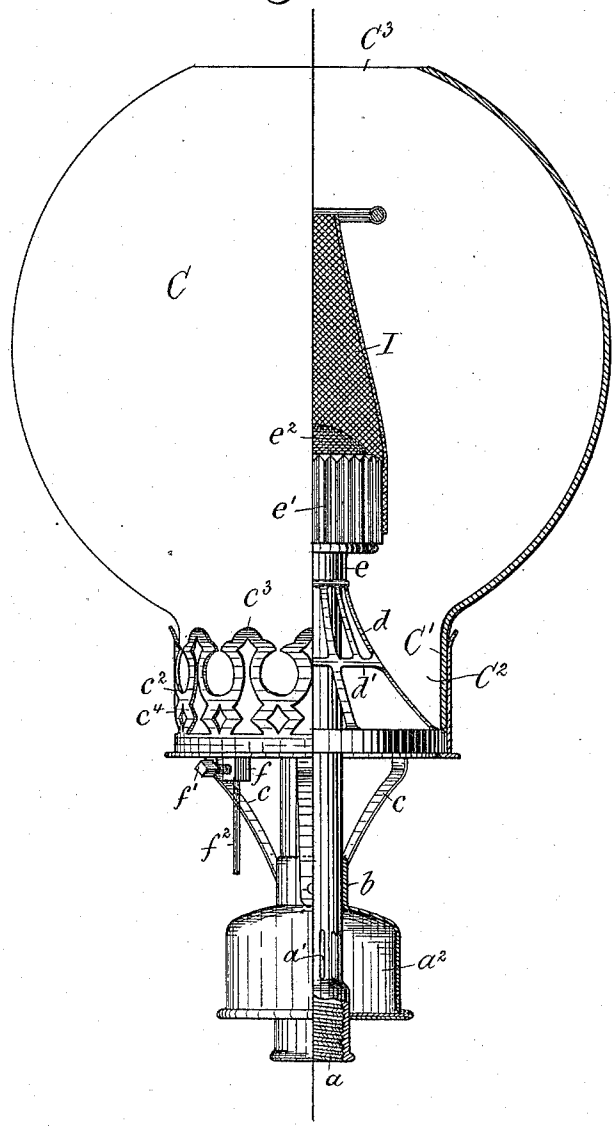
(No Model.) 2 Sheets—Sheet 1.

# W. E. BARROWS.

## SHADE OR GLOBE AND HOLDER FOR INCANDESCENT GAS BURNERS.

No. 537,433. Patented Apr. 16, 1895.

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

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## SHADE OR GLOBE AND HOLDER FOR INCANDESCENT GAS BURNERS.

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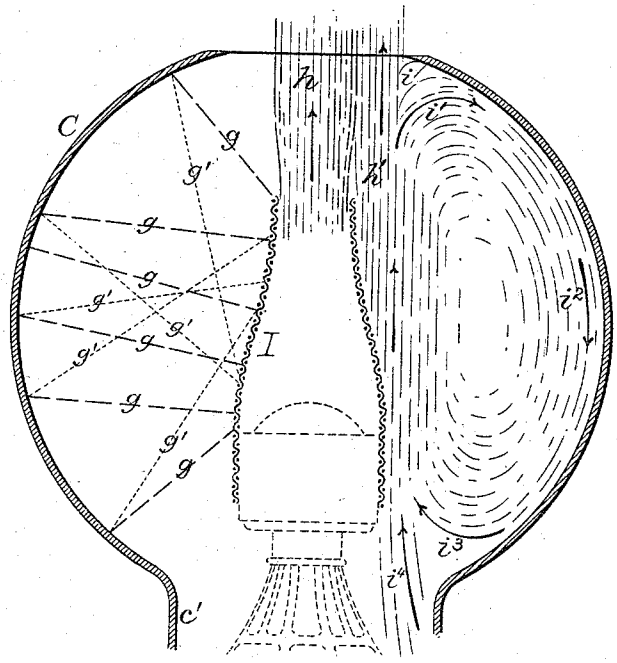
*Fig. 2.*

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# UNITED STATES PATENT OFFICE.

