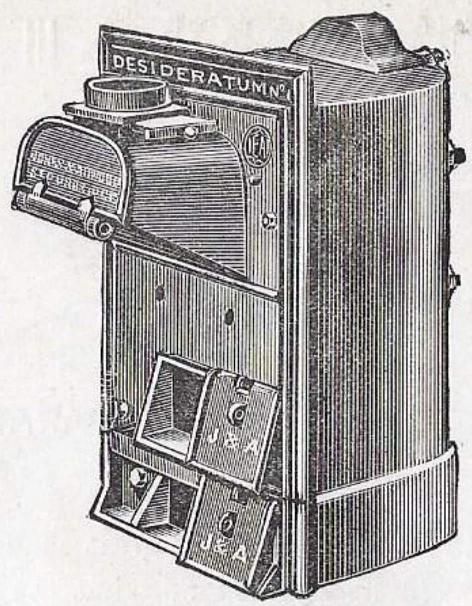

Fig. 21.
The "Desideratum" Boiler.

Independent boilers are usually considered "tenants' fixtures," and are often preferred on this account, especially when there is a probability of the occupier removing to some other residence.

The "Desideratum" apparatus (Fig. 22) is a most convenient form of apparatus for heating small greenhouses, coachhouses, and other structures. The total height being only 20 to 24 inches, dispenses with the cost and inconvenience of a stoke-hole. It is economic in fuel, occupies a limited space, is low in price, has fuel space sufficient to last 10 or 12 hours, and is thoroughly reliable.

Boilers with large water spaces are slow in action, and require more fuel. If the water space is too small, they are liable to be filled with sediment or deposit, and allow the plates to burn through, or the circulation may be impeded by choked passages. A small water-space and large heating-surface will give a more rapid circulation. For small boilers a 2 inch water-space, for medium boilers 3 inches, and for very large boilers 3 inches to 5 inches may be considered good proportions.

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(SECOND EDITION),

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HOT WATER SUPPLY for Public Institutions,

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Laundry Drying Stoves, Swimming Baths, Turkish Baths,

CAUSES of, and hints to PREVENT FAILURE;

BY

WALTER JONES.

---

96 ILLUSTRATIONS.

LONDON:

CROSBY, LOCKWOOD, AND SON,

7, STATIONERS' HALL COURT, LUDGATE HILL.

1894.

CHAPTER X.

DUPLICATE BOILERS.

The fixing of boilers in duplicate so that either or both may be used jointly or separately is not always necessary, and in many instances would not justify the additional cost: there are however cases in which the system may be adopted with considerable advantage, and the extra expense would be more than justified. In the majority of cases where a breakdown or failure of the boiler occurs, it happens during severe weather, and at a time which causes the greatest amount of inconvenience and loss. How often does it happen that a range of glass houses, containing orchids, or other rare and valuable plants, is dependent upon a single boiler which has to heat from 2,000 to 5,000 ft. of pipes, the failure of the boiler at a critical time may in a single night result in loss or damage that is almost irreparable, besides the anxiety and trouble consequent thereon. I have known many such cases where independent boilers and pipes, petroleum lamps and other temporary expedients have been resorted to, until the boiler could be repaired or a new one substituted. The value of an additional boiler in duplicate in such a case can scarcely be estimated, and the first cost is a mere trifle compared with the advantages derived.

