No. 695,889. Patented Mar. 18, 1902.

# J. S. SHERMAN & G. H. HARMS.

## VAPOR BURNER.

(Application filed Mar. 14, 1898.)

(No Model.) 2 Sheets—Sheet 1.

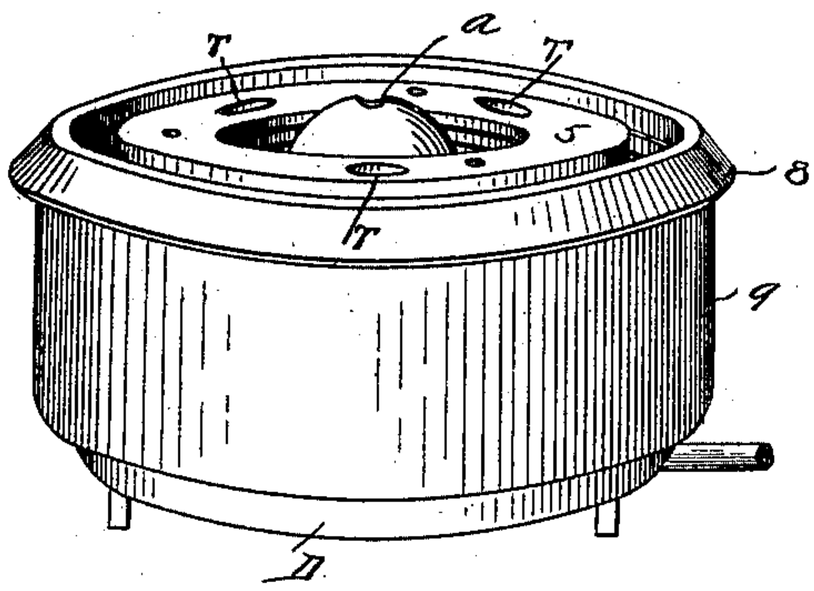


Fig. 1.

