STEAM & HOT WATER BOILERS 1840-1930

High Pressure Hot Water Boiler (Perkins)

PATENTED IN 1831

HEATING BY HOT WATER

(SECOND EDITION),

WITH

INFORMATION & SUGGESTIONS ON THE BEST METHODS

OF

HEATING

PUBLIC, PRIVATE, AND HORTICULTURAL BUILDINGS.

Treating on the HIGH and LOW Pressure Systems,
BATH APPARATUS,
HOT WATER SUPPLY for Public Institutions,
DUPLICATE BOILERS, RADIATORS,
Laundry Drying Stoves, Swimming Baths, Turkish Baths,
CAUSES of, and hints to PREVENT FAILURE;

BY

WALTER JONES.

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96 ILLUSTRATIONS.

LONDON:

CROSBY, LOCKWOOD, AND SON,

7, STATIONERS' HALL COURT, LUDGATE HILL.

1894.

FROM WALTER JONES TEXTBOOKS 1894 ONWARDS

HEATING BY HOT WATER.

CHAPTER I.

THE HIGH PRESSURE SYSTEM.

THE **system of heating** known as the "hot-water system" is simply a ready and convenient method of conveying and distributing heat from a given point to any other point where it may be required. There are two distinct systems or methods of doing this, known as the "high pressure" and the "low pressure"; and, although there is a wide difference in the two systems, the principle and its application are similar. The heat is in both cases transmitted from the boiler or heating-chamber to the room or rooms where the heat is required.

The high-pressure system consists of a series of strong wrought-iron tubes, similar to hydraulic tubes, the boiler being coiled from the same material. The size or number of laps contained in the boiler depends on the length of pipes that require to be heated.

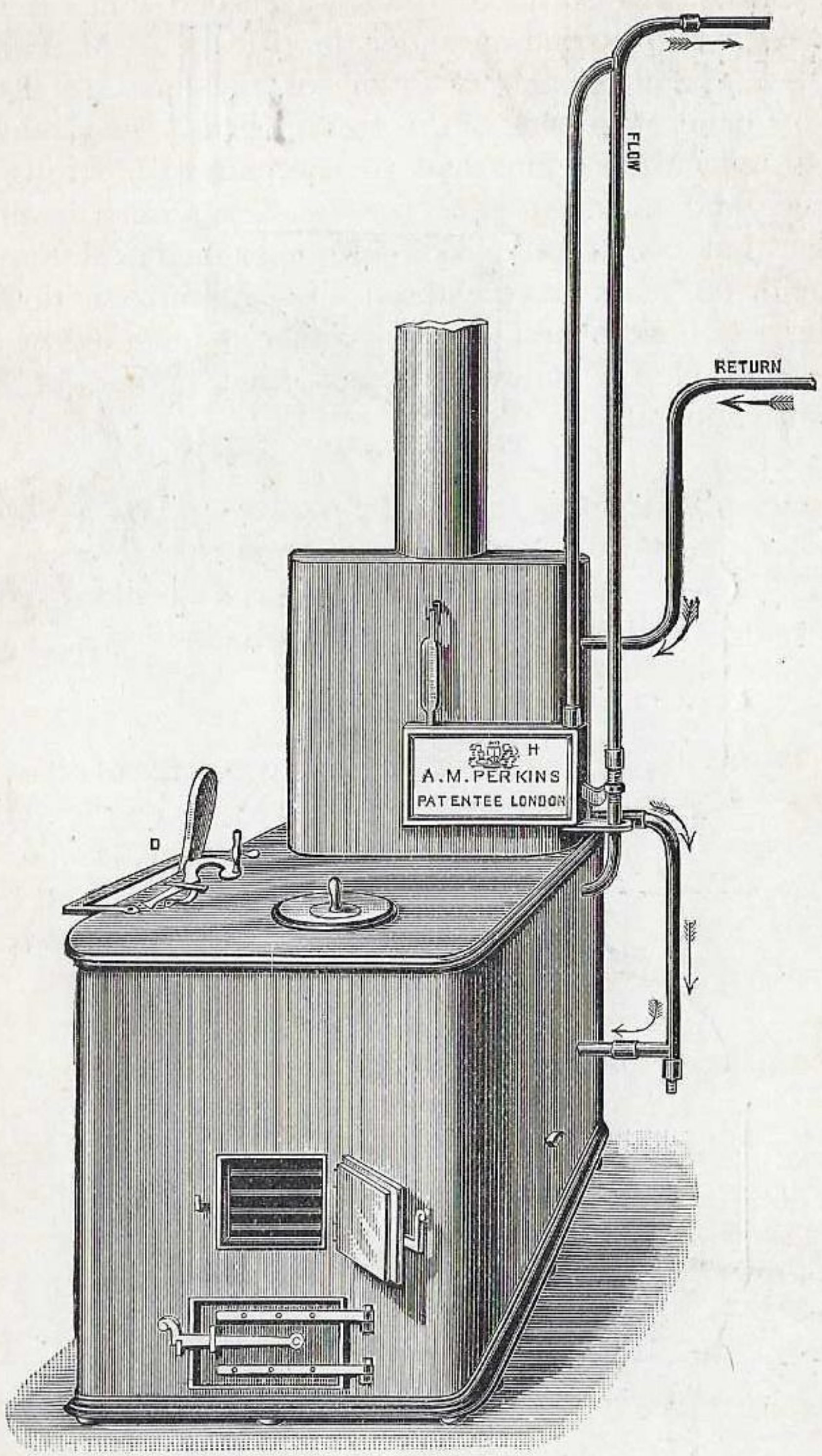
This system was introduced by Mr. A. M. Perkins, of London, and is commonly known as "*Perkin's system;*" his first invention, which included the Expansion tube, was protected by Royal Letters Patent, No. 6,146, in the year 1831.