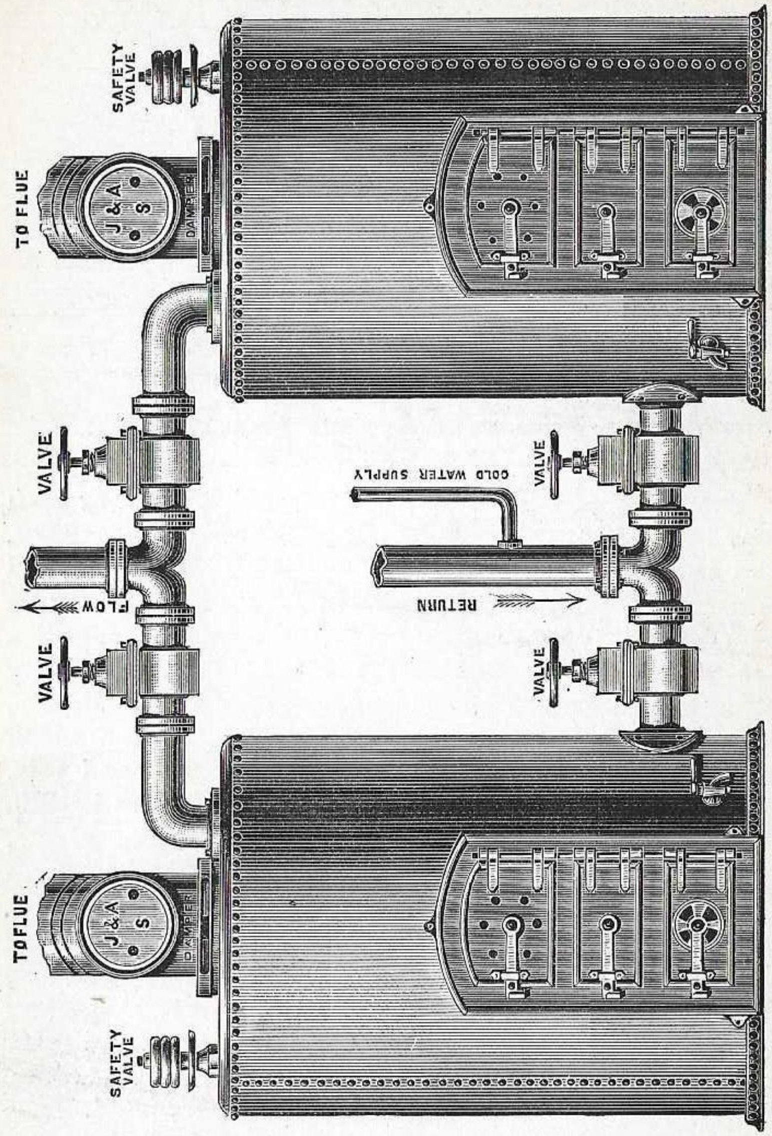

Fig. 40.

The illustration (Fig. 40) shows an arrangement of two boilers in duplicate, with the necessary valves, &c., so arranged that either boiler may be used separately or both jointly, and important advantages will result; the boilers should be used alternately, say for three or four weeks each during mild weather, and in severe weather the two boilers used jointly will prevent either from being over-worked or strained, and in most cases with economy of fuel also; forced work from any boiler always means increased fuel consumption. Wherever boilers are set in duplicate, the following points should be carefully observed:—

1. Each boiler should be sufficiently powerful to heat independently all the pipes that may be connected.
2. Screw down or perfect valves should be fixed on flow and return pipes of each boiler.
3. The supply pipe from cistern should be connected to each boiler, or to the return pipe near boilers.
4. An expansion pipe (about 2 in.) should be taken off the top of each boiler or off the flow pipe between boiler and valve, and carried up two or three yards above the level of cistern to relieve undue pressure, or in case the valves should be inadvertently closed whilst boiler is working.
5. Expansion pipes when carried outside should be protected from frost.
6. In cases where an expansion pipe cannot be thus fixed, a safety valve should be fixed on each boiler instead.

The boilers illustrated (Fig. 40) are self-contained; boilers set in brickwork may be similarly fixed, but with duplicate boilers the points above-mentioned are most important.

The duplicate system is especially recommended:—

1. For large Public Institutions where any stoppage would lead to great inconvenience.

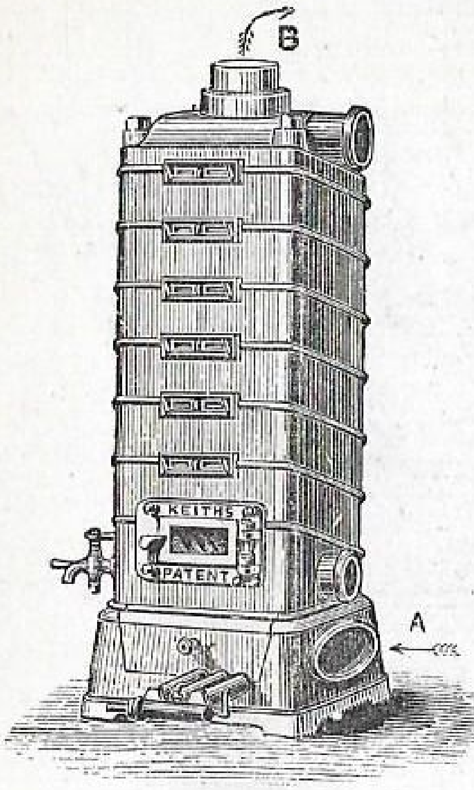

Fig. 46.

