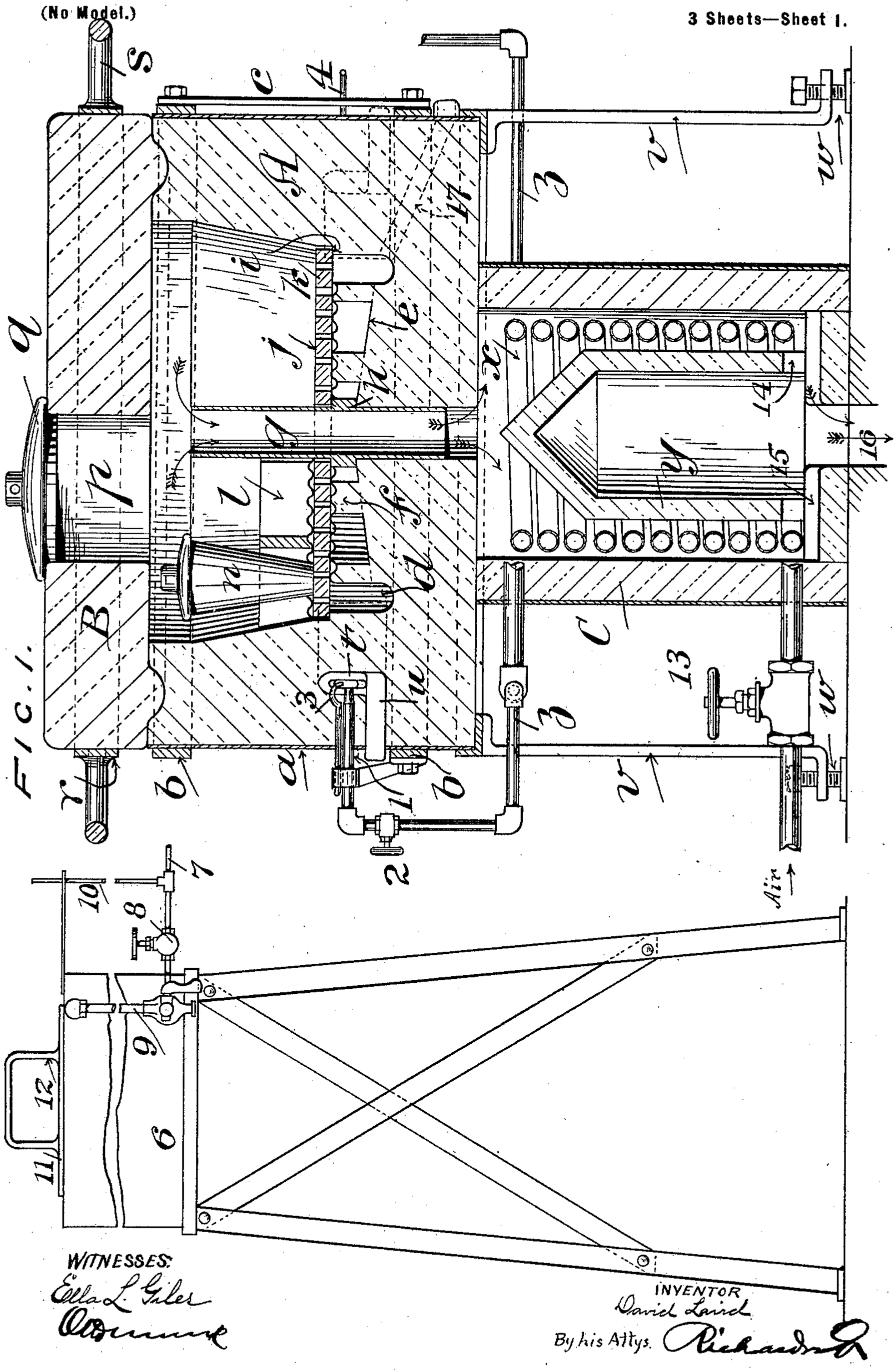
No. 671,558. Patented Apr. 9, 1901.