His son, Mr. Loftus Perkins, succeeded him, and the business is still carried on under the title of A. M. Perkins and Son, Limited, the two sons of the late Mr. Loftus Perkins being members of the present firm. As pioneer of this system, Mr. Perkins had to contend with strong prejudices, and he must have possessed not only inventive power, but constructive skill of no ordinary ability, for although 60 years have elapsed since its introduction, the patterns of boilers and other accessaries invented by him, have been closely followed by all other makers of high-pressure apparati.

Comparatively few important improvements have been made, although there are some deserving of special mention as will appear further on; certainly the development has been trifling compared with the important strides made in low-pressure heating.

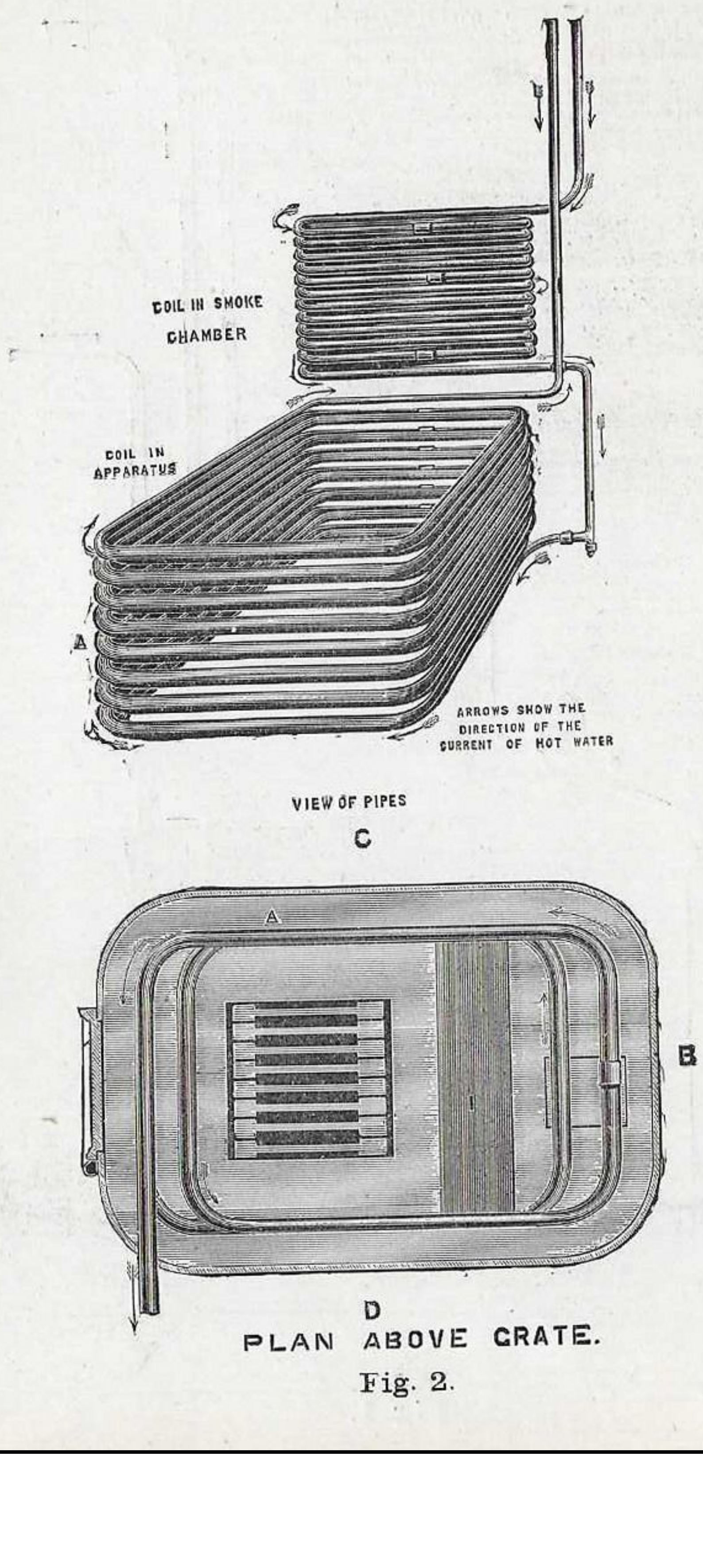
In confirmation of this statement it is only necessary to compare the appliances still in general use, with the illustrations, Fig. 1, 2, 3, and 4, which are reproduced from a book (kindly lent to me for this purpose) published in 1840, entitled "*A. M. Perkin's Improved Patent Apparatus for Warming and Ventilating Buildings.*"

