

Nov. 25, 1930.

H. THOMAS

1,782,885

TUBE STILL FURNACE

Filed July 6, 1927

5 Sheets-Sheet 1

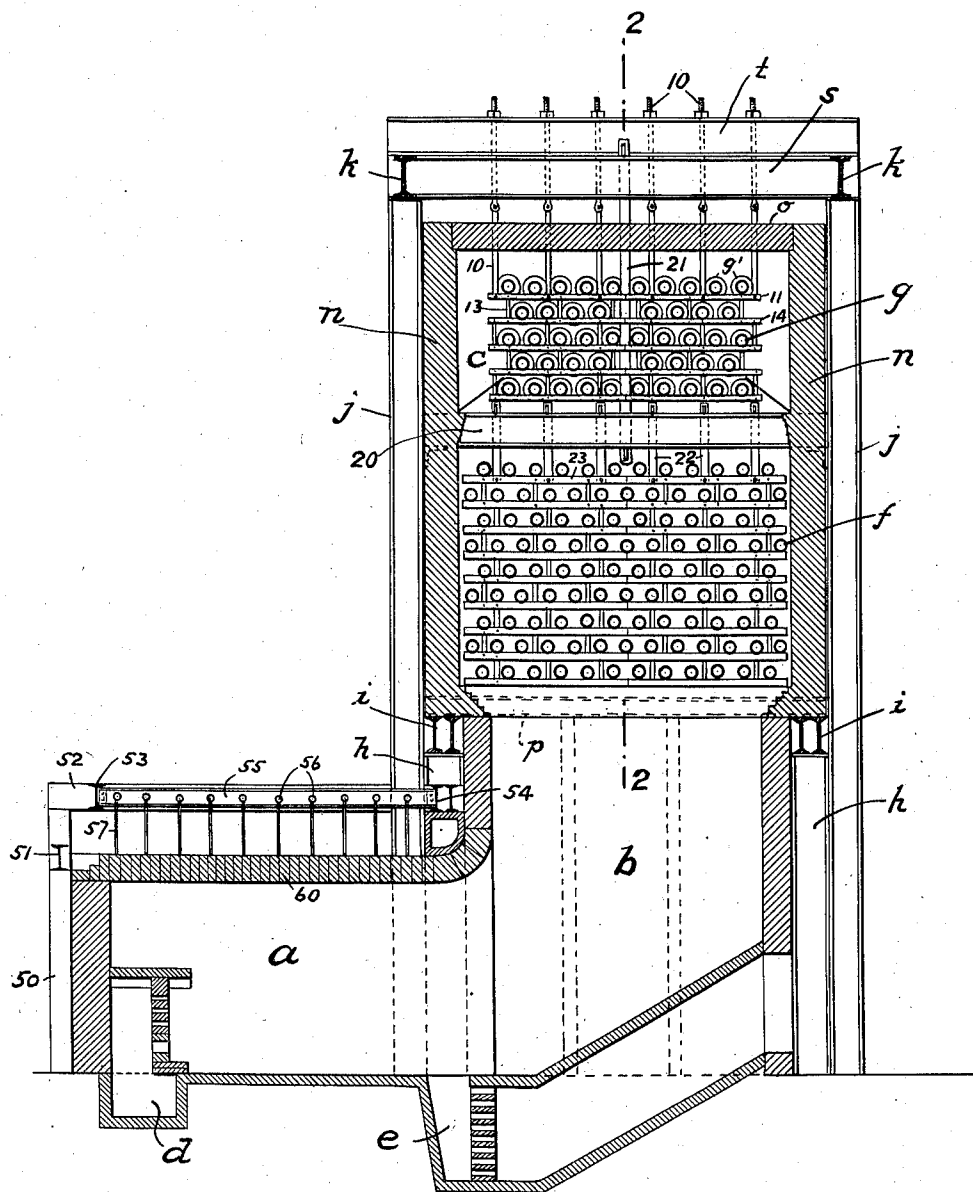


FIG. 1.

INVENTOR

WITNESS:

Robt. R. Kitchel.