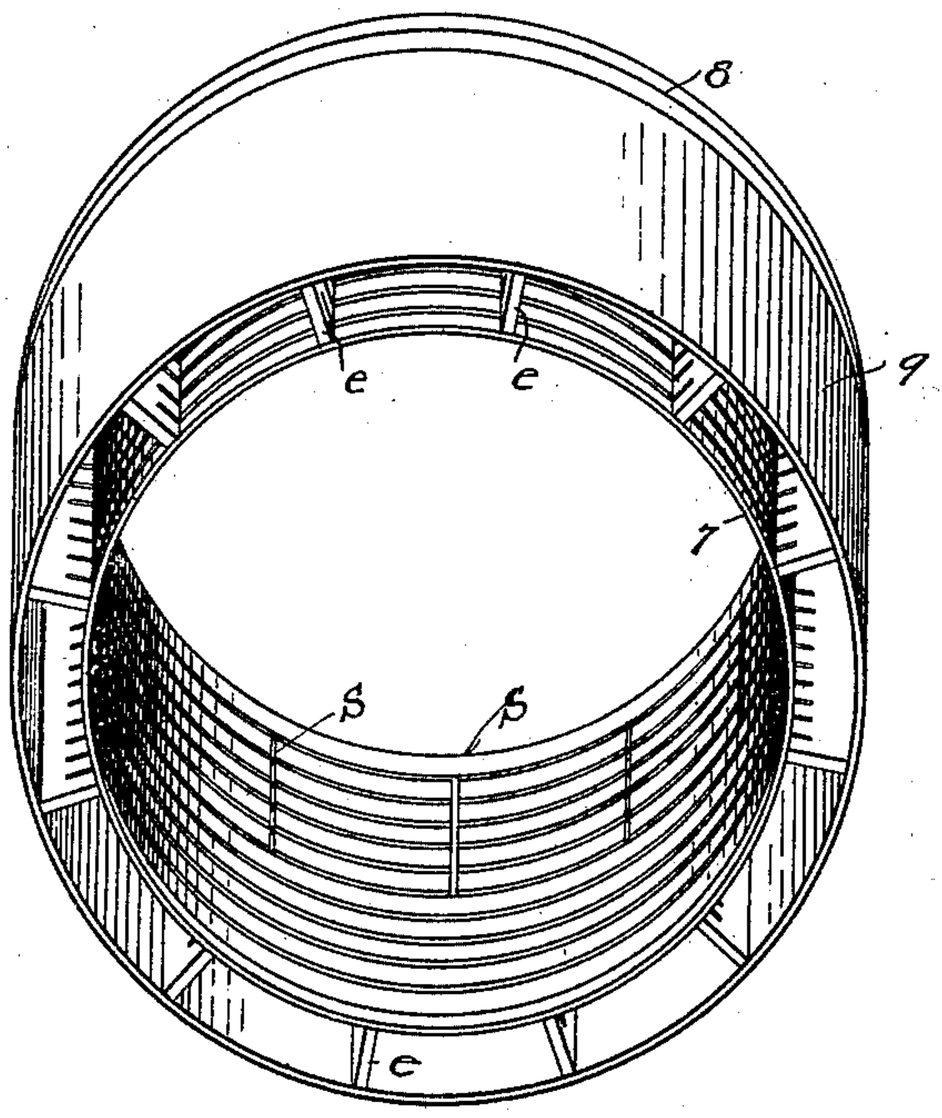


Fig. 2.

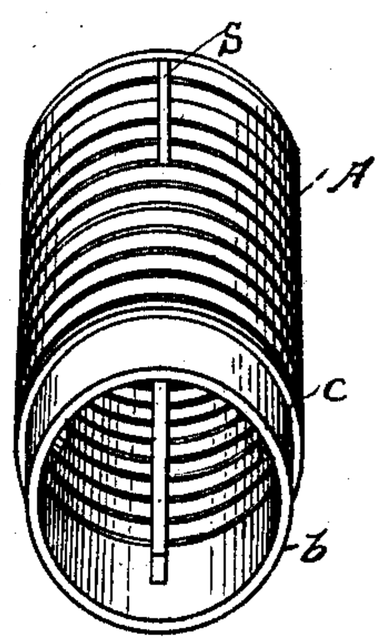


Fig. 3.

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## VAPOR BURNER.

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(No Model.) 2 Sheets—Sheet 2.

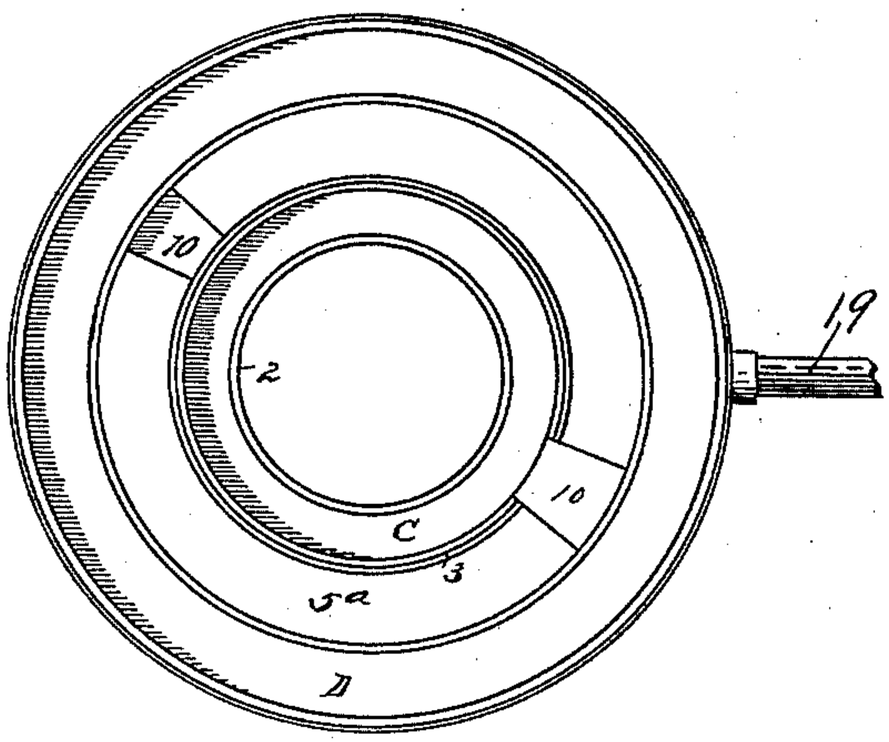


Fig. 6.