KEITH'S SECTIONAL CHALLENGE GAS BOILER.

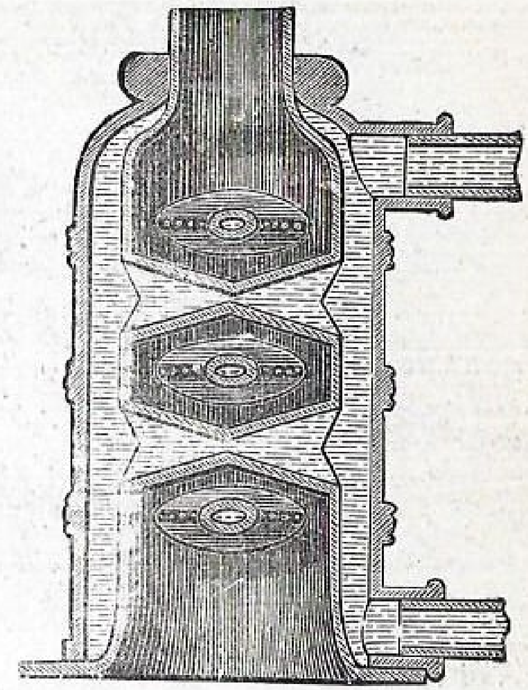

Fig. 47.

FLETCHER'S CROWN TUBE GAS BOILER.

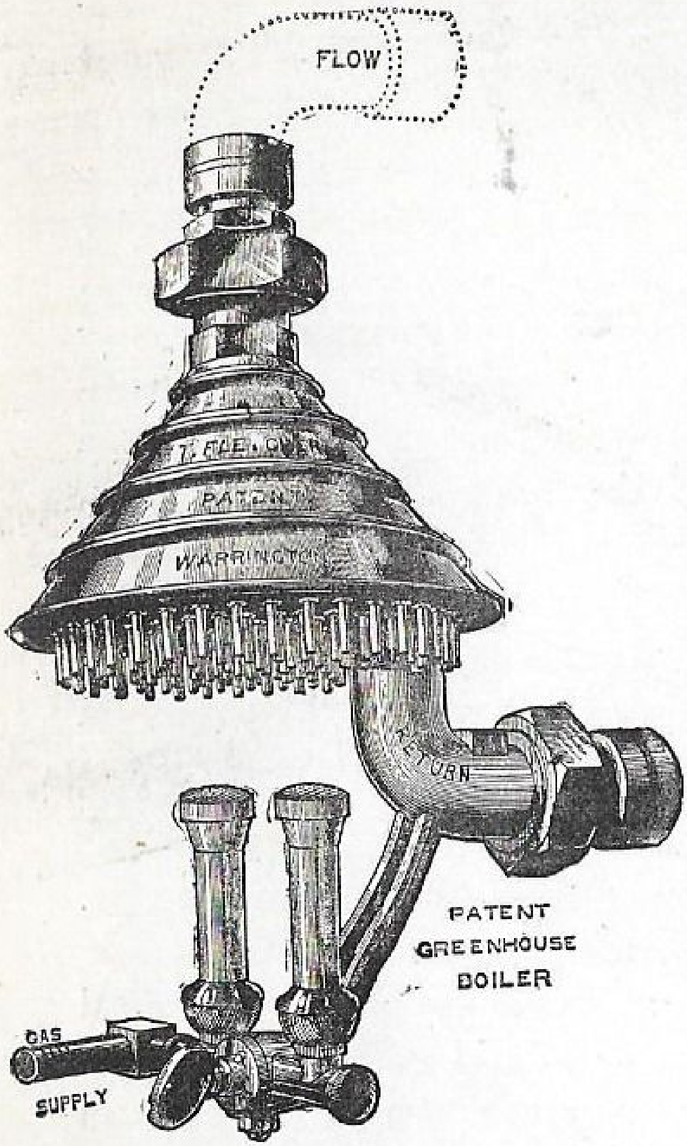

Fig. 48.

