No. 633,518. Patented Sept. 19, 1899.

# O. KERN.

## GAS BURNER.

Application filed June 3, 1899.

(No Model.)

Fig. 3.

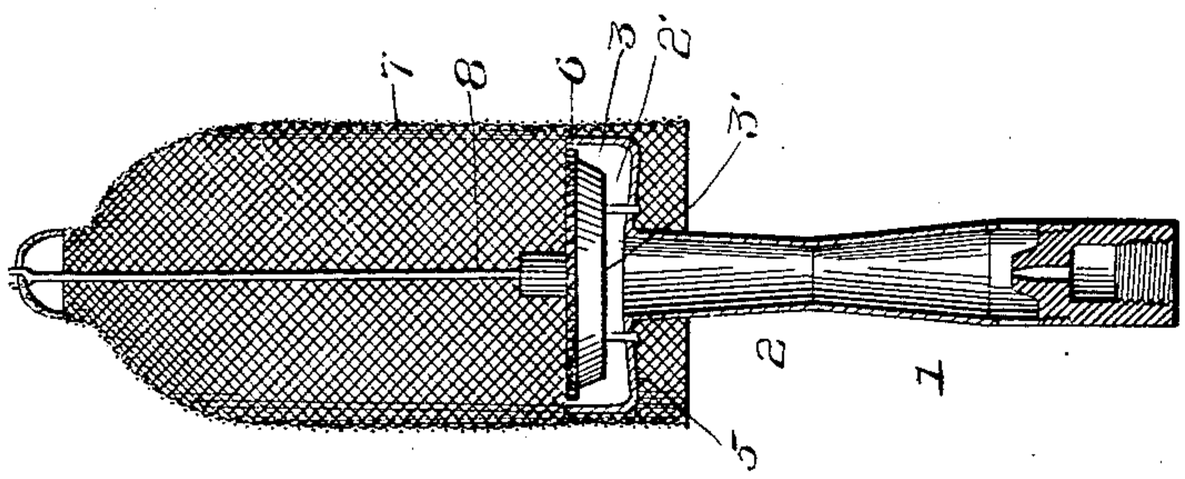



Fig. 2.

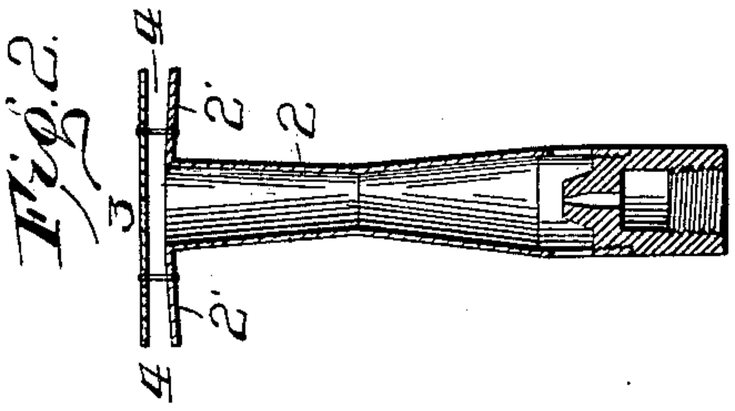
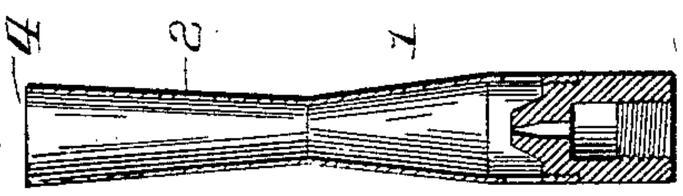



Fig. 1.

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# UNITED STATES PATENT OFFICE.

OTTMAR KERN, OF PARIS, FRANCE.

## GAS-BURNER.

SPECIFICATION forming part of Letters Patent No. 633,518, dated September 19, 1899.

Application filed June 3, 1899. Serial No. 719,235. (No model.)

*To all whom it may concern:*

Be it known that I, OTTMAR KERN, a citizen of the United States, and a resident of Paris, in the Republic of France, have invented certain new and useful Improvements in Gas-Burners, of which the following is a specification.