D. LAIRD.

ASSAY FURNACE.

(Application filed Dec. 4, 1900.)

(No Model.) 3 Sheets—Sheet 1.



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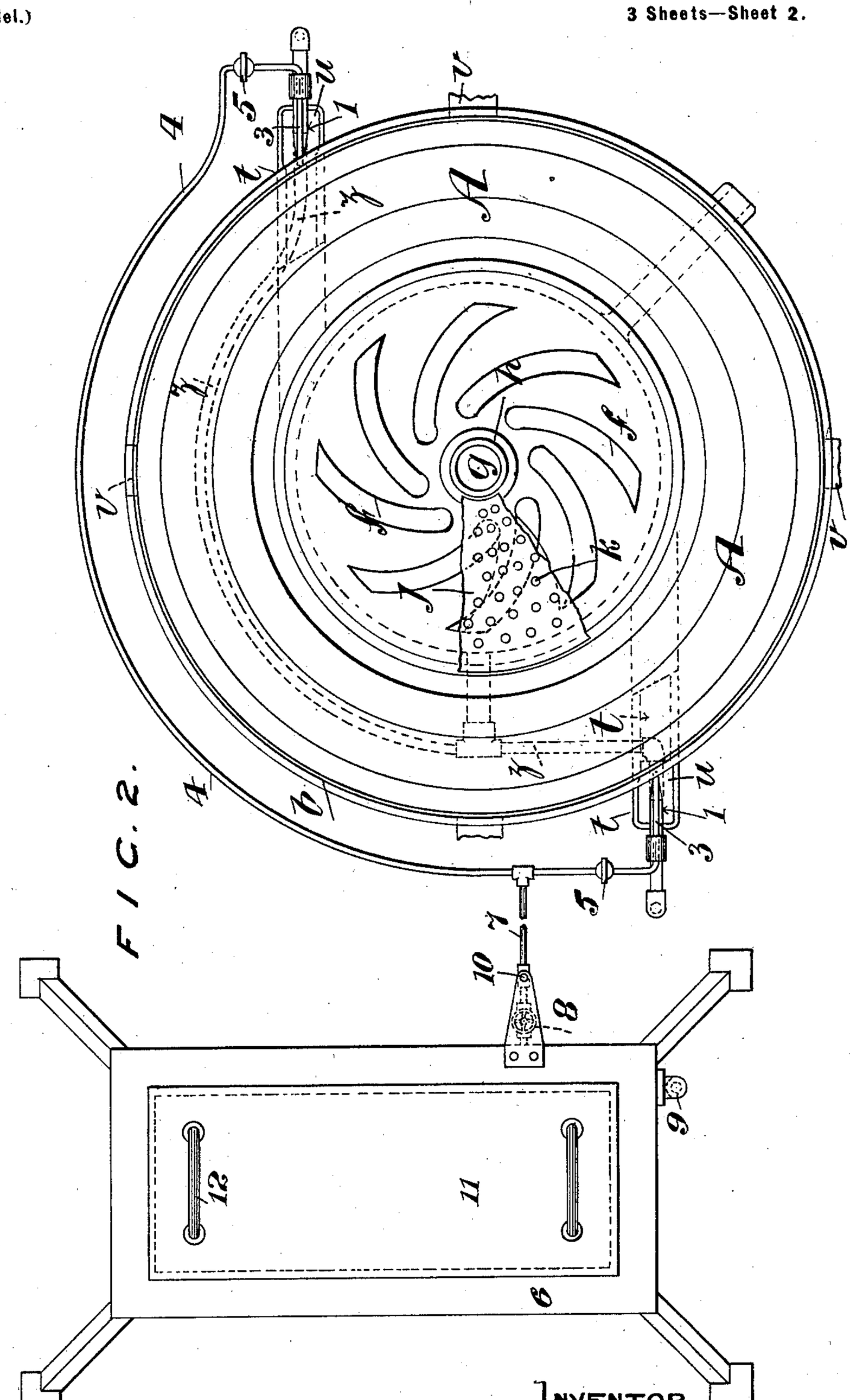

FIG. 2.