FLETCHER'S CIRCULATING BOILER.

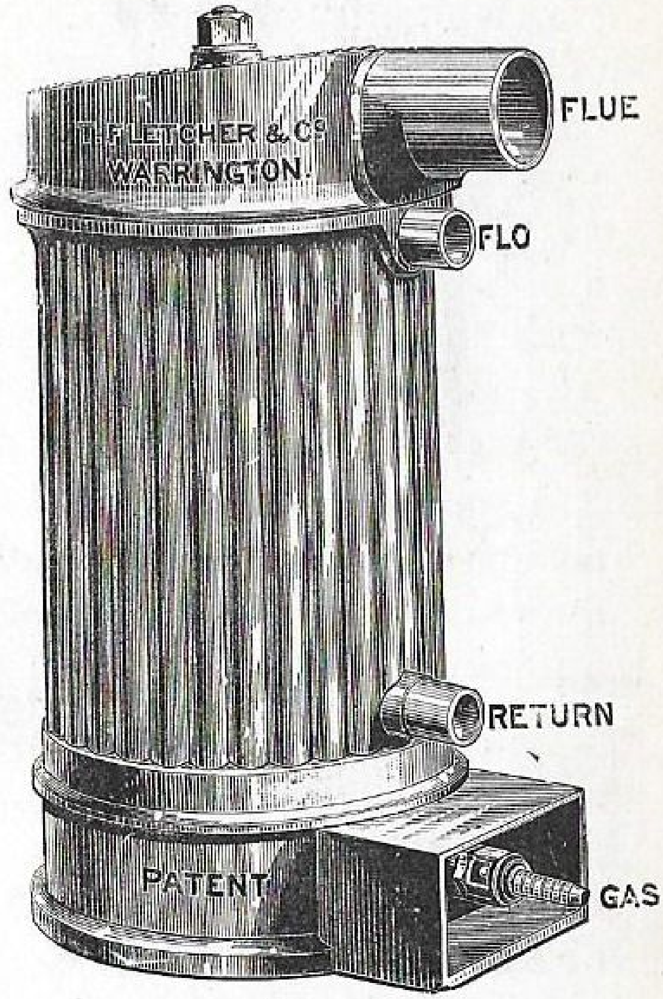

Fig. 49.

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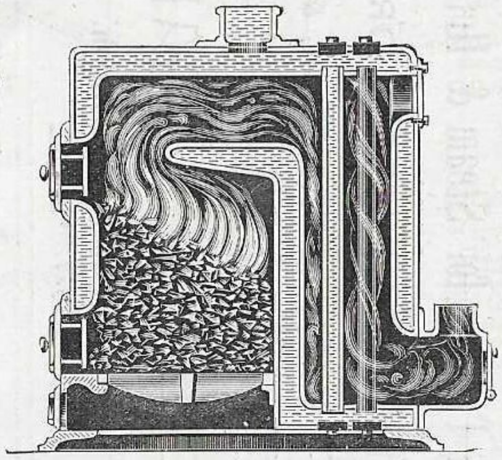
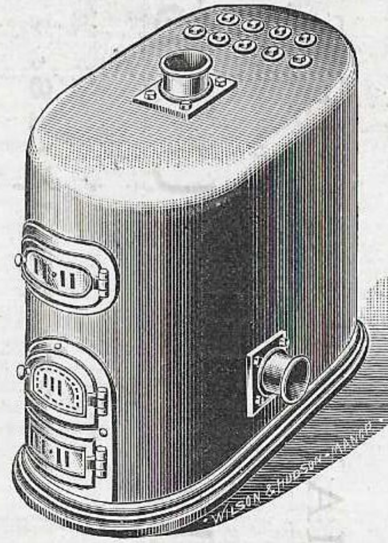


SECTION.