My invention has reference to improvements in incandescent gas-burners designed to produce self-burning mixtures of air and natural gas or other like mixtures in which the propagation of the flame is slower than the speed with which the mixture issues from the burner-tip under moderate or high pressure.

The present invention is an improvement upon the gas-burners shown and described in Letters Patent of the United States No. 574,805, granted to me on January 5, 1897, and No. 611,914, granted to me on October 4, 1898. In the said Letters Patent I have shown Bunsen burners so improved as to produce self-burning mixtures of air and gas, and I have there shown how such burners can be utilized for producing incandescent lights of the Clamond or Welsbach type. Since ordinary lighting-gas when mixed with air in such proportion as to produce a self-burning mixture is a quick-burning gas—that is to say, a gas in which the flame is propagated from point to point with great rapidity—I have shown in the said patents arrangements whereby the propagation of the flame downwardly into the modified Bunsen burner is prevented. This resulted in a complex burner composed of several parts that must be properly related to each other and whereby the burner as a whole becomes somewhat expensive. In addition thereto the burner as a whole became necessarily elongated.

I have found that when self-burning mixtures are made with air and natural gas the propagation of the flame downwardly into the improved Bunsen burner proper does not occur unless the pressure under which the gas issues is rather low. With moderate or higher pressures there is no downward propagation of the flame. This observation led to the present improvement, which consists in a simplification of the incandescent burner and in a shortening of the same without impairing its function of producing a self-inducing mixture.

In the accompanying drawings, which form a part of this specification, Figure 1 represents a longitudinal section of a Bunsen burner constructed to produce a self-burning mixture of air and gas in accordance with my aforesaid Letters Patent No. 574,805. Fig. 2 is a like section of such burner modified in accordance with my present invention, and Fig. 3 is a like section of my present improvement adapted for use in connection with refractory mantles of the Clamond or Welsbach types.

Like figures of reference indicate like parts throughout all the drawings.

Referring to Fig. 1, which represents the improved Bunsen burner of my Patent No. 574,805, its chief characteristic is the division of the same into two sections that have distinct functions. The lower section 1, which is called a "mixing-cone," has its length determined experimentally and has an angle of convergence that may vary between certain narrow limits. The upper portion 2, which is called the "suction-cone," should be made about twice as long as the mixing-cone, although it may be made somewhat shorter, and its angular divergence may also vary between certain narrow limits. As set forth in the said Patent No. 574,805, a Bunsen burner constructed with the observance of these rules furnishes a self-burning mixture of air and gas, which issues at the top with considerable speed. When such burner is used with ordinary artificial lighting-gas, the flame is propagated downwardly and cannot be used for incandescent lighting, and in order to avoid this difficulty I have shown in my aforesaid patent a superstructure by which the downward burning is prevented and by which the burner is made available for incandescent lighting. I have found, however, that when such burner is used with natural gas the flame does not propagate downwardly, and I ascribe this to the presence in the mixture of a considerable percentage of nitrogen and other inert gases, so that with natural gas the burner, as shown in Fig. 1, would maintain the flame at the top.

I have also found that the suction-cone can be replaced by any structure that provides a passage for the gas mixture that gradually widens in the same proportion as the successive cross-sectional areas of the suction-cone increase. In other words, it is not necessary that the suction-space have the form of a truncated cone or be vertical, but that it is sufficient that its successive sectional areas increase in accordance with the law of increase of areas in such a truncated cone as is shown in my Patent No. 574,805 or in such an hyperboloid as is shown in my Patent No. 611,914. These observations led to the present improvement, which is theoretically represented in Fig. 2.

The vertical length of the suction-cone 2 is here made considerably shorter than in the structure shown in Fig. 1, and it terminates in a flange 2′, the width of which is equal to that upper portion of the original suction-cone by which its vertical length has been reduced. Over this flange 2′ is supported in any suitable manner (not here indicated) a disk 3, whereby an annular space is defined between the flange 2′ and the said disk. The circumferential area of this annular space gradually increases outwardly in the same manner or in accordance with the same law in which the areas of the cross-sections of the suction-cone in Fig. 1 increase. The suction effect is by this change in no way modified, so that the gas mixture issues from the annular opening 4 in the construction shown in Fig. 2 with the same speed as it issues at the circular opening 4 in Fig. 1. In other words, the effect of the suction-cone is not impaired or in any way modified by the reduction of the vertical length of the same so long as the total length of the suction-space remains unchanged and its gradual increase of area also remains unchanged. Now in order that the gradual increase of area remain unchanged it is necessary in the construction shown in Fig. 2 to widen the successive circumferential areas of the annular space between the flange 2 and disk 3 from point to point in an outward direction, and this is accomplished by inclining the flange 2′ downwardly in a suitable manner, as shown in Fig. 2. The same object may of course be attained by making the flange 2′ horizontal and bending the corresponding portion of the disk 3 upwardly or in any other similar manner.