Henry Thomas
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Bussler and Hardin
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5 Sheets-Sheet 2

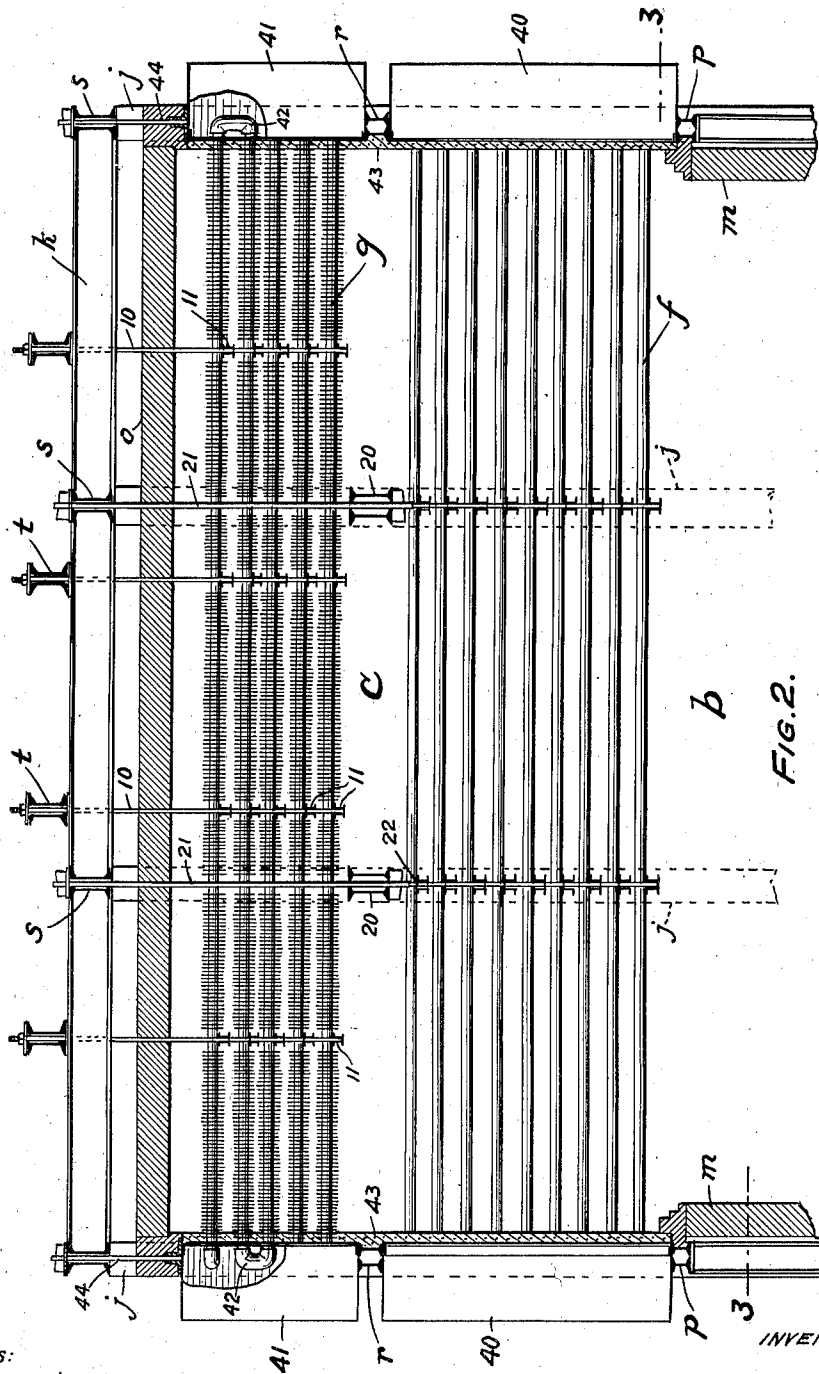


FIG. 2.