The illustrations Fig. 5 and 6 are copied from a book (now in my possession) printed in 1837, entitled "*Warming and Ventilation by C. J. Richardson, Architect,*" wherein he shows some of the details of construction. I would point out that the arrangement of valves in Fig 5 is bad, a bye pass being necessary to allow of circulation when valves are closed, otherwise an explosion may happen, and, although Mr. Richardson's book shews this arrangement, it is improbable that a point of such importance would have been overlooked by the inventor.



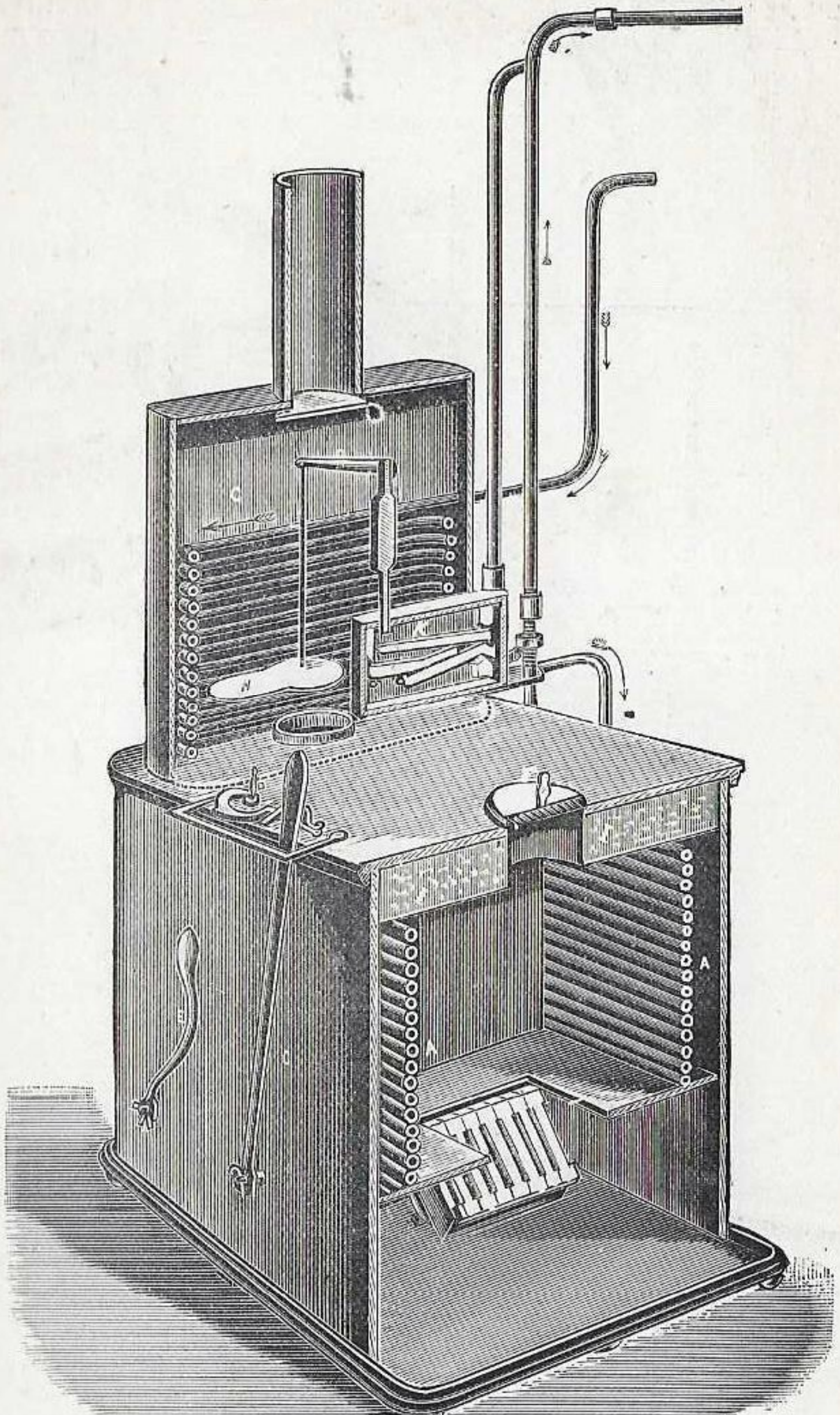
VIEW OF BOILER.