WILLIAM E. BARROWS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE WELSBACH LIGHT COMPANY, OF GLOUCESTER CITY, NEW JERSEY.

## SHADE OR GLOBE AND HOLDER FOR INCANDESCENT GAS-BURNERS.

SPECIFICATION forming part of Letters Patent No. 537,433, dated April 16, 1895.

Application filed June 30, 1890. Serial No. 357,172. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM ELIOT BARROWS, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Shades or Globes and Holders for Incandescent Gas-Burners, of which the following is a specification.

For indicating the status of my invention, as an improvement in incandescent gas lamps, I deem it proper to state, that so far as my knowledge extends, all incandescent gas lamps as heretofore organized, have included as a practically essential element, a true chimney, however varied as to form; also that with such chimneys, various kinds of globes or shades have been used, as in ordinary lighting apparatus.

It is well known that incandescent gas lamps, embody incandescing mantles, hoods, or films, which are exceedingly delicate; and also that very high heat is involved with a consequent excessive liability of breaking chimneys, with an almost inevitable destruction of the delicate mantles, as by falling fragments of glass.

In using chimneys of any form, whether straight, tapered, or having bulbous bases, sudden exposures to drafts of cold air, as on opening adjacent doors or windows, are very liable to cause the breakage of chimneys, and when this does not occur, said cold drafts cause highly objectionable fluctuations in the incandescence of the mantles or films, which not only result in the unsteadiness of the light afforded, but also imperil the mantle, which being very delicate, should when in actual service, be maintained at as nearly a uniform temperature as may be practicable, in avoidance of unnecessary expansion and contraction.

In the use of ordinary chimneys in any type of lamps, the upwardly rising columnar body of highly heated air, and products of combustion, is compactly maintained, and its air lifting capacity, or "draft," is of course proportioned to the height of the chimney; and hence the induction of air at its base, is proportioned in matter of volume, to the power of said draft. With an ordinary oil lamp, for instance, any steadily supplied excess of atmospheric oxygen, due to chimney draft, greater than is really needed, does not impair the illuminating capacity of the lamp; whereas any excess of air above that which will afford the requisite oxygen for securing perfect combustion of non-luminous gas, is a seriously adverse factor in an incandescent gas lamp, because such excess of air involves a reduction in temperature, which in turn involves a reduction of incandescence, with a consequent loss in the candle power of the lamp. In the burning of ordinary gas for illumination, the flame requires abundant oxygen, as from immediately adjacent space, and hence no excess of atmospheric oxygen need be guarded against, and in many instances a forced draft is needed, but in using non-luminous gases, oxygen is largely blended therewith before combustion, and hence the flame of an incandescent gas burner, actually requires comparatively little additional oxygen, for affording practically perfect combustion, and as already indicated an excess of supplied air should be carefully avoided, in an incandescent gas lamp.

With ordinary gas lighting burners, protecting media, as globes, or shades, of various kinds are required, not only for modifying or softening the light, but also with a view to preventing the undue flickering of the flame, which is incident to variable drafts of air; and said requirements are also involved in many oil burning chimney lamps, which demand a forced draft, for affording oxygen in great abundance, but whether said protecting globes or shades be employed as heretofore, with or without chimneys, they perform no valuable or useful duty, as reservoirs or conservers of heat at the lighting point, or flame, this being a matter of special value in an incandescent gas lamp, and of no material value in connection with the luminous flame of any lighting apparatus known to me; although in some cases, as in retort vapor lamps, heat from the flame is relied upon, for vaporizing the liquid fuel, and in some few instances, in gas burners, heat from the flame has been so applied, as

to heat the gas, prior to its exit for combustion.