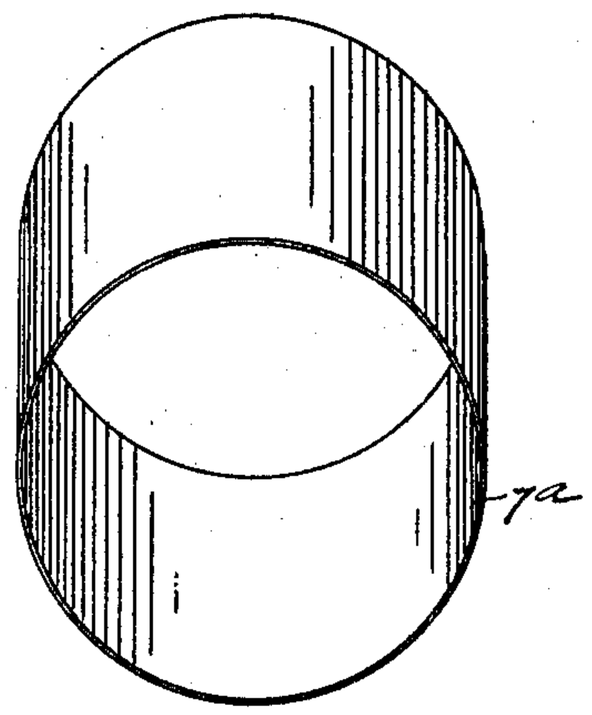


Fig. 7.

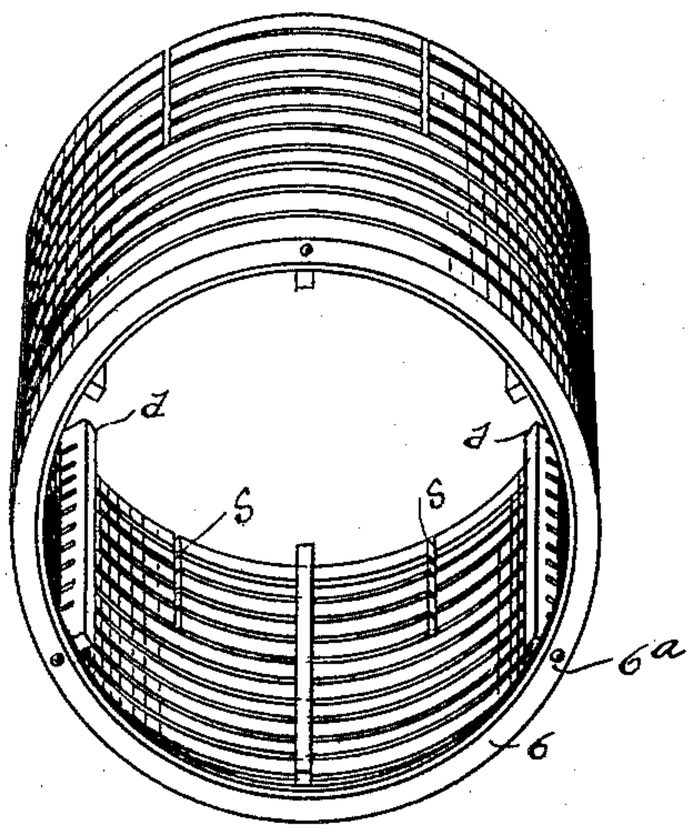


Fig. 4.

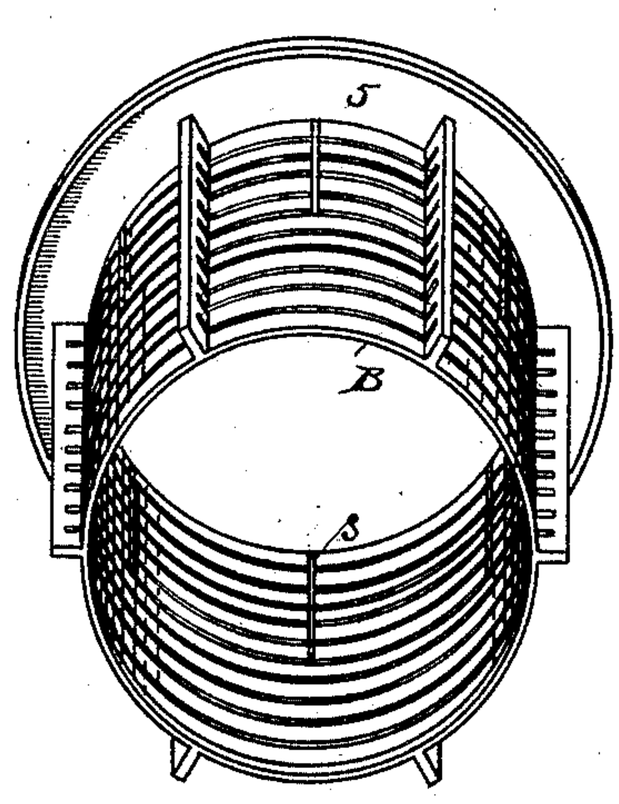


Fig. 5.