Fig. 1.

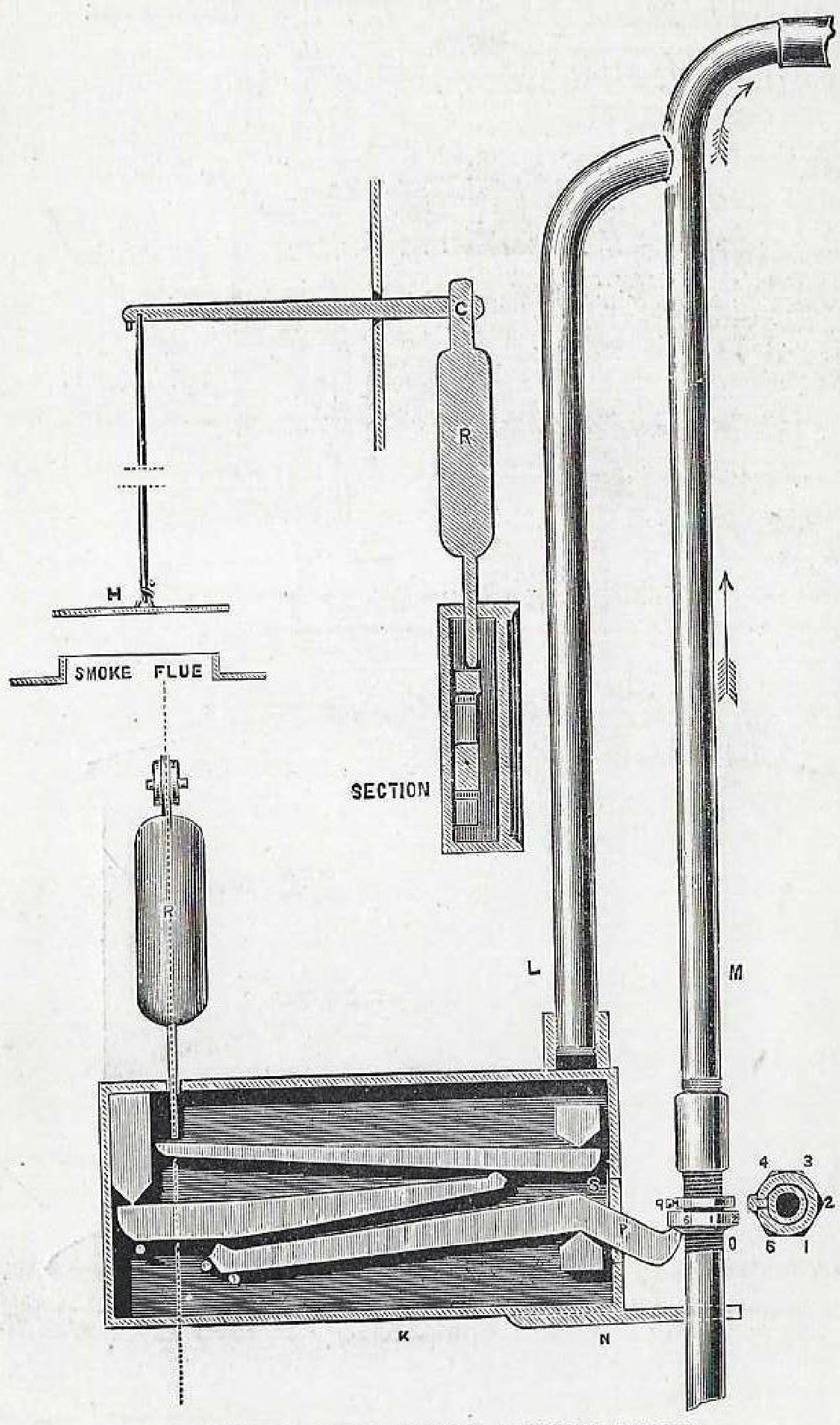


PLAN ABOVE GRATE.