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5 Sheets-Sheet 3

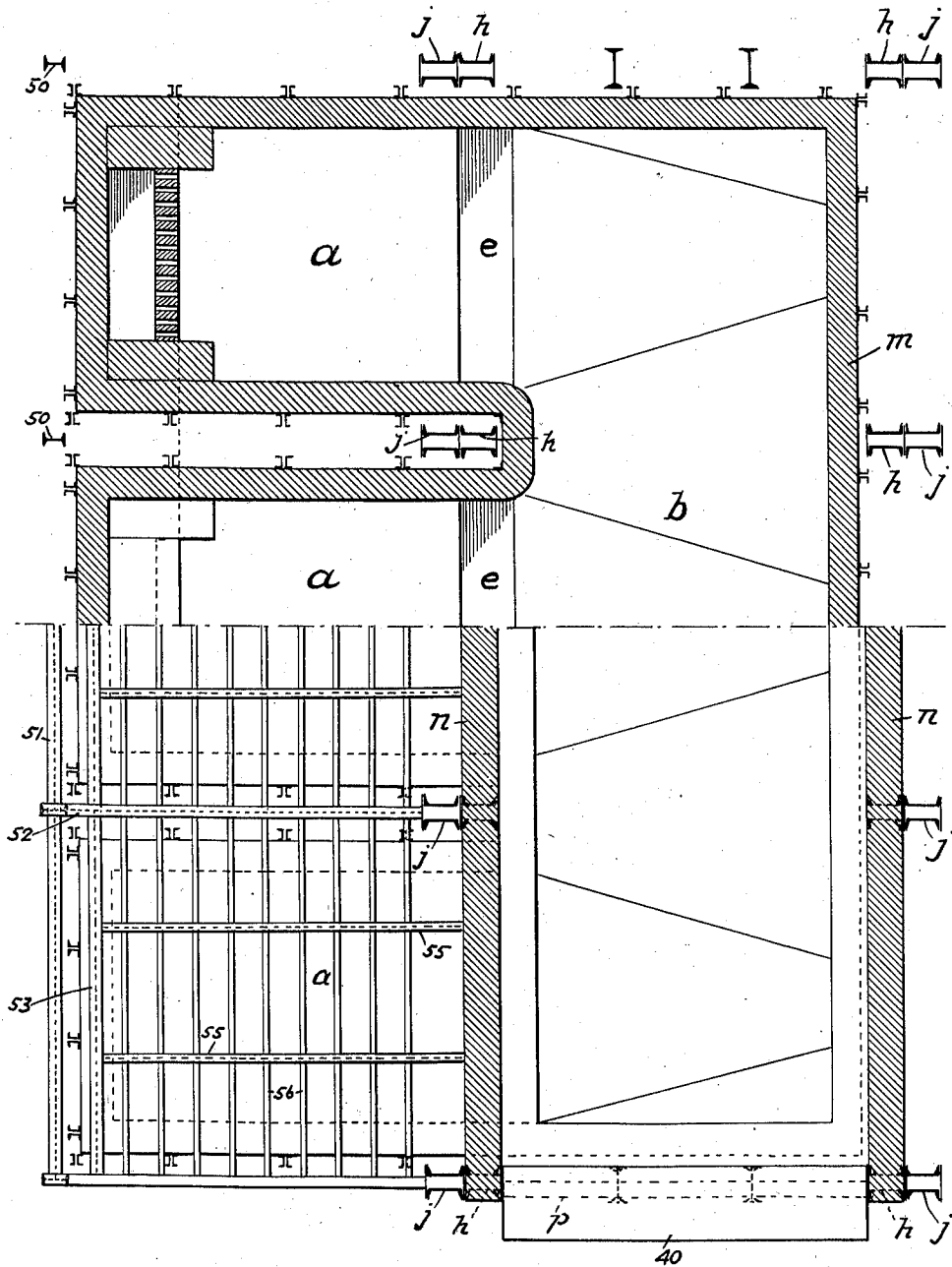


FIG. 3.

