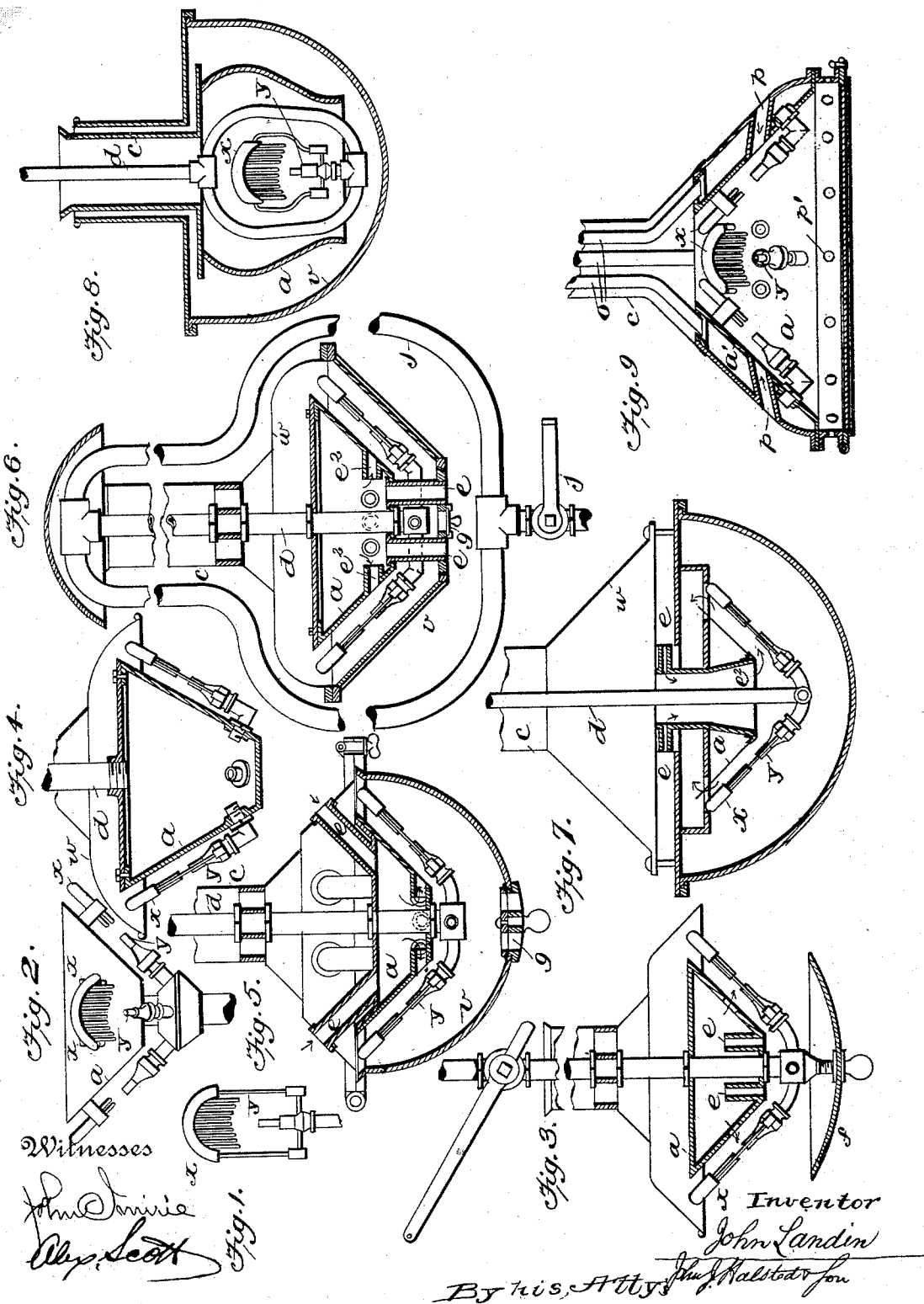


J. LANDIN.  
INCANDESCENT LIGHTING.

Patented Nov. 1, 1892.



# UNITED STATES PATENT OFFICE.

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## INCANDESCENT LIGHTING.

SPECIFICATION forming part of Letters Patent No. 485,281, dated November 1, 1892.

Application filed June 10, 1891. Renewed September 19, 1892. Serial No. 446,315. (No model.) Patented in Belgium December 31, 1890, No. 93,162; in England February 28, 1891, No. 7,335; in France March 17, 1891, No. 210,043; in Spain March 31, 1891, No. 11,572, and in Sweden April 30, 1891, No. 2,973.