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# UNITED STATES PATENT OFFICE.

JOHN S. SHERMAN AND GEORGE H. HARMS, OF DETROIT, MICHIGAN.

## VAPOR-BURNER.

SPECIFICATION forming part of Letters Patent No. 695,889, dated March 18, 1902.

Application filed March 14, 1898. Serial No. 673,719. (No model.)

*To all whom it may concern:*

Be it known that we, JOHN S. SHERMAN and GEORGE H. HARMS, citizens of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Vapor-Burners; and we declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

This invention relates to hydrocarbon-burners of that class in which the hydrocarbon in liquid form is delivered into an open trough located at the bottom of and closing the chamber between vertical walls that are provided with air-inlets through the walls, the air-openings being of so small a size that the gas which rises from the trough is burned between the walls and the flame rises above the top of the confining-walls.

We have found from experience that in burners of this character the walls must be made of substantially uniform thickness, and the slits or holes through which the air is admitted must be smooth and regular and properly proportioned in size with reference to the thickness of the wall itself. If the slit or hole is too narrow in proportion to the thickness of the wall, not enough air is admitted and the gas is not thoroughly consumed. If the slit or hole is too large, other and different difficulties arise. If the walls are not of uniform thickness, there will be spots where the combustion is improper. At some places there may be an excess of air if the wall is thin, and at other places there may be a deficiency of air if the wall is thick. We have also found from experience that the ordinary perforated sheet metal will not produce good results, or if it does produce good results when the burner is new such perforated sheet metal very soon buckles and bends under the action of heat, changes the size of the opening between the walls at some places, and also somewhat changes the direction with which the air passes through the sheet metal, although this latter change is slight, owing to the thinness of the metal.

We have found that even cast-iron from the effects of constant heating and cooling expands and becomes permanently set, and one object of this invention is to provide a means to compensate for the permanent expansion due to the high temperature to which the burner is repeatedly subjected.

We have found that a properly-constructed burner of cast-iron will hold its shape very much longer and better than the sheet metal which is sometimes used, and we have in this invention shown and described a form of such cast-iron burner so constructed that the walls are of uniform thickness, and the openings cut therethrough are consequently of uniform capacity, so that a burner constructed in accordance with this invention produces extremely good results in the first instance and retains its capacity to produce good results for a long period of time.

In the drawings, Figure 1 shows our improved burner in perspective. Fig. 2 shows that one of the fire-walls which is outside. The view is in perspective as seen from a position below it. Fig. 3 shows the interior cone. Figs. 4 and 5 show the intermediate walls, and of these Fig. 4 shows the inner wall of the outside ring and Fig. 5 the outer fire-wall of the inside ring. Fig. 6 is a plan view of the double annular trough. Fig. 7 shows a band or ring sometimes used between the rings of Figs. 4 and 5. Fig. 4 is seen from the top and Figs. 3 and 5 are seen from the bottom.

The inner wall consists of the cylinder A of Fig. 3, the top of which is closed except for a central opening *a*. (Seen in Fig. 1.) On the interior of the cylinder are vertical ribs *d*, which hold the various segments together. This cylinder is cast with integral walls, and the slots *c* are sawed through the walls, thus producing a number of rings, which are held together by the uncut portion of the ribs *d*. Several of the upper rings of this cylinder and of each of the cylinders, Figs. 2, 4, and 5, are split into two or several segments, leaving between the ends of the segments a saw-kerf *s*, which will allow each ring or segment of ring to expand. We have found that it is not necessary to split all of the rings, but only those of the upper half of the fire-walls. The lower half is not subjected to so high a heat as the upper and is

not so injuriously affected by the heat. The same form of structure is used on the other fire-walls of the burner, each of which is originally cast as a cylinder, with ribs running lengthwise of the cylinder. The ribs of those cylinders which are to form the outer fire-wall of the ring are cast on the outside, and the ribs of those cylinders which are to form the inside or inner wall of the combustion-chamber are cast on the inside. Thus the wall A in the assembled burner rests on the flange 2 of Fig. 6, and the ribs which hold the rings of this wall together are on the inside of the cylinder and are never in actual contact with the burning gases.

