(No Model.) 2 Sheets—Sheet 1.

# S. DANIELS.

## VAPOR BURNER.

No. 377,548. Patented Feb. 7, 1888.

Fig. 1.

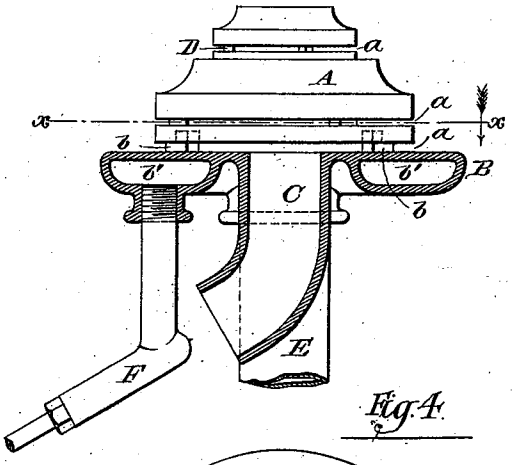



Fig. 2.

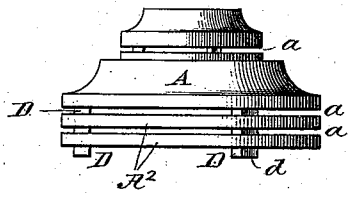



Fig. 3.

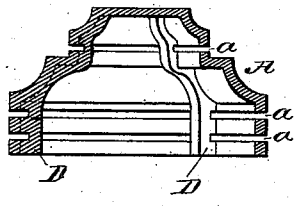



Fig. 4.

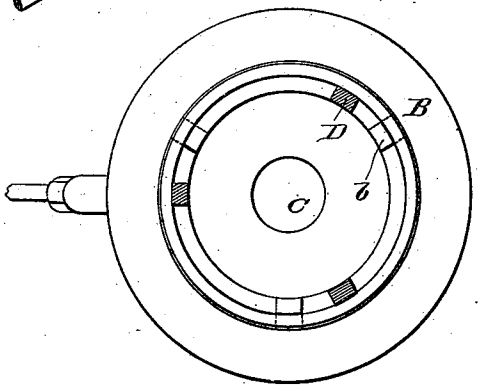



Fig. 6.

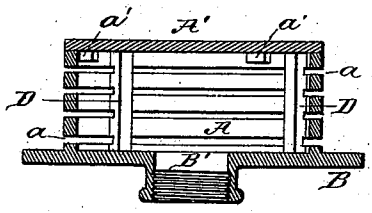



Fig. 5.

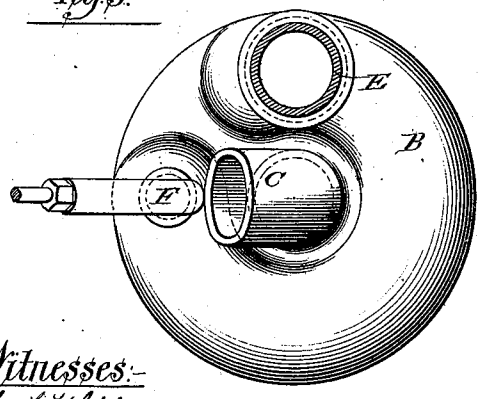
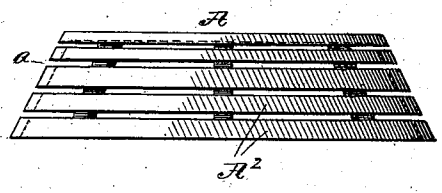



Fig. 7.




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N. PETERS. Photo-Lithographer, Washington, D. C.

(No Model.) 2 Sheets—Sheet 2.

# S. DANIELS.

## VAPOR BURNER.

No. 377,548. Patented Feb. 7, 1888.

Fig. 8.

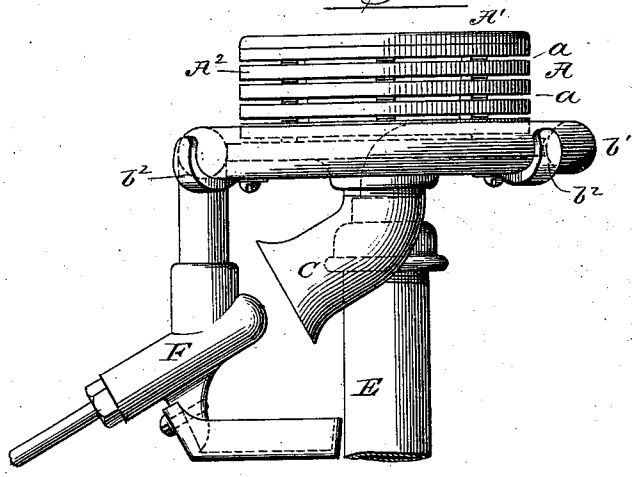
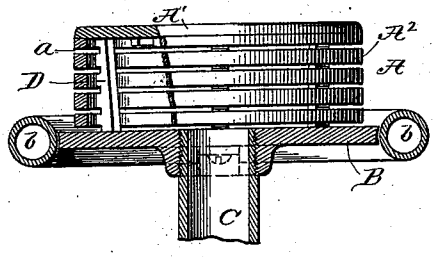



Fig. 9.