Fig. 2.



SECTION ON LINE C.D.
Fig. 3.



GOVERNOR OR HEAT REGULATOR.

Fig. 4.

The book referred to contains illustrations of several buildings heated by Mr. Perkins, a reference to Fig. 1, 2, 3, 4, 5, and 6, will shew that the boilers, and other accessories are almost slavishly copied by most makers at this date. There are, however, boilers of different design, some with larger tubes, thus presenting a greater surface to the flame; but alterations are not necessarily improvements, and the test of merit is, what will give the best results with the least risk, and the smallest consumption of fuel? Until I have had further opportunities of practically testing the merits of the various boilers, I will suspend my own judgment, and leave others to form their own opinion. I may, however, state that boilers are made of $\frac{7}{8}$-in. bore tube, capable of heating 10,000 feet of tubing, and I think this is quite as much as ought to be put on one boiler.

One advantage that may reasonably be urged in favour of powerful boilers being made from larger tubes is, that the increased area, and the smaller number of bends required, would reduce the friction, which is excessive in every form of high-pressure apparatus, as proved by the great difference in temperature between the flow and return pipes.

The tubes originally used were $\frac{5}{8}$ inch bore, but experience has proved that a pipe of $\frac{7}{8}$ bore is more suitable and convenient, and this size is now almost universally adopted for all classes of high-pressure work, irrespective of the size of the apparatus; other sizes of pipes are occasionally used, some makers preferring 1-in, others 1$\frac{1}{4}$-in, or still larger sizes for portions of the apparatus, it is, nevertheless, a very great convenience to adopt some universal standard, and the alteration and multiplication of sizes should not be entertained unless some special advantage is derived therefrom.

