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Patented Jan. 16, 1900.

C. B. JACOBS.

CONSERVATION OF VOLATILE PRODUCTS FROM BEEHIVE COKE OVENS.

(Application filed Nov. 22, 1897.)

(No Model.)

Fig. 1,

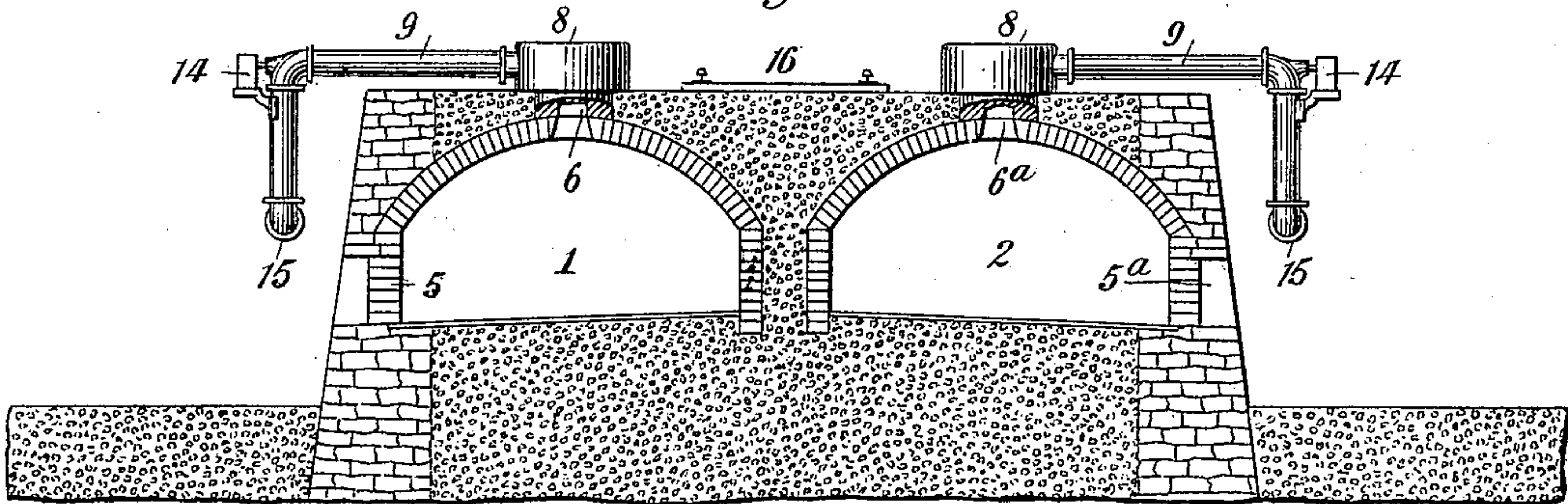


Fig. 2

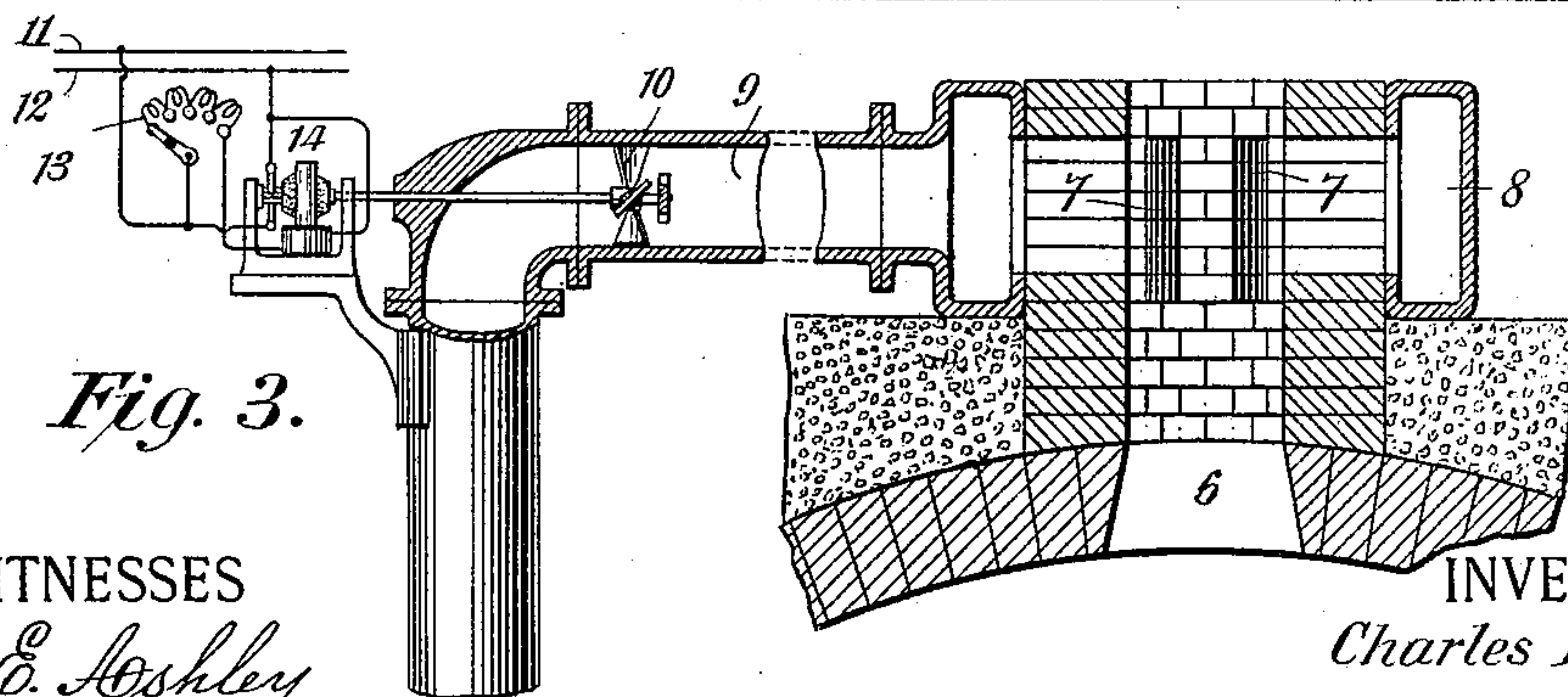
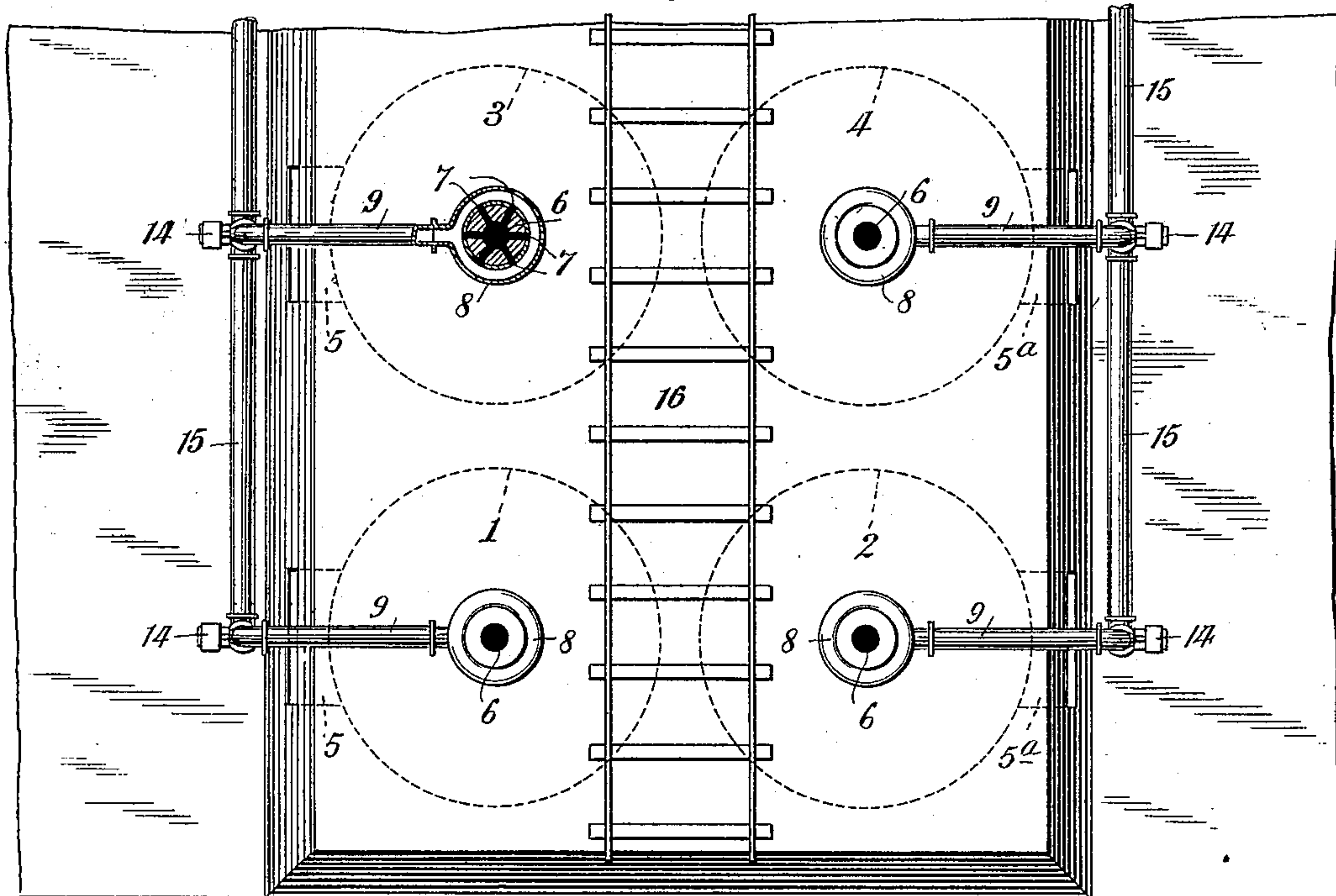