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# UNITED STATES PATENT OFFICE.

SAMUEL DANIELS, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO MELVILLE E. DAYTON, OF SAME PLACE.

## VAPOR-BURNER.

SPECIFICATION forming part of Letters Patent No. 377,548, dated February 7, 1888.

Application filed February 1, 1886. Serial No. 190,392. (No model.)

*To all whom it may concern:*

Be it known that I, SAMUEL DANIELS, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Vapor-Burners; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates, primarily, to the caps of burners for vapor-stoves, and more particularly to the construction of said caps with respect to their orifices, through which the vapor escapes to the flame.

Heretofore a certain class of vapor-burners have been provided with caps through which horizontal rows or series of small holes have been bored to emit a series of jets of vapor, which, upon being ignited exteriorly to the burner-cap, form a series of small radial jet-flames adjacent to each other, encircling the burner-cap. This form of cap is well known under the name of the "perforated cap." The numerous holes of such caps are drilled separately, which operation is consequently expensive. In order to lessen the labor of drilling, the cap has sometimes been cast of sufficient thickness to give interior softness to the metal, and then turned off on both outer and inner surfaces to leave the metal thin. This construction is also believed to give to the jets greater uniformity in length. In still other forms of caps or burners heretofore made a single horizontal slot has been provided, commonly formed between the margins of large separate disks. Slotted caps have also been made of separate rings cast with studs thereon, which support one ring from another, and a single broken slot has been formed in a cap by cutting short slots end to end or in the same plane and separated by parts of the cap left uncut between them, but without the advantage of interior ribs, either with respect to cheapness and accuracy in construction, to perfection of the flame obtained, or to capacity for practical use in vapor-stoves. So far as I am aware no practical burner of the last-mentioned description has been heretofore made at all.

This present invention remedies these defects by the provision in a cap of desirable diameter of a series of horizontal slots arranged parallel with and at suitable distances apart from each other for the escape of the vapor to the flame in a series of practically continuous sheets one above the other, and by the provision of a series of vertical ribs on the inner surface of the body of the cap or shell, whereby the latter may be cut entirely through its thickness for the entire distance around it, said ribs not only serving to hold the adjacent parts of the cap together, which would otherwise be entirely severed from each other by the continuous slots mentioned, but also by their position interior to the cap allowing the body of vapor, which is divided by said ribs, to come together again exterior to said ribs, and to thus form a practically continuous or unbroken annular flame at the line of ignition exterior to and embracing the entire circumference of the burner-cap.

In the accompanying drawings, Figure 1 is a side elevation of a slotted and interiorly-ribbed burner-cap constructed in accordance with my invention, said burner-cap being illustrated as resting upon a base-plate, shown in central vertical section, having a vapor-generating cavity therein, and provided with studs which uphold the cap and give an additional slot between the base-plate or other form of support and cap. Fig. 2 is a side elevation of a burner-cap having slots cut therein and interior ribs, as in Fig. 1, but having the ribs prolonged below the bottom of the cap to rest upon a base-plate, between which and the cap a slot will thus be afforded additional to those cut in the cap itself. Fig. 3 is a central vertical section of a slotted and interiorly-ribbed burner-cap. Fig. 4 is a horizontal section of the slotted and ribbed cap, taken through one of the slots, as, for example, through *x x* of Fig. 1. Fig. 5 is an under side view of the circularly-chambered base-plate of Fig. 1. Fig. 6 represents in vertical central section a ribbed and slotted burner-cap of cylindric form and with a flat removable top, the slots being cut in the cylindric portion of the cap and said cylindric portion being cast integral with a base-plate. Fig. 7 is a side elevation of a conical cap slotted in

accordance with my invention. Fig. 8 is a side view of a burner having the slotted and interiorly-ribbed cap cast integral with the base-plate and provided with a removable top plate, the base plate being encircled by a bent wrought-metal tube arranged in position to be impinged upon and heated by the lowermost of the annular flames. Fig. 9 is a central vertical section of the base-plate and an oblique vertical section of the cap, as shown in Fig. 8.

A represents a cap, and B a base-plate, on which the cap rests, said base-plate being provided with a central induction-tube, C, through which the vapor is injected, along with a suitable quantity of air, into the interior of the cap A. The horizontal slots in said cap are represented at *a a*, and through these slots the vapor and air escape and are ignited to form the flame outside of the cap.

D D are ribs which are cast on the interior surface of the cap in a generally vertical direction, and which serve to hold together the separate parts or rings $A^2$ $A^2$, into which the cap is cut by continuous slots *a a*.