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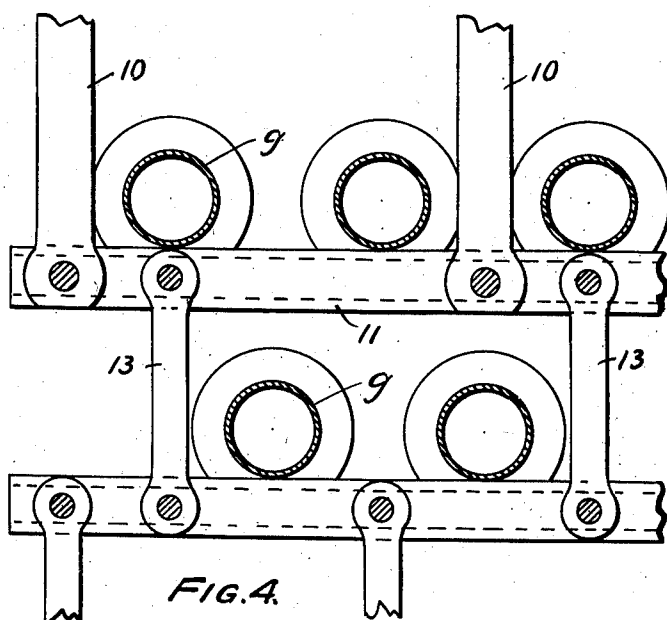
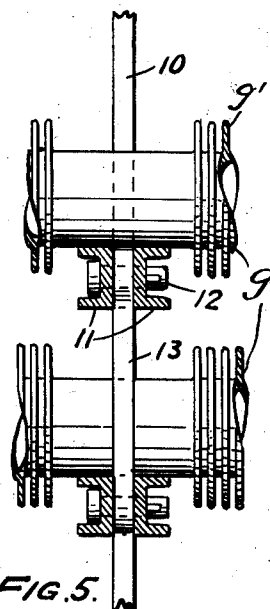
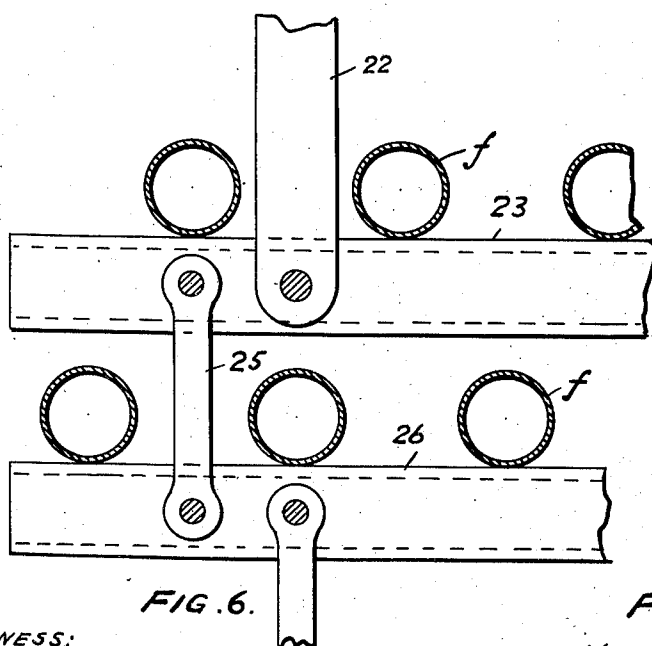
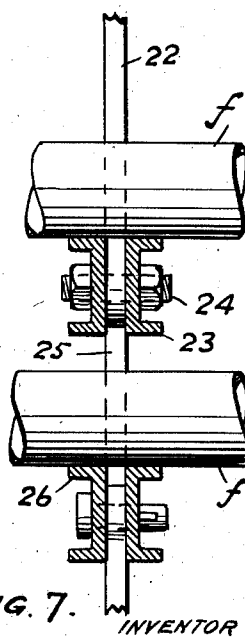
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TUBE STILL FURNACE
Filed July 6, 1927

1,782,885

5 Sheets-Sheet 4



WITNESS:

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FIG. 7.
INVENTOR
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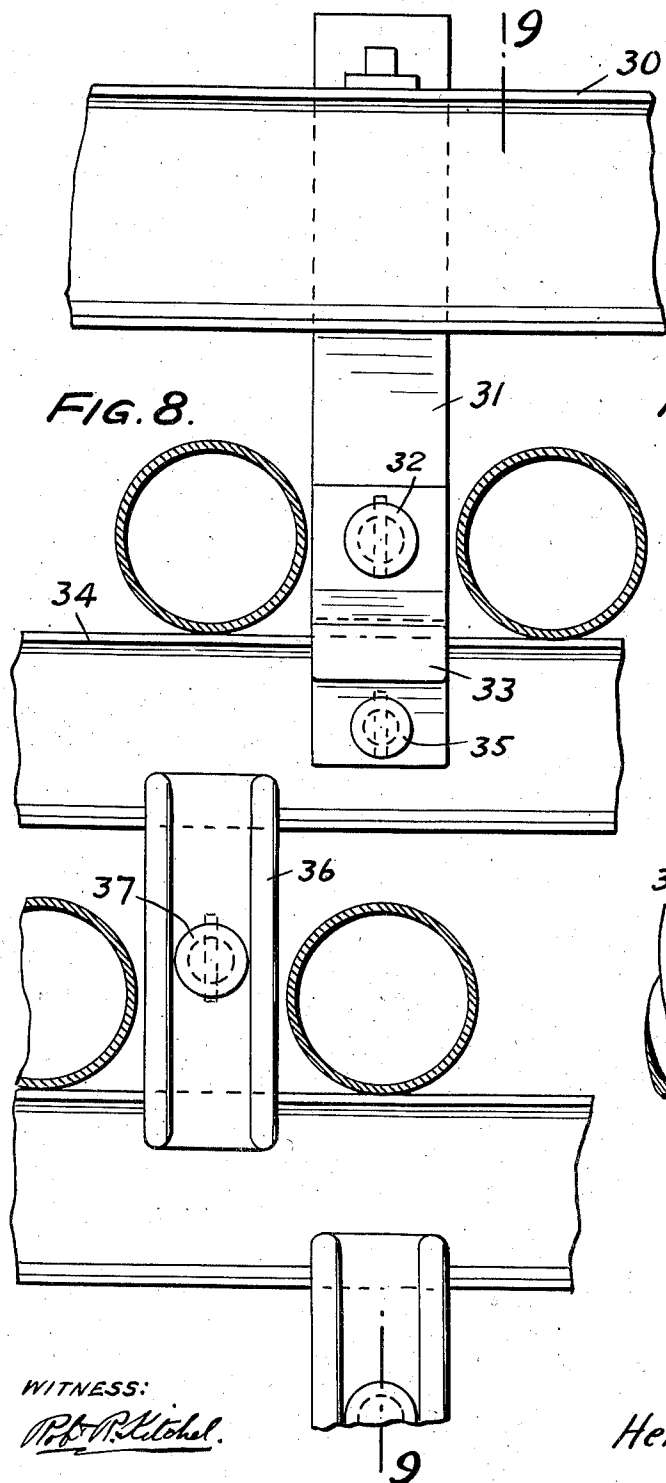
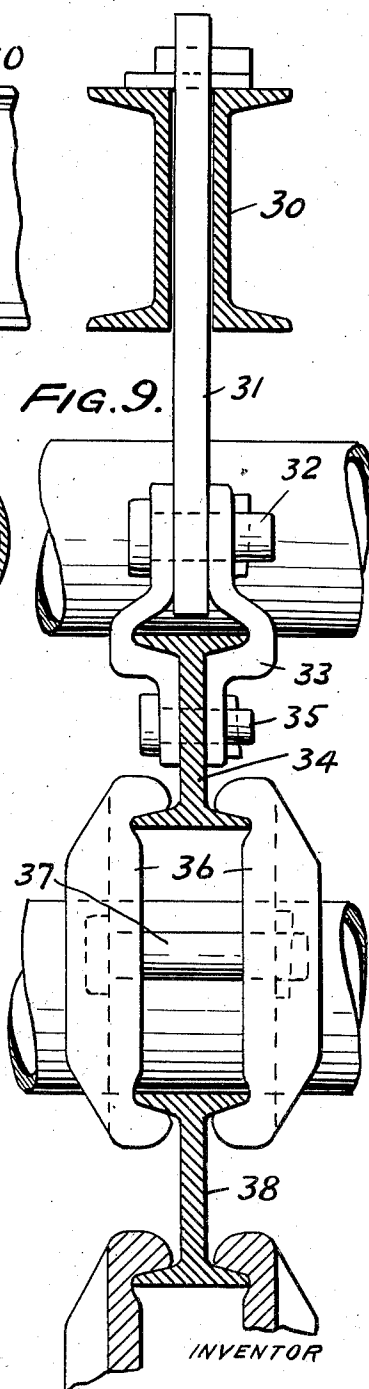
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TUBE STILL FURNACE

Filed July 6, 1927

5 Sheets-Sheet 5



Henry Thomas
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UNITED STATES PATENT OFFICE

HENRY THOMAS, OF RIDLEY PARK, PENNSYLVANIA, ASSIGNOR TO SUN OIL COMPANY,
OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF NEW JERSEY

TUBE STILL FURNACE

Application filed July 6, 1927. Serial No. 203,702.

My invention relates to tube still furnaces. Such furnaces comprise fire-brick walls enclosing banks of tube-sections through which circulates oil that is heated by means of hot gases that flow between and around the tubes and transfer thereto and to the flowing stream of oil more or less of their heat.