An incandescent gas lamp embodying my invention, includes as an essential element in the organization, a globular, or spheroidal protector, which occupies such environing relations to the incandescing structure, whether of the Welsbach, Lungren, or other variety, that it is enabled to, and does cause substantially all of the reflex heat rays to be directed toward and upon the incandescent mantle; also, so that a practically quiescent body of highly heated air in considerable volume, will be constantly retained between the sides of the mantle, and the coincident inner surfaces of the protector, for serving as a heat governing factor, and thereby guarding against undue variations in the incandescence of the film or mantle, which would otherwise occur, and be due to sudden variations in the supply of cold air to the flame, as during the opening of adjacent doors and windows; also, so that portions of the retained and highly heated air will be continuously circulated in substantially vertical planes, between the mantle, and the vertically concave surface of the globe or protector; and hence near or below the base of the mantle, said circulating currents of heated air are caused to merge with incoming bodies of cold air, before the latter can fairly reach the mantle or film; also, so that the heat within the globular protector is distributed with such complete uniformity, as to reduce the liability of breakage to a minimum; also so that said protector will perform all that duty which a chimney ought to do, without any of the objections incident to the use of chimneys in this connection, and especially such bad results as are due to enforced drafts, and injury to the films or mantles, by falling fragments of glass, as when chimneys break.

To more particularly describe my invention, I will refer to the accompanying drawings, wherein—

Figure 1, in both side elevation and vertical central section, illustrates an incandescent gas lamp, embodying my invention. Fig. 2, illustrates the globe or spheroidal protector, and the incandescing mantle, in vertical central section, as if the lamp was in operation. At one side of said figure, are illustrated the direct, and reflex lines of heat radiation, and at the other side, the action, and the control of the body of air maintained within the protector.

In the drawings, Fig. 1, A, is a gas-burner of the type commonly known as a "Bunsen burner" and arranged for use in connection with natural gas, and although my invention will be described in connection with such a burner still it is applicable in whole or in part to other types of burners employed for incandescent gas lighting.

$a$, is an internally threaded cap formed at the base of the burner A, and adapted for attachment to a gas supply pipe.

$a'$, are air vents for supplying air to the interior of the burner.

$a^2$ is an air chamber provided with means, not shown, for permitting of the regulation of the quantity of air which is allowed to mix or mingle with the gas before the latter is burned.

$b$, is a cap or ring adapted to fit snugly over or around the gas burner or tube A. In the present instance this ring $b$, rests upon and is supported by the upper surface of the air chamber $a^2$.

$c$, are outwardly curved stays or rods attached at one extremity to a ring or cap $b$, and at the other extremity to a ring $c'$ provided with a ring or band of fret-work $c^2$, adapted for the reception of the globe or shade C. The respective frets $c^3$, of the ring $c^2$ are curved or bent inward at the point $c^4$, in order to press against the cylindrical depending neck or flange C', of the shade or globe and thereby retain the latter firmly in position.

$d$ is a spider ornamented with frets $d'$, and attached to the ring $c'$, and to a ring $e$, fitted over or around the burner or tube A.

$e'$ is a burner tip provided with a sieve $e^2$, and attached to or formed integral with the ring $e$, so that the burner tip $e'$, fits over the upper extremity of the gas burner A.

$f$ is a socket provided with a thumb-screw $f'$, and adapted for the reception of a rod $f^2$, for vertically adjusting and supporting a tubular mantle I adapted to become incandescent or other similar tubular device.

My globular protector as shown, is provided with a neck $c'$, (unlike any prior lamp globe known to me,) but it is to be understood that said protector is not, in this organization a mere globe, as when more or less similar structures are employed as heretofore, in ordinary lighting apparatus, as has been hereinbefore stated, and as will hereinafter be more fully indicated.

Although my said protector may be properly called a "globe," it can only serve as a "shade," when it is composed of porcelain, or of glass, either ground, colored, or translucent, but it will hereinafter be made obvious, that certain thermal and mechanical functions of the protector, do not specially depend upon either of said materials, although being a part of an illuminating apparatus, the protector should of course be more or less permeable to light or luminous rays.

The neck C', is a cylindrical flange depending from the globe or shade C, and adapted to engage with the frets $c^3$, of the ring $c^2$. However, the shade or globe C, may be attached to the holder in any other preferred manner.

$C^2$ is an aperture cut or otherwise formed in the shade or globe C, at the lower pole or base thereof and adapted to permit of a supply of air being admitted to the gas flame and to the appliance capable of readily assuming an incandescent condition.