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(No Model.) 3 Sheets—Sheet 3

FIG. 3.

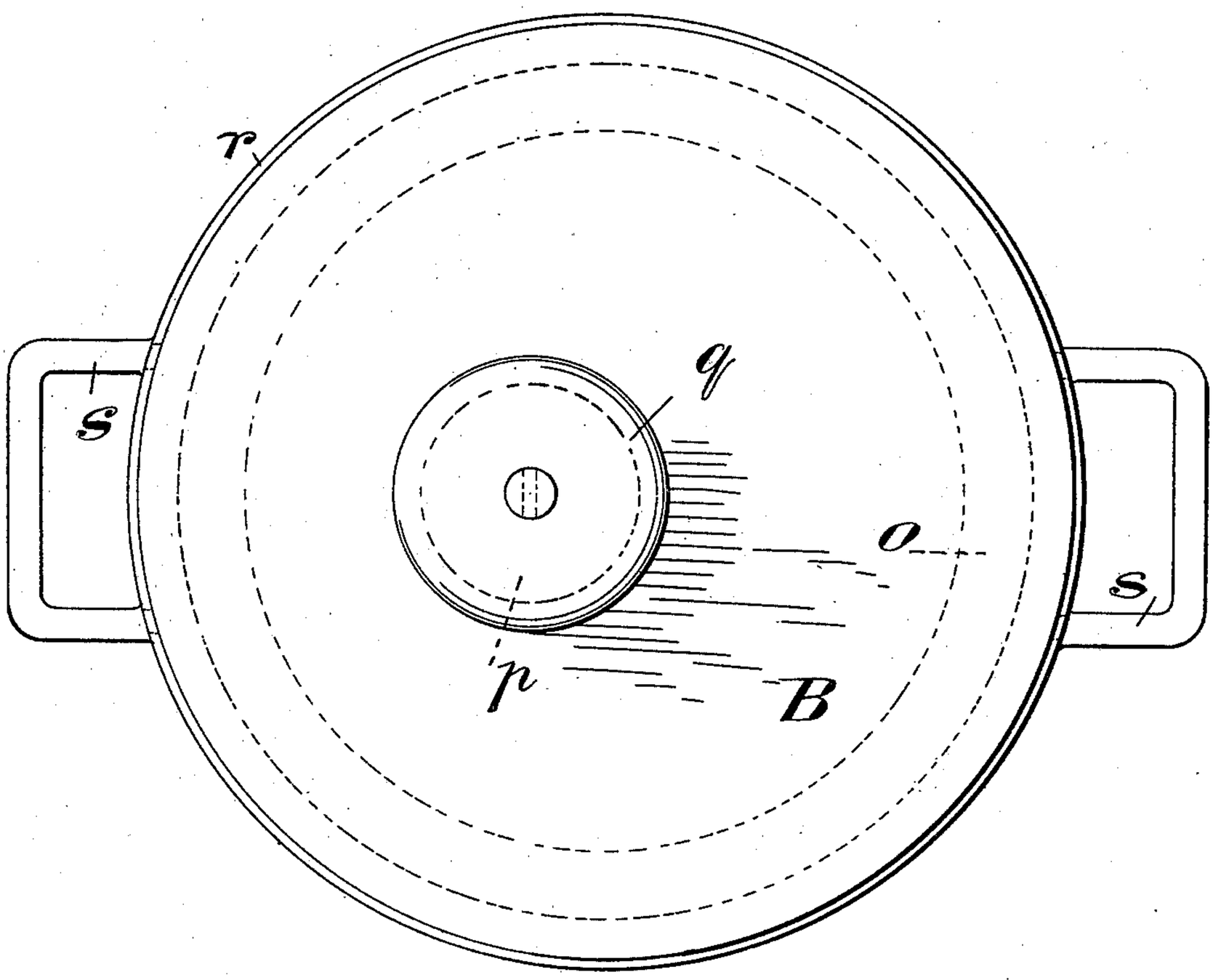

FIG. 5.