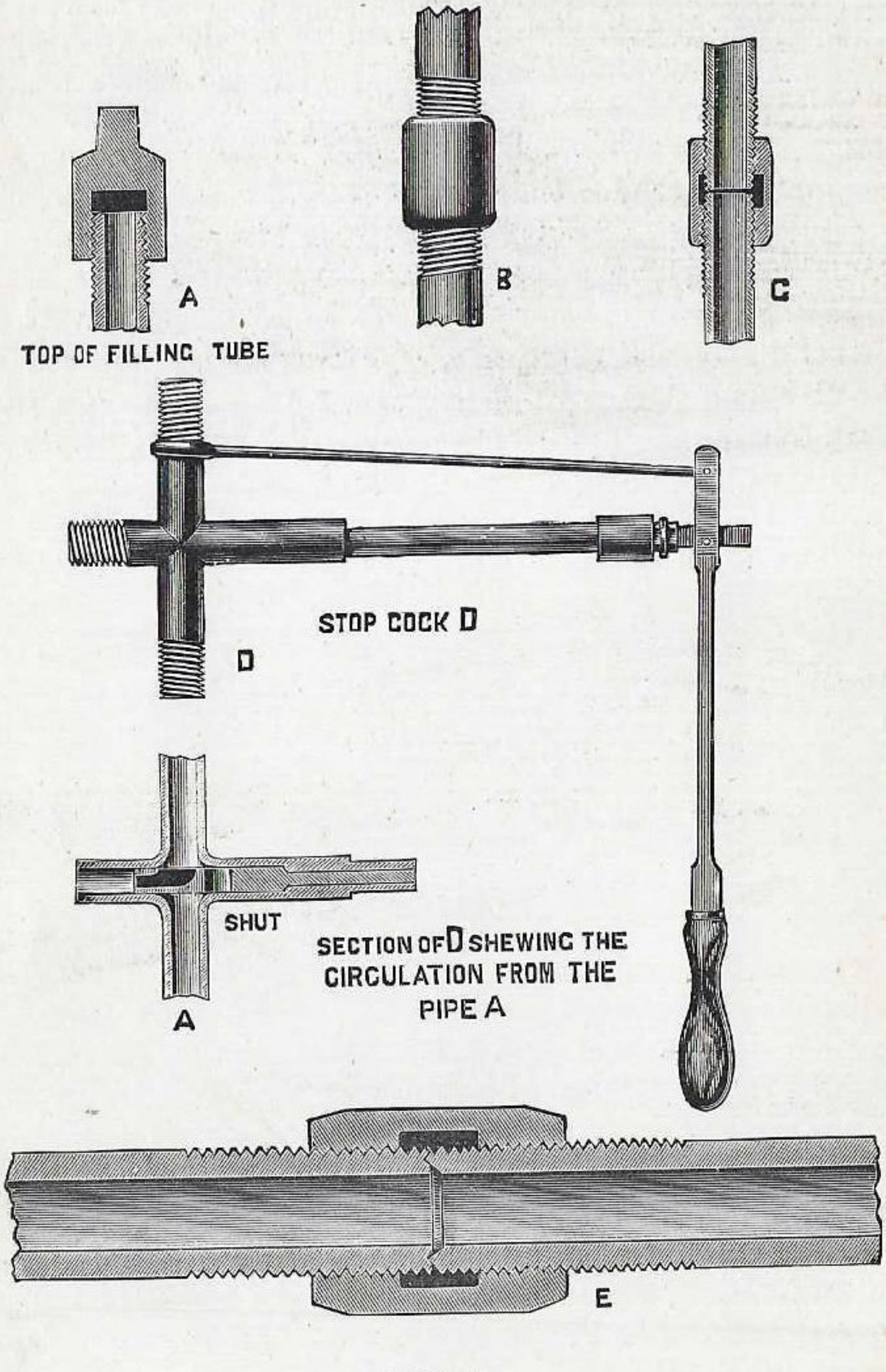

A
TOP OF FILLING TUBE
B
C
STOP COCK D
D
SHUT
SECTION OF D SHEWING THE
CIRCULATION FROM THE
PIPE A
A
E

Fig. 5.