The main objects of my invention are to provide a construction whereby the tube-supporting means will oppose a minimum of obstruction to the free flow of gases; to provide tube-supporting means that will effectively support the tubes at different points along their length so as to permit the use of a furnace of any desired length and tube sections of corresponding length; to provide tube-supporting means that may be, and preferably are, wholly independent of the furnace walls, and more particularly to provide tube-supporting means that are hung from cross-beams located preferably above the furnace and supported from columns preferably outside the furnace wall.

These and other objects of the invention are accomplished by means of the embodiment thereof shown in the accompanying drawings, in which—

Fig. 1 is a cross-sectional elevation through the furnace.

Fig. 2 is a longitudinal section, through the tube-containing part of the furnace along the lines 2—2 of Fig. 1.

Fig. 3 is a horizontal section the left-hand part taken on one level and the right-hand part on a higher level, as indicated at 3—3, Fig. 2.

Fig. 4 is a detail view of part of the suspension means for the upper bank of tubes.

Fig. 5 is an end view of the parts shown in Fig. 4.

Fig. 6 is a detail view of part of the suspension means for the lower bank of tubes.

Fig. 7 is an end view of the parts shown in Fig. 6.

Fig. 8 is a view, similar to Fig. 4, of a modification.

Fig. 9 is a cross-section on the line 9—9 of Fig. 8.

A furnace to which my invention has been actually applied comprises several "Dutch

ovens", or rearwardly extending combustion chambers, *a*, communicating with a single, long, upright gas-combining and oil-heating chamber *b*, *c*. Air for combustion enters the Dutch oven through ducts *d*, and there mixes with fuel, which may be oil, or gas, or gas and oil; the combustion being nearly or wholly completed at the rear of the Dutch ovens *a*. The gases heat the banks of tubes *f* and *g* in chamber *c* and outflow at the top through ducts not shown. A part of the escaping and still warm gases is utilized to heat incoming fresh air on its way to duct *d*, while the remaining gases enter the rear of the Dutch oven through duct *e* and there start to mix with the hot gases of combustion, thorough admixture being effected in the combining space *b*, thereby subjecting the oil flowing through the tubes *f*, *g*, in the heating space *c* to the moderate temperature desired to effect vaporization of the lighter fractions of the oil.

This particular type of furnace is set forth with more particularity in my application Serial No. 193,703, filed June 14, 1927. It is not herein described in further detail because the present invention is not restricted in its application to any specific type of furnace having any specific mode of operation, but is applicable to many different types of furnace, and indeed to any furnace containing banks of tubes containing oil or other liquid intended to be subjected to the heating influence of a current of gases.

The metal frame in part supporting and in part enclosing the gas-combining and heating chamber of the furnace comprises, at the four corners and along the front and rear thereof, short upright columns *h*, on which rest longitudinally extending I-beams *i*, and tall upright columns *j*, on which rest longitudinally extending overhead beams *k*.

The fire-brick walls *m* enclosing the gas-combining space *b* are erected within the short columns *h*. The fire-brick walls *n* enclosing the heating or tube-containing space *c* are erected within the tall columns *j* and rest on the I-beams *i*. The roof *o* of the furnace may be supported in any known way, as, for example, by means similar to that hereinafter

described for supporting roof 60 of Dutch oven *a*.

Cross-beams *p* and *r* extend across the ends of the furnace between opposite tall columns *j*.

Between the longitudinal overhead beams *k*, and resting on the tall columns *j*, extends a lower series of cross-beams *s*. Resting on the longitudinal overhead beams *k* is an upper series of cross-beams *t*.

Depending from the upper overhead cross beams *t* are rods 10 (see Figs. 2, 4 and 5), jointed so that their lower ends form links. On opposite sides of the lower ends of rods 10 extend pairs of transverse channel bars 11 secured to the rods by means of pins 12. The upper tier of tubes *g* rests on the upper series of channel bars 11. All the metallic tube supporting structures, hereinafter described, with the furnace should be composed of a suitable heat resisting metal or metal alloy, as, for example, chrome steel or nickel-chrome steel.

Depending from channel bars 11 are links 13, from which is suspended a lower series of pairs of transverse channel bars 14, which support a lower tier of tubes *g*.