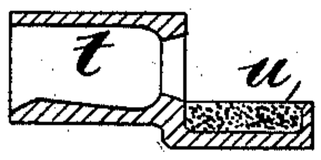

FIG. 6.

FIG. 4.

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UNITED STATES PATENT OFFICE.

DAVID LAIRD, OF FORFAR, SCOTLAND.

ASSAY-FURNACE.

SPECIFICATION forming part of Letters Patent No. 671,558, dated April 9, 1901.

Application filed December 4, 1900. Serial No. 38,629. (No model.)

To all whom it may concern:

Be it known that I, DAVID LAIRD, engineer and metallurgist, a subject of the Queen of Great Britain and Ireland, residing at Canmore Works, Forfar, in the county of Forfar, Scotland, have invented a certain new and useful Assay-Furnace, of which the following is a specification.

My invention relates to assay-furnaces used for ascertaining the quantity of precious metals in ores or minerals and for the cupellation of precious metals, as is well understood.

The essential feature of my invention consists in the provision of means whereby the crucibles or cupels containing the ore or precious metal are subjected to heated gases due to the combustion of liquid fuel or gas under air-pressure.

In order that my invention may be fully understood, I have attached hereto three sheets of explanatory drawings, to which I will refer.

Figure 1 represents in sectional elevation my improved assay-furnace. Fig. 2 is a plan thereof with the cover removed. Fig. 3 is a plan of the cover. Fig. 4 shows in plan view the grid and the crucibles in position thereon. Figs. 5 and 6 are detail views.

In carrying my invention into effect I provide a chamber A, which is preferably cylindrical, constructed of fire-clay or other refractory material, which may be surrounded with a casing of sheet metal *a*. The chamber A is strengthened by metallic hoops *b*, maintained in position by a number of distance-strips *c*, bolted to the hoops. The interior of the chamber A is of hollow conoidal formation, as shown in the sectional view, Fig. 1, and an annular trough *d* surrounds an inclined hearth *e* at the bottom of the chamber A. The inclined hearth *e* is formed with a number of curved corrugated ribs *f*, radiating toward the center of the hearth, as more clearly shown in Fig. 2. The inclined hearth *e* is pierced by a funnel *g*, which is formed with a collar *h*, resting on the hearth. Upon the collar *h* and an annular ledge *i* rests a plate *j*, formed with perforations *k* to carry the crucibles or cupels.

Upon the plate *j* is arranged a skeleton frame *l*, consisting of an annular rib and ribs radiating therefrom, the crucibles being disposed in the spaces formed by the ribs. This arrangement is clearly shown in the plan view, Fig. 4. The ribs of the skeleton frame *l* serve to separate the crucibles and prevent the tipping over of the same to some extent. The bottoms of the ribs of the skeleton frame *l* are corrugated to provide circulating-channels for the hot gases.

A lid or cover B for the chamber A is provided, which cover is formed with a beading *o*, fitting in a corresponding channel in the top of the chamber A. A sight-hole *p*, covered by a lid *q*, is also formed in the lid or cover B. The cover, which is also constructed of fire-clay or other refractory material, is strengthened by the metallic hoop *r*, provided with handles *s*, by means of which the cover can be readily removed and replaced.

In conjunction with the chamber A, I provide two combustion-chambers *t*, having a pan *u*, filled with asbestos fiber. The combustion-chambers *t* are used with a spray-burner, hereinafter to be described. The combustion-chamber is shown separately in longitudinal section in Fig. 5 and in end view in Fig. 6. The combustion-chambers *t* are arranged in passages leading to the inclined hearth *e* and below the plate *j*.