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142 Illustrations.

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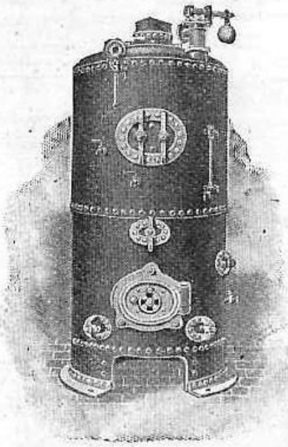

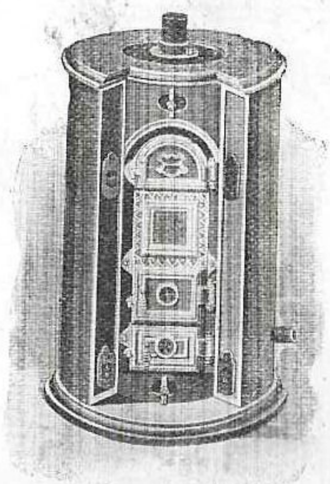

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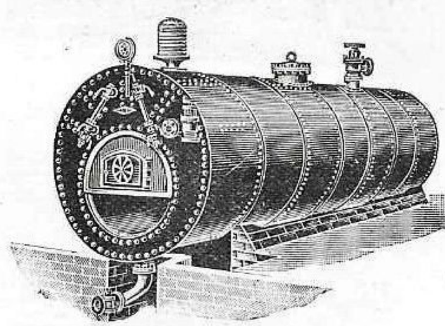

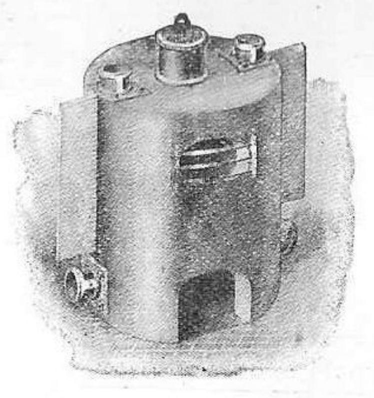

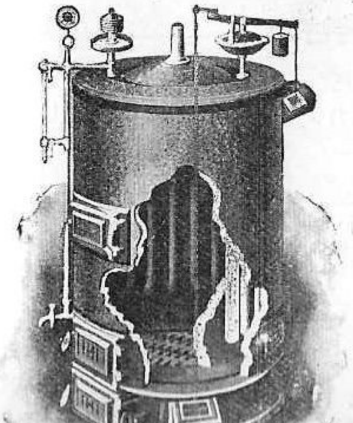

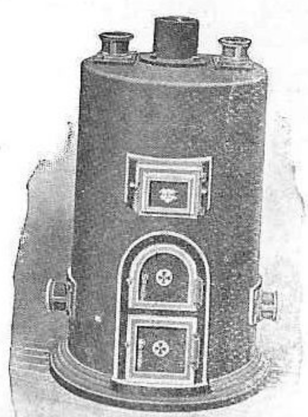

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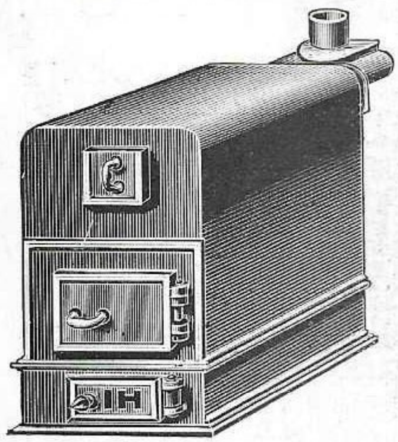
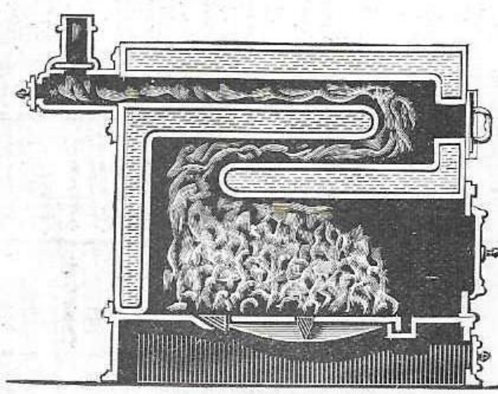


Elevation.