In the same way still lower series of pairs of transverse channel bars are supported from immediately overlying series of transverse channel bars, and the series of channels at each level directly supports a tier of tubes *g*.

It will be understood that the so-called "tubes" *g* are, in fact, sections of one long continuous tube, which in turn constitutes a continuation of one long continuous tube formed by the "tubes", or tube sections, *f*.

It is desirable that the upper bank of tubes *g* shall be provided with annular webs or fins *g'* to increase the surface exposed to the hot gases and the amount of heat per given length of tube that it is transferred to the oil.

It is desirable to space apart the adjacent series of transverse channel bars a distance slightly exceeding the diameters of the webs *g'* so as to facilitate the insertion and removal of tubes.

The lower bank of tubes *f* is supported somewhat similarly to tubes *g*. As shown, rods 21 (see Figs. 2, 6 and 7) depend from the lower overhead cross-beams *s* and support, between their ends, pairs of transverse I-beams 20, opposite ends of which extend through the side walls of the furnace and are supported from columns *j*. Depending from beams 20 are rods 22, on opposite sides of the lower ends of which extend pairs of channel bars 23 secured to rods 22 by means of pins 24. The upper tier of tubes *f* rests on the upper series of channel bars 23.

Depending from channel bars 23 are links 25, from which is suspended the next lower series of pairs of transverse channel bars 26,

which support the next lower tier of tubes *f*. In the same way still lower series of transverse channel bars are supported from immediately overlying series of channel bars, and the series of channel bars at each level supports a tier of tubes *f*.

In Figs. 8 and 9 are shown alternative tube-supporting means. From cross-beams 30 (which may be assumed to be the cross-beams 20, but may be the cross-beams *t*) depend rods 31, from which are hung, by means of pins 32, pairs of plates 33, from which in turn are hung transverse I-bars 34, the upper flanges of which rest on shoulders formed on plates 33 and the webs of which are secured to the lower ends of the plates by means of pins 35. The upper tier of tubes (which may be assumed to be the upper tier of tubes *f*) rests on the I-bars 34.

Hung from the lower flanges of the I-bars 34 are pairs of plates 36, from the lower ends of which are suspended transverse I-bars 38, on which rest the next lower tier of tubes *f*. Plates 36 are held in engagement with I-bars 34 and 38 by means of bolts 37. In the same way still lower series of transverse I-bars are supported from immediately overlying series of I-bars and the series of I-bars at each level supports a tier of tubes *f*.

A salient feature of the tube suspension structures herein shown and described and of other possible modifications thereof is that the tubes are supported from hangers which extend through the furnace roof, which hangers are in turn supported from a metal framework extending above the furnace roof. The tubes are thus supported independent of the brickwork. Within the furnace, they may be, and preferably are, supported wholly upon transversely extending bars engaging the tubes at spaced apart points between their ends; the hangers being of such construction and so hung that they offer no substantial obstruction to the free flow of gases upwardly around the tubes: thereby permitting the tube-containing chamber to be made of indefinite length and the tubes or tube sections themselves to be of indefinite length and yet be adequately supported. At their ends, the tubes are preferably supported by the metal boxes 40, 41.

These metal boxes 40 and 41 are supported on the end I-beams *p* and *r* and close the ends of the furnace. They may be covered with heat insulating material as at 43, Fig. 2. The ends of the tubes *f* and *g* project through, and are supported by, the inner walls of these boxes, and adjacent tubes that are intended to communicate one with another are connected by short U-shaped tubular sections 42 located entirely within these boxes. The upper boxes 41 are further supported by rods 44 connected to their tops and extending up between the end pairs of cross-beams *s* from which they are hung. Access to the boxes

may be had by making the front walls thereof removable.

The Dutch ovens may be constructed as shown in Figs. 1-3.

- 5 Arranged along the front of the Dutch oven are columns 50 connected by longitudinally extending beams 51. Extending between columns 50 and the tall columns *j* at the rear of the Dutch ovens are cross-beams 52.
- 10 Extending between beams 52 are longitudinal beams 53. Extending between the short columns *h* at the rear of the Dutch ovens are longitudinal beams 54. Connecting longitudinal beams 53 and 54 are cross-beams 55.
- 15 Connecting cross-beams 52 with cross-beams 55, and also connecting cross-beams 55, are longitudinally extending rods or pipes 56, from which depend hangers 57 having feet extending into and supporting the bricks
- 20 forming the roof 60 of the Dutch ovens.