*To all whom it may concern.*

Be it known that I, JOHN LANDIN, a subject of the King of Sweden, residing at Stockholm, Sweden, have invented certain new and useful Improvements in Incandescent Lighting by Means of Calefacient Gases and in Apparatus Therefor, (patented in Belgium, No. 93,162, dated December 31, 1890; in France, No. 210,043, dated March 17, 1891; in Great Britain, No. 7,335, dated February 28, 1891; in Spain, No. 11,572, dated March 31, 1891, and in Sweden, No. 2,973, dated April 30, 1891;) and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention relates to improved methods of applying the calorific power of calefacient gases burned by means of burners giving flat flames applied to refractory substances manufactured into small bars, rods, or needles and arranged in such a way that the small bars, rods, or needles may be effectively heated by means of the flames issuing from the burners.

The invention is primarily applicable to what is known as the "Fahnehjelm" system of incandescent lighting, but it may also be applied to other systems in which the illumination is due to the incandescence of refractory substances (metallic or otherwise) produced by the calorific power of calefacient gases burned by means of ordinary flat-flame burners, such as are generally called "fish-tail" or "bat-wing" burners, or by combinations of burners producing flat flames.

In the Fahnehjelm system as practically applied a number of small rods of a specially-refractory composition, arranged generally in two straight and parallel rows, are fixed by a suitable cement in a metallic socket, the aggregation of small rods, together with the socket, being termed a "comb." These combs are suspended at a suitable height above ordinary flat-flame burners—such as Bray's No. 3 union jet or slit burners—and rendered highly incandescent by the combustion of

what is called "water-gas." The combs have heretofore been used vertically, or nearly so, in which position they give an excellent illuminative effect in directions at right angles to their planes, but not equally in other directions in proportion to the absolute photometric power of the lights.

In the drawings, Figure 1 shows the combs held in small wire supports, as has heretofore been done. Fig. 2 illustrates my improved construction, in which such supports are dispensed with. Fig. 3 shows in vertical section a partially-regenerative suspension-lamp with four flanges and embodying my invention; Fig. 4, a simpler form of lamp in vertical section; Fig. 5, a vertical section of a fully-regenerative lamp embodying my invention. Fig. 6 shows how the air may be introduced through the lantern into tubes leading to a heated vessel, and thence by tubes to the burners. Fig. 7 illustrates in section a fully-regenerative lamp, in which both the air and gas are highly heated before their combustion. Fig. 8 represents a lamp having a single comb, and Fig. 9 a vertical section of one for four flames and with the combs inclined inwardly.

The first part of my invention consists (with a view to obtain a better downward and more equal illumination) in inclining the combs  $x$  and burners  $y$  to any required angle, as seen in Figs. 2, 3, 4, 5, 6, 7, and 9 of the accompanying drawings, and, furthermore, in insuring sufficient contact of the calefacient flame with the comb by placing a plane  $a$  of any sufficiently-refractory material, metallic or otherwise, preferably with a reflecting-surface, immediately above or behind the combs in such a way as to guide the calefacient flame in the direction of the axes of the refractory bars, rods, or needles forming the comb and to neutralize as far as possible any tendency of the calefacient flame to leave the comb through the action of upward currents of air. The planes  $a$ , placed above the burners and behind the combs, are called "guide reflecting-surfaces," because they serve the twofold purpose of guiding or directing the flames and of reflecting the light produced by the action of the flames on the refractory bars, rods, or

needles forming the combs. The guide reflecting-surfaces *a* should not be placed so near the comb as to come into actual contact with the flames, and it is recommended that they should not be placed at a greater distance from the comb than about one inch. In practice excellent results have been obtained with a space of three-eighths of an inch between the combs *x* and the guide reflecting-surfaces.

Single combs may be treated, as above described, for use as wall or bracket lamps or any number of combs, inclined either from or to each other to any desired angle, may be grouped together in proximity with guide reflecting-surfaces arranged so as to project the light in any desired direction. When a number of flames with the burners inclined outward are thus arranged in a circle, so as to give an equal illumination in all directions, the guide reflecting-surfaces *a* form an inclined polygonal vessel of some depth with a flat surface opposite each flame, or when the number of flames is considerable the inclined reflecting-vessel may be made circular. These reflecting-vessels may be of any diameter to suit the number of flames required; but when lamps of very great power are needed it is preferable to keep the diameter within certain limits and to arrange the reflecting surfaces or vessels and flames in tiers or rows one above the other.

In the Fahnehjelm system as practically applied the combs are supported in the proper position above the burners by the means of small metallic wire supports resting in sockets attached to the gas-brackets, as seen at Fig. 1 of the drawings, but in lamps of the construction herein described the wire supports may be dispensed with and the combs attached directly to the guide reflecting-surfaces by brackets, as at *b*, Fig. 2.

When an absolutely-downward illumination is required, the combs and burners with the guide reflecting-surfaces above them may be fixed horizontally or almost horizontally.

The invention further consists (with a view to obtain improved illuminative effect and economy in consumption of gas) in applying the principle of regeneration or recuperation to lamps of the types already described. This is accomplished by utilizing the sensible heat of the products of combustion or waste gases for heating the air or a portion of the air required for combustion, or for heating both the gases and the air, or for heating the combustible gas alone, according to the methods about to be explained.