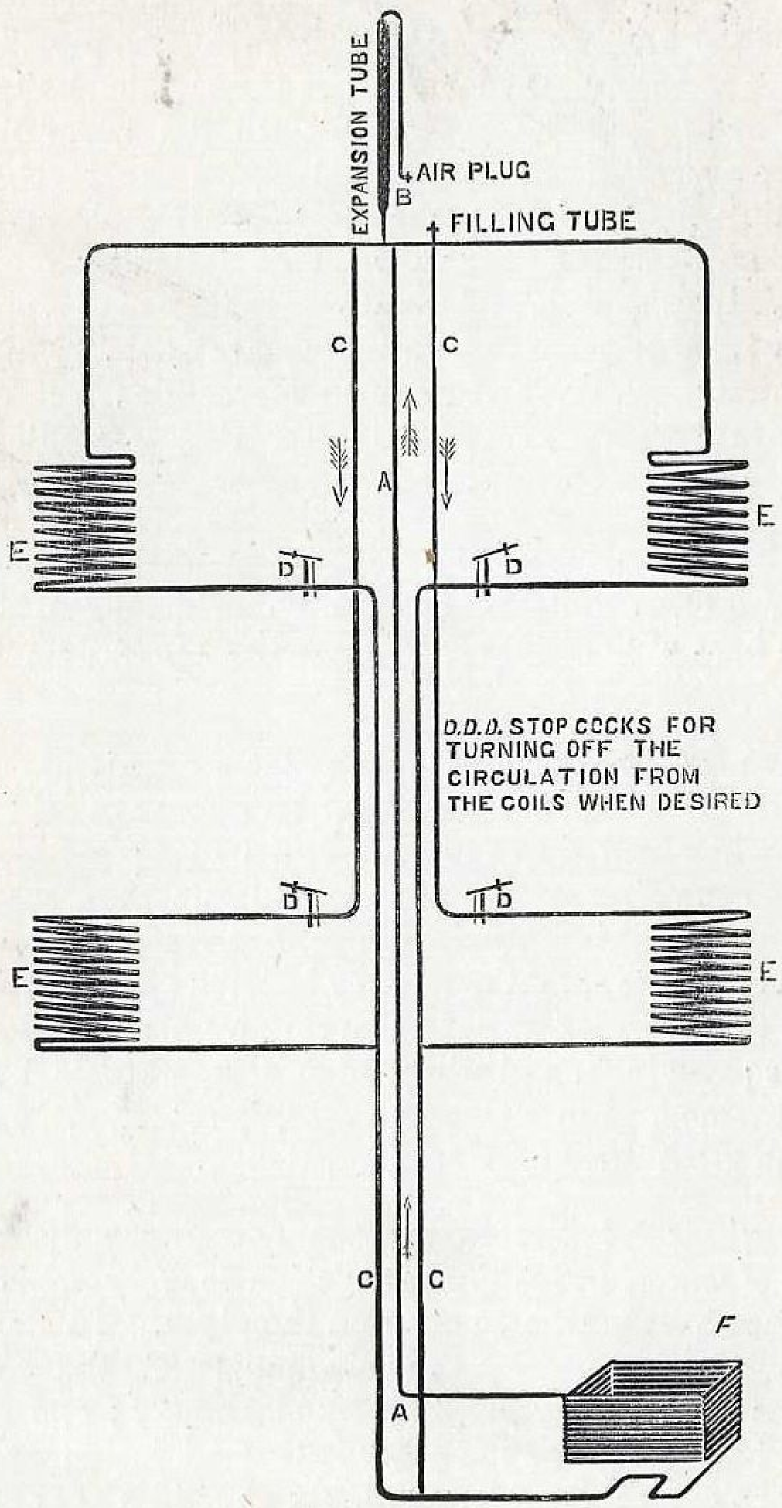

EXPANSION TUBE
AIR PLUG
B
FILLING TUBE
C
C
A
E
E
D
D
D.D.D. STOP COCKS FOR TURNING OFF THE CIRCULATION FROM THE COILS WHEN DESIRED
D
D
E
E
C
C
F
A

Fig. 6

At the highest point of the apparatus is fixed a larger tube, called the "air-vessel" or "expansion pipe." The pipes are filled from the lower level P near the boiler (see Fig. 7) by means of a force-pump until the water reaches an overflow pipe, which is fixed above the level of the circulating-pipes, and at the base of the air-vessel or expansion-pipe. The overflow is then sealed by means of a screwed cap or plug, and the apparatus tested to a pressure of from 1,000 to 3,000 lbs. on the square inch. This may appear unnecessary, and to some incredible; but as the pipes are hermetically sealed after they are filled, the necessity will be obvious.

The Syphon bend S is to prevent the water backing up the return pipe, which it is apt to do, especially when the intense heat of the fire is acting on the lower part of the boiler.

In the process of heating, water expands about one twenty-third of its bulk, so that 23 gallons of cold water would, when heated to 212°, be equal to 24 gallons, and the air in the air-vessel (being more elastic than water) is compressed by this expansive force, hence if provision were not thus made it would inevitably burst the pipes; they are subject to a working-pressure varying from 50 to 500 lbs. on the square inch, and where high temperatures have to be maintained, as in stoves or ovens, it sometimes exceeds even the great pressure above mentioned.

The whole of the apparatus contains only a few gallons of water, hence the circulation is very rapid, and an intense heat is thrown off from the pipes. To stand the enormous strain to which they are subjected, the ends of the pipes are carefully prepared by machinery; one end is flattened or faced, and the other is tapered inside and out to a sharp conical edge (see Fig. 8); the pipes are cut with right and left-hand threads, and the screwing up of the