Fig. 3.

WITNESSES
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CONSERVATION OF VOLATILE PRODUCTS FROM BEEHIVE COKE-OVENS.

SPECIFICATION forming part of Letters Patent No. 641,591, dated January 16, 1900.

Application filed November 22, 1897. Serial No. 659,483. (No model.)

To all whom it may concern:

Be it known that I, CHARLES B. JACOBS, a citizen of the United States, and a resident of Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in the Conservation of Volatile Products from Beehive Coke-Ovens, of which the following is a specification.

This invention relates to the conservation of the volatile products from beehive coke-ovens in such manner and by such means as to enable the conditions of coking in such ovens to be unaffected by such conservation.

Among the various methods of coke manufacture the one most preferred on account of its cheapness of construction and operation and for the excellent quality of the coke produced is that followed in the use of the beehive oven. The coke produced in this oven is of higher quality than that made in the closed retorts, in which the coke is roasted by external heat. The oven is made of fire-brick and is a dome-shaped cylindrical structure about twelve feet in diameter and six feet from the floor to the center of the dome and has a capacity of about six tons of bituminous coal. The ovens are provided with charging-holes at the center of the dome, which also serve as an escape for the products of combustion during the coking operation.

Tunnel-head doors are built with the ovens at the floor-level, which are bricked up during the coking operation and luted with clay, the draft being controlled by the attendants by the removal of clay from the brick-joints, so as to admit only sufficient air above the coal to carry on combustion. The coal is fired at the surface by the residual heat in the walls which the oven acquired in the previous operation.

The coking in the beehive ovens proceeds from the top downward gradually through the mass, the heat necessary to expel the gases being supplied partly by the heat in the walls and the burning of the escaping gases in the coking-chamber or zone of combustion of the gases above the coal and partly at the expense of the carbon of the coal. It requires about seventy-two hours' burning to produce No. 1 foundry-coke, and the yield of the ovens is about sixty per cent. of the coal charged into them.