Fig. 3 of the drawings illustrates in vertical section a suspension four-flamed lamp constructed in accordance with my invention and which is partially regenerative, the gas-inlet pipe *d* passing downward through the chimney *c* and through the reflecting-vessel *a*, the upper and lower parts of which are closed in such a way as to convert the inte-

rior into a practically-air-tight chamber somewhat resembling an inverted pyramid, and the gas is thus considerably heated before it reaches the burners *y*. Some of the air for supporting combustion may also be heated by conducting it through tubes *e*, which pass through the interior of the reflecting-vessel *a*. A hood *w*, somewhat larger than the upper part of the reflecting-vessel *a*, is placed above the lamp, the chimney *c* being connected to the said hood to conduct away the hot products of combustion. As the interior of the vessel *a* becomes highly heated after the lamp has been in operation for a short time, a considerable degree of heat is imparted to the air passing through the tubes *e*, with a correspondingly-beneficial effect on the illumination. A glass tray *f* is provided below the burners *y* to arrest any falling particles of magnesia. A still more simple form of lamp may, as seen in vertical section at Fig. 4, be constructed by merely connecting the closed reflecting-vessel *a* with the gas-supply pipe *d*. The reflecting-vessel then becomes a gas chamber or reservoir, from which the gas is led directly to the burners.

Fig. 5 illustrates in vertical section a fully-regenerative lamp constructed with a view to obtain the highest illuminative effect with the greatest economy in the consumption of gas, the flames being inclosed in a glass globe or lantern *v*, and the whole volume of hot waste gases caused to pass into the chimney *c*. The whole of the air to support combustion may be introduced above the globe or lantern through tubes *e* and led into the interior of the highly-heated reflecting-vessel *a*, and an auxiliary supply may also be introduced through a valve *g* in the bottom of the lantern; or, as seen at Fig. 6, the air may be introduced through the lantern into the tubes *e*, passing to the interior of the vessel *a*, and thence through tubes *e*<sup>2</sup> to the burners, in which case is also provided a valve *g* for the admission of an auxiliary supply of air when necessary. In either case the air, after being subjected to sufficient contact with heated surfaces, issues in proximity to the points of combustion of the several flames.

When the lamps are used with an ascending-gas supply, as in the case of street-lamps, the supply-pipe *j* may either be passed directly upward through the globe or lantern air-vessel to the chimney and then returned downward to the burners, or, as seen at Fig. 6, it may be bent or branched below the lamp and led into the upper part of the chimney from the outside.

Fig. 7 shows a section of another form of a fully-regenerative lamp, in which the air, as well as the gas, is highly heated before the combustion in the burner. The gas enters the pipe *d* and during its passage to the burners *y* is heated by means of the products of combustion ascending through the chimney *c*. The air enters the openings *e* and is also

heated during its passage through the channel down to the burners.

In Fig. 8 is shown a lamp for a single comb. The gas entering the pipe *d*, as also the air, which has to pass between the chimney *c* and the outer channel, and, further, between the small globe *a* and the outer globe *v* is here heated before reaching the burner *y*.

Fig. 9 is a vertical section of an arrangement of four-flamed lamp with combs *x*, inclined inward or toward each other, and in which the gas descends through pipes *o*, placed in the chimney *c* and communicating at their lower ends with an annular chamber *a'*, made in the reflecting-vessel *a*, and from whence the gas passes to the burners *y*, the air to support combustion being admitted through the pipes *p* or through orifices *p'* above the glass door or globe; or part of the air may be admitted through both sets of openings *p p'*.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is—

1. A flat-flame incandescent lamp having the burners and their respective combs arranged in the same plane and disposed above and behind said burners and combs, a closed vessel having its outer perimeter with a reflecting-surface and on a plane parallel with that of the burners and combs and said vessel containing within it a passage for the gas before it reaches the burner or burners, whereby said vessel may be subjected to the action of the heat of the burners and combs and the

gas within said vessel heated before it reaches the burners, all as set forth.

2. A flat-flame incandescent lamp having the burners and their respective combs arranged in the same plane and disposed above and behind said burners and combs, a closed vessel having its outer perimeter with a reflecting-surface and on a plane parallel with that of the burners and combs and said vessel containing within it passage-ways for the gas and air before the former reaches the burner or burners, whereby said vessel may be subjected to the action of the heat of the burners and combs and the gas and air within said vessel heated before they have reached the burners, all as set forth.

3. A flat-flame incandescent lamp having the burners and their respective combs arranged in the same plane and disposed above and behind said burners and combs, a closed vessel having its outer perimeter with a reflecting-surface and on a plane parallel with that of the burners and combs and said vessel containing within it passage-ways for the gas and air before the former reaches the burner or burners, and auxiliary air-tubes in which are valves leading to the burners, all as and for the purposes set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

JOHN LANDIN.

Witnesses:

AUT. GEORGIS,  
TH. WAWRINSKY.