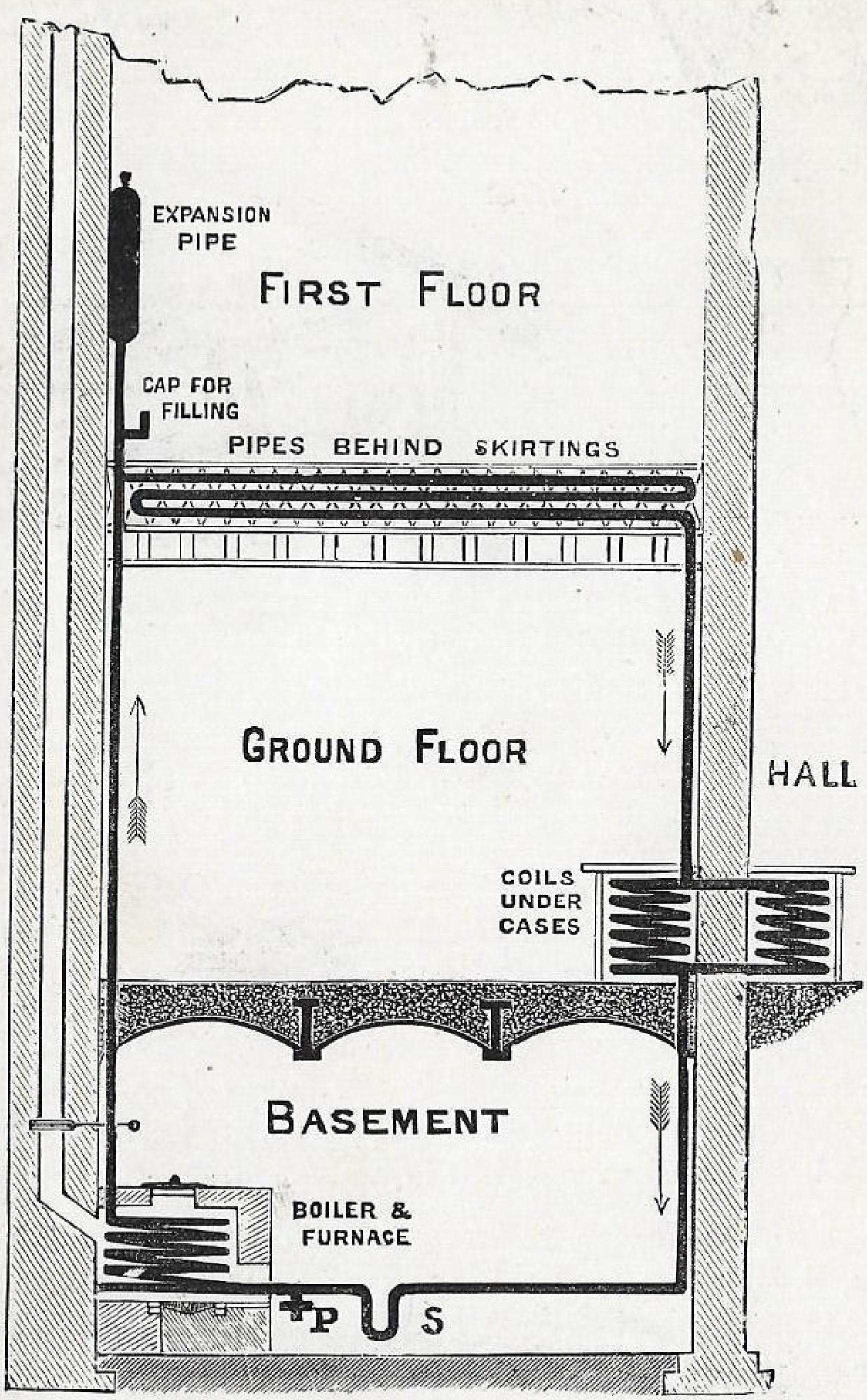


Fig. 7.

Fig. 7.—Complete High-pressure Apparatus. P, Pumping Cock for filling; S, syphon bend.

sockets with powerful pipe-tongs draws the two pipes together simultaneously; the joint does not require white lead or yarn, as it is formed by metallic contact, the coned edge of one pipe being forced into the flat end of the other, which makes a joint as strong as the solid pipe itself.

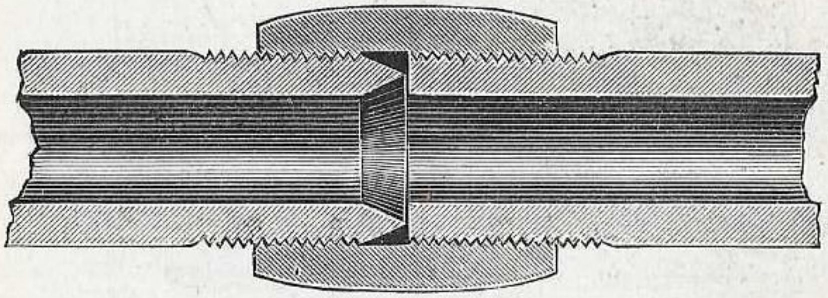


Fig. 8.

It is sometimes urged in favour of this system that it is more economical, and that owing to the small quantity of water to be heated the consumption of fuel is necessarily smaller than that used by the low pressure system. Several reasons may be given to show that such is not the case, and the following will tend to disprove this theory.

1. The consumption of fuel depends on the area of the fire-bars and the rapidity of draught, and not on the size of the pipes, or the quantity of water they may contain.

2. To ensure economy of fuel it is necessary to have a large heating surface exposed to the flame impact, and so arranged that the heat shall be spent on the boiler, and not on the brick-work in which it is cased.

3. The colder the boiler-surface when exposed to the flame, the greater the heat it will receive; and as the coil boiler is nearly three times hotter than the low pressure, there must be a proportionate waste of fuel.

In proof of this statement I give one or two (out of many) tests I have made. The results may be verified by others desirous of proving it for themselves.