The ovens are usually arranged in double rows in blocks or batteries of about fifty ovens, with track for the charging-lorry or coal-wagon running between the charging-holes in such a manner that the ovens on either side of the track may be conveniently charged with coal.

It is admitted by all authorities that the character of the coke produced in the beehive oven is much superior to that produced in those types of retort-ovens in which the coal is roasted by the external application of the heat to the oven-walls and in which the coking proceeds from the bottom upward. This is due partly to the direct effect of the radiant heat and the burning of the gases and partly to the fact that the lower strata are the last to be influenced by the heat and that the gases driven off from the coal traverse the upper layers of partially-connected coke. Eminent authority asserts that the coke from the beehive ovens gives a greater yield of iron in the same blast-furnace for the same quantity of coke than the coke from the so-called "Belgium" or "closed" distilling types.

It is the object of my invention to utilize the inherent qualities of the beehive oven, so far as the production of high-grade coke is concerned, and to so construct the oven that the waste products are recovered without in any way interfering with the conditions necessary for the best operation of a beehive oven. The cooking proceeds in the same manner from the top downward through the mass, the evolved gases burning in the zone of combustion above the charge, as usual, and being drawn off while maintaining the natural-draft communication of the oven and without, therefore, interfering with the cooking process. The gases are not removed from the oven until they have fulfilled all their usual functions in furnishing heat to aid in the coking of the coal, as in the ordinary beehive-oven operation.

The conservation of the waste gases and by-products from the coking operation is acknowledged to be a desideratum by coke manufacturers, but they are unwilling to effect this at any sacrifice of quality of the coke. My invention is directed particularly to meet this condition by providing means for saving the waste products, while permit-

ing the operation of the coke-oven to proceed exactly as at present. No risk is therefore incurred by the coke-maker in adopting the process, and he can take advantage of all the experience gained in the many years during which the manufacture of coke in the beehive oven has been brought to its present high state of perfection.

In carrying out my invention I permit the beehive oven to be operated in its ordinary and proper manner, but provide in the dome of the oven, at the charging-hole or open flue, which is in free communication with the outer air, a lateral duct, through which the volatile gases may be sucked during their dissociation from the coal. The gases are led through a condenser to trap the tar and through a scrubbing-tower to take up the ammonia, after which the residual gases may be used for lighting or heating, as desired. The substitution of this open flue with lateral ducts for the solid fire-brick collar which ordinarily constitutes the charging-hole of the beehive oven is an essential feature of my invention, since it reduces the operation of this oven to that practiced in the ordinary beehive oven and allows of the collection of the waste gases only after they have passed through the zone of combustion and performed their part in the coking of the charge in the oven.

In the accompanying drawings, illustrating my invention, Figure 1 is a transverse section of a plant of beehive ovens embodying my improvements. Fig. 2 is a plan of a part of a battery of ovens, the charging-hole of one of them being shown in section. Fig. 3 is a detail view, on an enlarged scale, illustrating the improvements.

1 and 2 represent ordinary beehive ovens, the walls of which are made of fire-brick, each being provided with a dome-shaped top and a door or opening at 5 and 5^a for raking out the coke at the conclusion of the operation.

During the coking operation the door is bricked up and the cracks luted with clay, some small air-passages being left at the top to promote combustion. At the top of the charging-hole 6 and surrounding said charging-hole is placed an open fire-brick frame, in the walls of which are lateral openings 7, as shown in Figs. 2 and 3. These openings communicate with an annular iron chamber 8, connecting with a pipe or duct 9, leading to a hydraulic main and other condensing apparatus. In this pipe is placed a fan 10, operated by an electric motor, by which a gentle suction may be set up to lead away the gaseous distillates. The electric motor may be supplied with energy from a constant-potential source 11 12 and may have its field-magnet in series relation to an adjustable resistance 13, by which the speed of the motor may be nicely graduated. Each oven of the system should be provided with an independent motor, as indicated at 14, so that the coking operation in each may be conducted independently of the others. The fire-brick

frame 7 and its inclosing casing should be as low as possible, so as not to interfere with the operation of charging the ovens with coal by means of a lorry run along the track 16, extending between the two tiers of ovens, and for the further purpose of preventing an increase of draft.