In Figs. 1, 2, 3, 4, and 7 the cap is shown as separate from the base-plate and resting or adapted to rest thereon, while in Figs. 6, 8, and 9 it is shown as cast integral with said plate. In the former of these constructions the top plate of the cap is integral with the sides thereof; but in the latter it is shown separate and fitted closely upon the top of the slotted side walls. It is practicable in either case to make the sides of the cap integral with both the top plate and base-plate by use of a core in casting, because it is not essential to make the walls accurately of uniform thickness, as is desirably the case when perforations are to be drilled therein; but to save the trouble of coring I prefer to make the sides of the cap integral with the base-plate and to provide a separate top plate, as shown plainly in Figs. 6 and 9.

In my experiments with the slotted cap I have found that a slot substituted in place of each of the two rows of holes heretofore employed in the perforated cap, though really affording a larger outlet for vapor, does not give an equal capacity, and I have found that this defect may be remedied by providing a greater number of slots or by making the cap of larger diameter, as I have further found by experiment that it is not sufficient or practicable to this end to merely enlarge the diameter of the slots, because when enlarged beyond certain limits the vapor will ignite within the cap and produce a roaring noise, and will also operate with diminished efficiency. To retain the cap within reasonable and desirable dimensions for practical use on vapor-stoves, and at the same time to obtain the desired capacity, I prefer to make it somewhat larger than the said old perforated cap, and to also provide a greater number of slots.

In Fig. 1 there are three slots, *a*, two of which are cut through the body of the cap and one of which is produced by resting the cap on studs *b*. In this figure the studs are cast on the base-plate B. In Fig. 2 three slots are cut through the cap, and a fourth will be produced by the studs *d*, which are continuations of the ribs D. In Fig. 3 and the following figures all the slots are shown cut in the body of the cap, and the latter, if separate from the base-plate, rests thereon closely. The diameter of the slots is desirably not more than about three sixty-fourths of an inch for a burner under the customary pressure, and may be less with advantage.

The interior ribs, D, which are transverse to the slots *a a*, enable the slots to be made continuous, which is advantageous not only because economical in the use of a milling or turning tool to cut them, but also in that they allow the body of vapor which is divided thereby to converge within or adjacent to the slots after passing said ribs, so as to produce a practically continuous annular sheet of flame opposite each slot. This effect will be heightened if, as shown in the several sectional figures, the ribs are cut in beyond the inner surface of the cap, which is entirely practical in the use of a milling-tool. The whole number of slots which are cut in a cylindric or substantially cylindric cap or part of a cap may be simultaneously cut by a gang of milling-cutters mounted on a single shaft or spindle. When this slotted form of burner-cap is used with a chambered base-plate for the generation of vapor, I prefer to locate or extend the chamber wholly or in part outside the diameter of the cap, as shown in Fig. 1, wherein the chamber is cored in the base-plate, and in Figs. 8 and 9, wherein the chamber is formed of a separate wrought-metal tube encircling the base-plate wholly or in part. In that construction, wherein the base-plate and cap sides are cast in one piece and with a removable top plate, A′, the upper edge of the slotted portion or sides of the cap may be milled or turned off at the same time that the slots are cut. The top plate, A′, is provided with depending lugs *a′*, which set down within the slotted portion and hold the plate from lateral displacement.

An especial advantage of the construction in which the ribbed and slotted side wall of the cap is cast as a flange integral with the base or support, and in which the cap is made of iron suitable to be slotted conveniently by means of a milling or turning tool, is found in the fact that the narrow rings into which said flange is separated by the slots are less likely to be broken than when the cap is freely separable from the base-plate and is liable to be dropped.

With respect to the slotted cap it is to be observed that the slots form the final apertures through which the vapor emerges and just outside of which the vapor is ignited to form the flames, and that they thus directly determine the position, number, and extent of said flames. In this respect the burner here described differs from that set forth in the ap-

plication for patent filed by me June 8, 1885, Serial No. 167,973, in which an annular space is provided between two disks wholly exterior to a slotted cylinder.

I claim as my invention—

1. The combination, with a support having a passage for the fluid to be burned, of a burner-cap resting on said support and covering said passage, said cap having its sides provided with a series of parallel slots which divide the sides into parts, and ribs which connect the said parts of the sides together, substantially as described.

2. The combination, with a base provided with a passage for the fluid to be burned, of an annular rising ribbed flange cast integral with the base and surrounding the passage, said flange being provided with a series of continuous parallel slots, which cut the flange into rings connected with each other by the ribs, and a plate fitted to close the top of the chamber embraced by the flange, substantially as described.

3. A vapor-burner cap provided with a series of continuous slots and with interior ribs cast integral with the slotted portion of the cap and running transverse to the slots, substantially as described.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

SAMUEL DANIELS.

Witnesses:
M. E. DAYTON,
J. BENNETT WALLACE.