The ring shown in Fig. 5 forms the outer wall of the inner combustion-chamber above the trough C, has the ribs on the outside of the cylinder, and at the top part of this cylinder there is a flange 5 projecting outward, it being broad enough to cover the air-opening $5^a$ between the troughs C and D. Preferably through this flange are air-holes T.

The cylinder 6 of Fig. 4 forms the inner fire-wall of the outer combustion-chamber, has its ribs *d* on the inside, and at the top has a narrow flange, upon which the flange 5 rests, spaced therefrom by small knobs $6^a$. The outer fire-wall 7 of the outer combustion-chamber has its ribs *e* on the outside and has at its top a projecting flange 8, and below the flange 8 close onto the ribs is riveted or otherwise secured a band 9, preferably of sheet-iron. No fire ever touches this, and it is at all times comparatively cool. Sheet-iron answers every purpose for this position.

The fire-walls which form the sides of the combustion-chambers get red-hot, especially the inner cylinder A, in which the proportion of metal for the exposure to cold air is large. This cylinder very soon after the burner is ignited becomes red-hot and remains red-hot so long as the fire is burning.

We sometimes place between the cylinders, Fig. 5 and Fig. 6, a sheet-iron ring $7^a$. This divides the air rising through the air-opening $5^a$ and produces a steadier flame.

By constructing the various fire-walls in the form indicated it is possible to make the walls of substantially uniform thickness and to cast them without special care, thereby making the original construction of them easy and reducing the loss in casting to a minimum. The subsequent work of finishing is reduced greatly, as uniformity in the size of the slits is produced in the wall of uniform thickness with an ordinary cutting-tool.

In assembling the various parts the cylinder A forms the inner wall and the cylinder B forms the outer wall of the annular combustion-chamber, which is located directly above the trough C. The air passes readily up through the opening within the trough C into the hollow of the cylinder A and through the slots *c* into the combustion-chamber. Some portion of the air also passes up through the opening *a* to furnish a secondary supply of air to the flame above the top of the burner.

Between the cylinder B and the cylinder 6 there is an air-space (or several air-spaces when the ring is used) over the opening $5^a$ covered by the flange 5, so that the air readily passes up through the space $5^a$ into the annular chamber between the cylinders B and 6 and passes through the slits into the combustion-chambers C and D, and a portion passes through the holes T to furnish a secondary supply of air above the burner.

The cylinder 7 rests over the outer wall of the trough D, and there are between it and the ring or wall 9 air-spaces, which are open at the bottom and which are covered by the flange 8, so that the rising current of air is drawn through the slots in the wall 7 into the combustion-chamber.

The double annular trough of Fig. 6 is fed with hydrocarbon through the pipe 19, which leads into the outer trough and from which the liquid hydrocarbon or vapor passes through the covered passage-way 10 into the trough C.

What we claim is—

1. In a hydrocarbon-burner, the combination of a plurality of distinct cylinders of cast metal, each of which is provided with longitudinal ribs and with circumferential slots which divide the cylinders into rings held together by said ribs, said slots extending into said ribs, the several cylinders being arranged to form combustion-chambers and air-chambers arranged alternately, and cover-plates above the tops of the air-chambers, substantially as described.

2. In a hydrocarbon-burner, the combination of annular, concentric combustion-chambers, an annular air-chamber between the combustion-chambers, and a dividing-ring located in the annular air-chamber, substantially as described.

3. In a hydrocarbon-burner, an outer cast cylinder provided with external longitudinal ribs and transverse slots dividing the cylinder into rings and which slots extend into said ribs, and an inner separate cast cylinder provided with internal longitudinal ribs, and transverse slots dividing the cylinder into rings and which slots extend into said ribs, said cylinders forming between them an annular combustion-chamber, substantially as described.

In testimony whereof we sign this specification in the presence of two witnesses.

JOHN S. SHERMAN.
GEORGE H. HARMS.

Witnesses:
CHARLES F. BURTON,
VIRGINIA M. CLOUGH.