In making coke with the apparatus herein described I proceed as follows: About 6 tons of coal are run from the charging-lorry with the charging-hole of each oven, filling the latter to the springing-point of the arch. The charge is leveled off and the door bricked up and secured with clay. The electric motors are cut out of circuit and the oven operated precisely as an ordinary beehive oven until smoke and flame issue from the charging-hole or, as it is technically known, until the charge "strikes off." The motors of such ovens as have struck off are then cut into circuit, thus creating a gentle suction from the charging-hole, not sufficient to materially affect the draft of the oven, but sufficient to lead the products of combustion through the pipe 9 and force it through a pipe 15, common to one row of ovens, from which it discharges into the hydraulic main, scrubbing-tower, &c. The speed of the motor may be graduated by the workmen to the exact degree required to produce the best results, especially in respect to the drafts established in the oven. The smoke increases in density for about eight hours, when it decreases, and in from sixteen to twenty hours after striking off almost ceases, showing that nearly all of the tar and heavy hydrocarbons have been driven off. The motors are then cut out of circuit and the oven allowed to remain in exactly the same condition as an ordinary beehive oven until the end of the coking operation, which varies from forty-eight to seventy-two hours from the time of starting, depending upon the kind of coke desired. With forty-eight-hour coke the motor should be operated from sixteen to twenty hours. With seventy-two-hour coke they may be operated from twenty-four to thirty hours. The coke is then allowed to remain in the oven until it becomes a glowing-red mass and no gas is seen to escape from the charging-hole, when it is quenched by a stream of water thrown into the oven and drawn out on the coke-wharf. The oven may then be recharged with coal for a new operation, its residual heat being sufficiently high to ignite the fresh charge of coal. Thus the operation becomes continuous.

It will be seen that by my mode of operation the products of combustion are taken from the top of the oven and above the zone of combustion, thereby permitting the charge of coal to be given as much heat by the burning gases as in the ordinary beehive oven, and the advantageous process involved in the operation of a beehive oven is in no way interfered with, thus permitting a high-grade coke suitable for blast-furnace fuel, foundry-work, and all metallurgical purposes to be produced

without the loss of the distillation products which has been heretofore inherent with such ovens. It will be seen, moreover, that with my organization any oven of the system may
5 be disconnected from the others for repair or other causes without interrupting the continuity of the operation of the plant as a whole.

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

1. The method of collecting the volatile products in the coking of coal in beehive ovens, which consists in laterally deflecting
15 the volatile products from the charging-hole of the beehive oven by means of suction applied laterally to such charging-hole, such suction being insufficient to affect the natural draft of the oven, and communication with
20 the outer air being maintained through such charging-hole.

2. In combination with a beehive oven provided with a charging-hole at its top in free communication with the outer air, of means
25 for collecting the volatile products arising from such oven, consisting of a duct leading laterally from such hole, and regulable suction apparatus for establishing in such duct a suction sufficient to draw off such volatile
30 products, without materially affecting the natural draft of the oven.

3. In combination with a beehive oven provided with a charging-hole at its top in free communication with the outer air, of means for collecting the volatile products arising
35 from such oven, consisting of a duct leading laterally from such hole, regulable suction apparatus for establishing in such duct a suction sufficient to draw off such volatile products, without materially affecting the
40 natural draft of the oven and condensing apparatus connected to such duct to receive and condense such volatile products.

4. In combination with a beehive oven provided with a charging-hole at its top in free
45 communication with the outer air, of means for collecting the volatile products arising from such oven, consisting of a fire-brick frame surrounding the charging-hole, and provided with lateral openings, an annular
50 chamber around such frame communicating with such openings, suction apparatus and a duct leading from such chamber to such suction apparatus.

In testimony whereof I have hereunto sub-
55 scribed my name this 19th day of November, A. D. 1897.

CHARLES B. JACOBS.

Witnesses:

JOHN D. MILLER,
JOHN MCENCROE.