The chamber A is carried upon legs *v*, which can be adjusted in length by means of screws *w*, and the chamber A is further supported by a smaller cylindrical chamber C, of fire-clay or other suitable material incased with sheet metal. The chamber C is preferably in two halves, suitably secured together for convenience in erecting therein a coil *x*, surrounding a cylindro-conoidal core *y* of fire-clay. A branch pipe *z* is conducted to the coil *x* and also to nozzles 1, provided with valves 2, the nozzles being directed to the mouth of the combustion-chambers *t*. Fuel-jets 3 are also arranged above the nozzles 1, the fuel being conducted to the jets 3 by means of a branch pipe 4, the supply of fuel being governed by valves 5. Any suitable fuel, such as gas or liquid hydrocarbon, may be used, and in the drawings I show an oil-tank 6, having a supply-pipe 7 and valve 8, the pipe being connected to the branch 4. The tank is provided with a gage 9 and vent-pipe 10. The lid 11 of the tank is removed and replaced by means of handles 12. The

function of the coil x is to conduct a blast of heated air to the nozzles 1.

The action of my improved assay-furnace is as follows: The coil x, which is provided with a valve 13, is connected with any suitable blowing-engine or air-compressor. The asbestos in the pan u of the combustion-chamber t is saturated with oil allowed to drip from the oil-jets 3 and the asbestos ignited. The air-blast is then turned on and the oil issuing from the jets is thus vaporized and ignited and the flames produced are directed through the combustion-chambers to the inclined hearth of the furnace. The chamber A at the commencement of operations is preferably without the cover, so as to afford inspection to the interior. The flame and hot gases are deflected inward by the curved ribs f, formed upon the inclined hearth e, and a rotary motion imparted to the flame and hot gases. The flame and hot gases circulate freely through the perforations in the plate j and come into intimate contact with the crucibles n, containing the ore. When the working of the furnace has been satisfactorily commenced, the cover B is placed in position to confine the hot gases, the lid of the sight-hole q being removed at any time when it is desired to inspect the furnace or the contents of the crucibles n. The hot gases have no outlet from the chamber A save by the funnel g, down which they pass, being deflected by the conical roof of the core y and coming into contact with the coil x, whereby the air-blast is highly heated, tending further to raise the temperature of the furnace, the gases finally escaping through the passages 14 in the core y and passages 15 in the base of the chamber C to the flue 16. In case of upsetting or breakage of the crucibles the slag passing through the holes k in the plate j falls on the inclined hearth e and runs down into the annular trough d. From the annular trough d the slag passes down the chute 17, by which it is conducted into any desired receptacle.

I declare that what I claim is—

1. In combination, a furnace having a central chamber with a conical bottom, flame-inlets leading through the side wall of the chamber, a series of vanes or flame-deflecting ribs projecting from said bottom, and a crucible-support supported on said ribs, substantially as described.

2. In combination in a furnace, a central chamber having a conical hearth, flame-passages leading through the side wall of the chamber, flame-deflecting radially-arranged ribs extending upwardly from the hearth, a perforated plate supported thereon, and a crucible frame or spider resting on said plate, substantially as described.

3. In combination in a furnace, a central chamber having a conical hearth, flame-passages leading through the side wall of the chamber, flame-deflecting, radially-arranged ribs extending upwardly from the hearth, a perforated plate supported thereon and a crucible frame or spider resting on said plate, said frame having a corrugated under face, substantially as described.

4. In combination in a furnace, a central chamber, a crucible-support in the lower part thereof, a flame-inlet at the bottom of said chamber, means for completely closing the top of said chamber, a supplemental chamber below the main chamber, a heating-coil therein having a discharge into said flame-inlet and a pipe extending axially of the first chamber to a point near the top thereof, said pipe discharging into the supplemental chamber, substantially as described.

5. In combination in a furnace having a central chamber, flame-directing ribs projecting from the hearth thereof, flame-passages leading into said chamber tangentially of the same, a vapor-burner at the end of said passages, a pipe feeding air to said burner, said pipe having a coil intermediate of its ends, a supplemental chamber inclosing said pipe, a core in said chamber having a conical top, a lid for closing the main chamber, and a pipe having its inlet in the upper part of the main chamber, said pipe discharging above the apex of the top of said core, substantially as described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

DAVID LAIRD.

Witnesses:
RICHARD WEBSTER IBBERSON,
ALFRED YATES.