Having now fully described my invention, what I claim and desire to protect by Letters Patent is:

1. A furnace comprising walls and a roof enclosing a chamber, two banks of tubes therein one above the other, two sets of metal beams overlying the chamber, a set of hangers depending from one set of beams, cross-bars connected with and supported by said
- 30 hangers and supporting the tubes of one bank, a second set of hangers depending from the other set of beams, and cross-bars connected with and supported by the second set of hangers and supporting the tubes of the
- 35 other bank.

2. A furnace comprising walls and a roof enclosing a chamber, a bank of tubes therein, metal beams overlying the chamber, hangers depending from said beams, cross-beams within the chamber supported by said hangers, hangers depending from said cross-beams, and bars extending within and transversely of the chamber and connected with and supported by the last named hangers and
- 45 supporting the tubes between their ends.

3. A furnace comprising walls and a roof enclosing a chamber, a bank of tubes therein, columns outside said walls, overhead beams supported by said columns above said
- 50 roof, cross-beams within said chamber extending through the side walls of the chamber and supported at the ends by said columns, hangers depending from said overhead beams and extending through the roof
- 55 and supporting said cross-beams between their ends, longitudinally extending tubes within said chamber and below said cross-beams, and hangers depending from said cross-beams and supporting said tubes at different points between their ends.
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4. A furnace comprising walls and a roof enclosing a chamber, two banks of tubes therein one above the other, two sets of metal beams overlying the chamber, a set of hangers depending from one set of beams, cross-
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bars connected with and supported by said hangers and supporting the upper bank of tubes, hangers depending from the second set of beams, cross-beams within the chamber below the upper bank of tubes and connected with and supported by the second set of hangers, hangers depending from said cross-beams, and cross-bars within the chamber connected with and supported by the last named hangers and supporting the lower

5. A furnace comprising walls and a roof enclosing a chamber, tiers of tubes therein, metal beams overlying the chamber, hangers depending from said beams, cross-bars connected with and supported by said hangers and supporting an upper tier of tubes, links depending from said cross-bars, and cross-bars connected with and supported by said links and supporting a lower tier of
- 80 tubes.

6. A furnace comprising walls and a roof enclosing a chamber, tiers of tubes therein, metal beams overlying the chamber, hangers depending from said beams and extending through the roof, series of cross-bars at different levels supporting respectively the tiers of tubes, supporting means connecting each series of cross-bars except the upper series with the immediately overlying series of cross-bars, and means connecting said hangers with the upper series of cross-bars.
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7. A furnace comprising front and rear rows of relatively short columns and front and rear rows of relatively tall columns outside the short columns, longitudinal beams supported on the rows of short columns, furnace walls above said short columns and longitudinal beams, a roof spanning said walls, overhead longitudinal beams and cross-beams extending over said roof and supported by the tall columns, tubes extending longitudinally within the space enclosed by said walls, and tube-supporting means depending from and supported by said overhead beams and
- 100 extending through said roof.

8. A furnace comprising front and rear rows of relatively short columns and front and rear rows of relatively tall columns outside the short columns, longitudinal beams supported on the rows of short columns, furnace walls above said short columns and longitudinal beams, a roof spanning said walls, overhead longitudinal beams supported by the two rows of tall columns, a lower row of cross-beams extending between said longitudinal beams above said roof, an upper row of cross-beams extending above said roof and supported on said longitudinal beams, two banks of tubes, one above the other, extending within the space enclosed by said walls, means depending from and supported by the upper row of cross-beams and extending through the roof and supporting one bank of tubes, and means depending from and sup-
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ported by the lower row of cross-beams and extending through the roof and supporting the other bank of tubes.

9. A furnace comprising walls forming a gas-mixing and heating chamber, tubes in the upper part of said chamber, short columns outside the front and rear walls of the gas-mixing space of said chamber and supporting the laterally overhanging walls of the tube-containing space of said chamber, tall columns outside the front and rear walls of both the gas-mixing space and the tube-containing space of said chamber, longitudinal and transverse beams supported by the tall columns, hangers depending from said transverse beams, and tube supports carried by said hangers.

In testimony of which invention, I have hereunto set my hand, at Marcus Hook, Pennsylvania, on this 5th day of July, 1927.

HENRY THOMAS.

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