The rule to be observed is that the suction-space shall gradually increase in sectional area from the point where it joins the mixing-cone in the same manner or in accordance with the same law in which the successive sectional areas of a cone that has an angle of divergence of between five degrees and seven degrees gradually increase and that the total length of the suction-space be the same as the proper length of the suction-cone. If this rule is observed, the gas mixture will issue from the annular exit under otherwise like conditions with the same speed as it issues from the circular opening of the improved Bunsen burner shown in Fig. 1.

If, therefore, the mixing-cone 1 of Fig. 1 is combined with the improved suction device shown in Fig. 2, the Bunsen burner will furnish a self-burning mixture of air and natural gas that will burn at the annular exit and will not propagate the flame backwardly and downwardly. In this manner a burner is obtained which as a whole is considerably shorter than the burners shown in my aforesaid Letters Patent and yet furnishes an annular flame that is adapted for rendering incandescent the Welsbach and other like mantles of refractory earths and which can be efficiently used with natural gas without danger of backward propagation of the flame.

For practical use I have given to my improved burner the construction shown in Fig. 3. The Bunsen burner has here the mixing-cone 1 of my Patent No. 574,805 and the considerably-reduced suction-cone 2, which joins an annular supplemental suction-space formed by the cup 2′ and the block 3. The cup 2′ and block 3 are here the equivalents of the flange 2′ and disk 3 of Fig. 2, and are therefore marked by the same numerals.

In the drawings the bottom 5 of the cup is shown as sloping downwardly and outwardly, while the bottom 3′ of the block 3 is flat. By this construction the outwardly-succeeding annular areas of the suction-space are made to increase in the manner of a regular continuation of the reduced suction-cone 2. If so desired, the same result may be obtained by making the bottom of the cup flat and the bottom of the block curved.

The edge of the block 3 is made flaring upwardly, so that between the same and the upturned wall of cup 2′ there is an upwardly-contracting space or nozzle by which the speed of the gas is increased, as is the usual practice.

Upon the block 3 there is fixed a disk 6, serrated or toothed at its edge, and the gas mixture thus issues and burns at an annular opening that is bounded by the circular edge of cup 2′ and the toothed disk 6.

The mantle 7, of refractory earth, is slipped over the cup 2′ and supported upon a rod 8, of refractory material, rising from disk 6, or in any other suitable manner.

Having now fully described my invention, I claim and desire to secure by Letters Patent—

1. An incandescent gas-burner composed of a mixing-cone and a suction-cone of reduced length, terminating in an annular suction-space, formed with a gas-exit, the said annular suction-space having the same gradual increase of successive sectional areas as the suction-cone, substantially as described.

2. An incandescent gas-burner composed of a mixing-cone, a suction-cone, and an annular suction-space, the latter having successive sectional areas that increase in accordance with the same law as the successive

sectional areas of the suction-cone; whereby a self-burning mixture of air and gas is produced, substantially as described.

3. An incandescent gas-burner for producing a self-burning mixture of air and gas, consisting of an upwardly-converging hollow, truncated mixing-cone into which the air and gas are admitted; and a hollow upwardly-diverging truncated suction-cone communicating with an annular space whose successive sectional areas increase in accordance with the same law as the successive sectional areas of the cone with which it communicates, substantially as described.

4. An incandescent gas-burner composed of an upwardly-converging mixing-cone, an upwardly-diverging suction-cone of reduced length, and a suction-space gradually expanding in area in the same manner as the suction-cone, formed by a cup joined to the suction-cone and a suitably-shaped block concentrically supported within the cup, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

OTTMAR KERN.

Witnesses:
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T. M. APPLEGARTH.