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1	30	16 ×	16	22 ×	43	7	650	22	0	0	25	0	0
2	36	18 ×	18	24 ×	45	7	820	26	0	0	29	5	0
3	42	18 ×	18	24 ×	45	7	930	30	0	0	34	0	0
4	48	18 ×	18	24 ×	45	7	1050	35	0	0	39	10	0
5	48	21 ×	21	27 ×	51	7	1130	40	0	0	45	10	0
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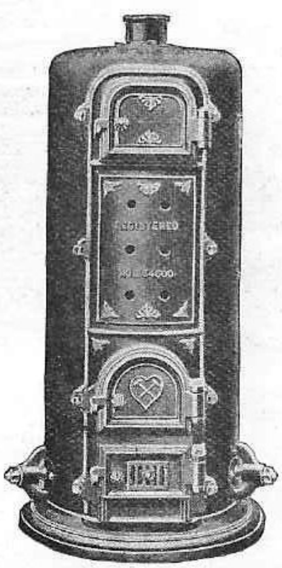

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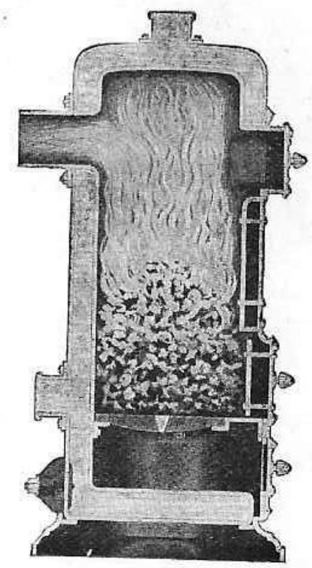

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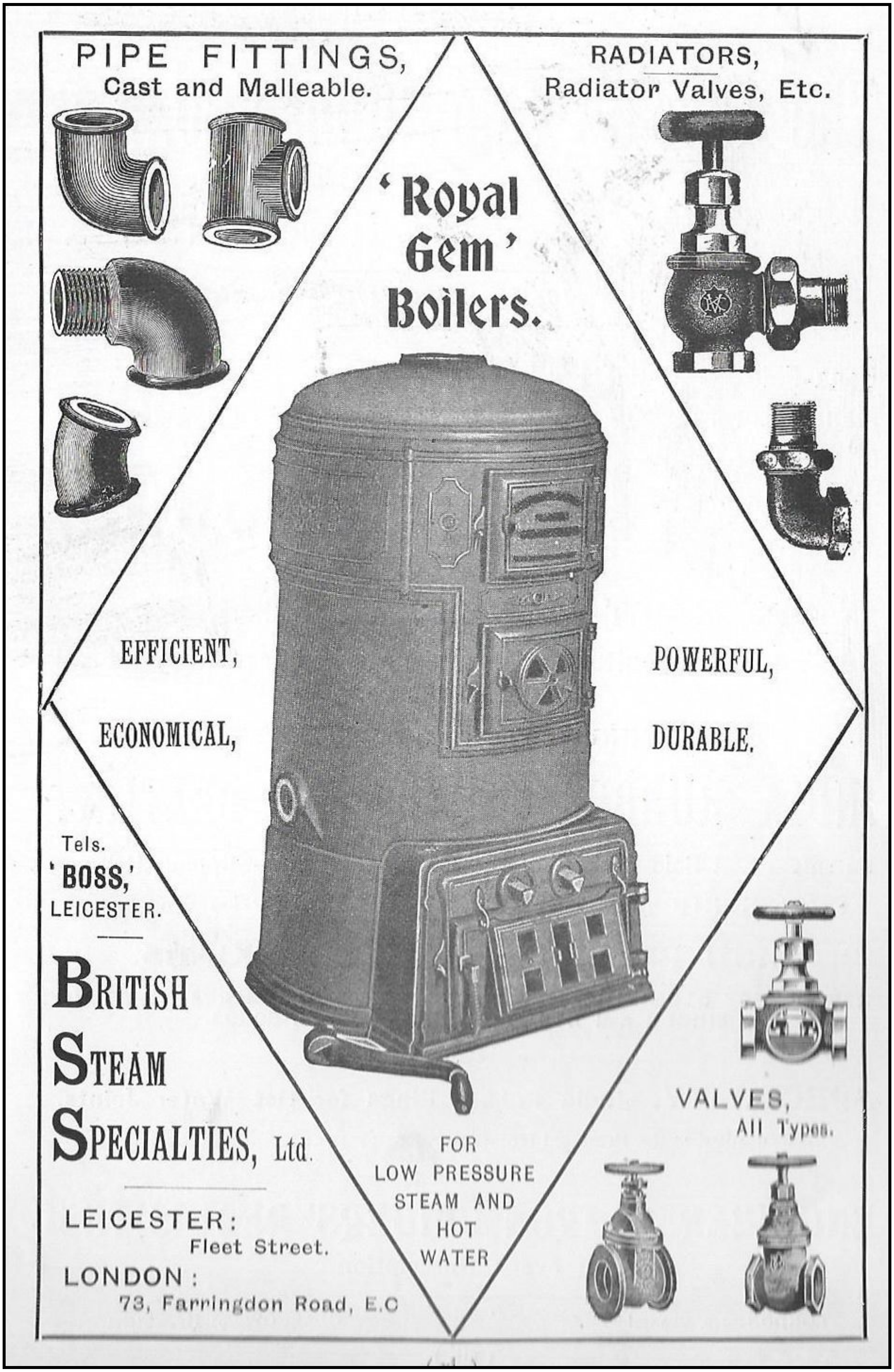
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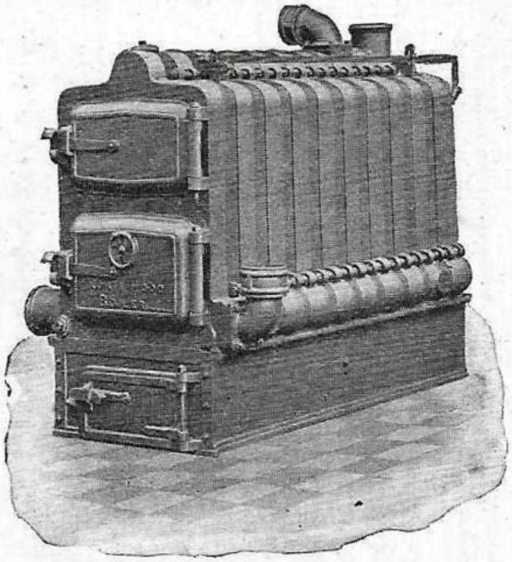

The "Robin Hood" Boiler
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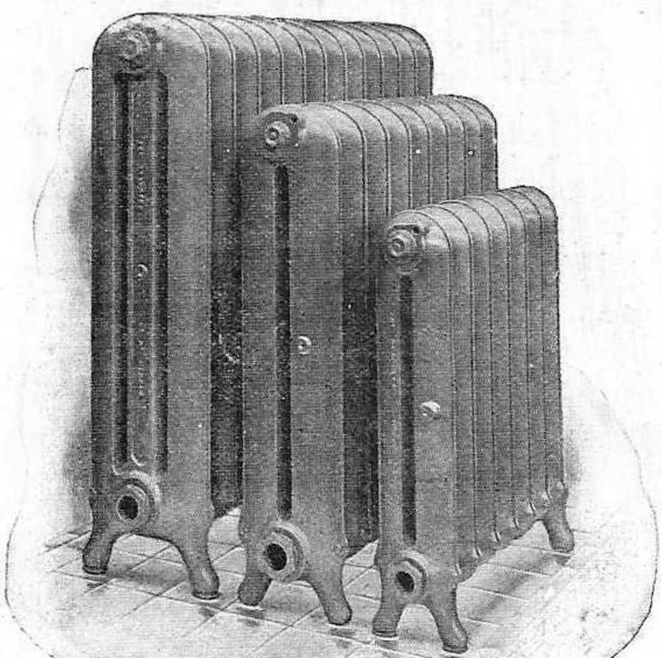

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