$C^3$, is an aperture cut or otherwise formed in the shade or globe C, at the top or oppo-

site pole thereof and adapted to permit of the escape of a sufficient quantity of the products of combustion to insure the best illuminating effects, while at the same time sufficient heat is retained in the globe or shade to insure proper incandescence of the mantle or other appliance adapted to assume an incandescent state or condition.

In practice the lower aperture $C^2$, is usually made smaller than the upper aperture $C^3$, but their relative areas or sizes will depend upon the size and form of the lamp. The object is to not only supply a sufficient quantity of air thereto but also to secure the best illuminating effects.

In Fig. 1, the area of the base aperture of the globe, considered apart from its organization with the lamp, is shown to be larger than the top aperture. The base aperture being however occupied by the tubular portion of the burner, and otherwise obstructed by the spider within the neck, and by the underlying supporting arms of the globe holder, only a greatly reduced net area of opening is afforded, and although not imperative this net area as a rule is intentionally less than the area of the top aperture.

Now referring to Fig. 2, it will be seen, that the globular protector C, and the incandescing tubular mantle, are both shown upon the same scale, as in Fig. 1; and that the same relative proportions, and their arrangement with relation to each other, have been as closely adhered to, as was practicable. The left hand portion of this figure, is devoted to the illustration of the function and operation of the protector as a heat reflector, and the right hand portion thereof, to the illustration of its function and operation as a hot air reservoir, and also as a heat governor or controller of circulating currents of air; it being of course understood, that the illustration at either side, is equally applicable to the other side of the figure.

The several dash lines $g$, at the left hand side of Fig. 2, fairly indicate direct heat ray lines, projected from the incandescent mantle I, against the interior reflecting surface of the globe or protector. The several dotted lines $g'$, also fairly indicate the reflex or reflected lines of heat rays. It is to be understood, however, that although both of said grades of lines are in fact infinitesimal in number, and hence permeate the entire interior space as indicated, the illustrative selection of the few lines shown, will in substance embrace all of them, inasmuch as the extreme upper and lower lines are delineated, as well as some of those intervening. It will be readily seen that substantially all of the dotted line reflex rays $g'$, are directed toward and upon the mantle I; and also, that a high degree of heat must be maintained within the annular space between the mantle, and the interior surface of the protector. Now, as is well known, the mantles I of the Welsbach lamps, for instance, are delicate tubular films, and, generally, more or less open at their tops, and hence when the lamp is in operation, there must be a central column of hot products of combustion, indicated at $h$, constantly rising from the interior of the mantle, and having its direct exit through, and at the center of, the top aperture of the protector. It will also be apparent that there is, and must be, a tubular column of hot air and hot products of combustion, indicated at $h'$, rising from the outer wall of the mantle, and that this column, merging with the central column $h$, has its exit therewith, thus largely filling and occupying, and thereby partially and nearly throttling the exit aperture, as against the undue exit, of additional aeriform matter. The size or area of said exit aperture can only be measurably defined, by stating that it should be so proportioned to the diametrical dimensions of the mantle, and to the heating power of the burner, that while said combined hot product columns $h$ and $h'$, shall have free exit, a small additional annular space will be afforded around said columns, when the lamp is operating normally, so that the edge of the aperture may not become unduly heated, and also so as to secure that throttling effect, which will prevent the undue exit of such air, as is not actually required in the process of combustion. As to the area of the base aperture, it will be readily understood, that it need afford an entrance to but little more air than will be required for perfect combustion, it being obvious that less atmospheric oxygen will be required than in ordinary luminous gas lighting apparatus, because all non-luminous heating gases contain, or are liberally merged with, oxygen, prior to ignition. Any surplusage of air admitted at the base aperture, of course enlarges the column of combined hot products of combustion and air, passing to and through the exit aperture, which being thereby further throttled, causes a portion of the upwardly moving air to impinge against the interior upper overhanging surface of the protector, as at $i$, which serves as a deflector; and hence outwardly, downwardly, and inwardly moving currents of air are continuously induced, as fairly indicated, by the arrows, $i'$, at the top; $i^2$, at the side; and $i^3$, near the base. These continuously circulating currents, inclose of necessity, a central annular body of air, which, however much or little it may be in motion, is practically retained within the globular protector, notwithstanding the necessarily continuous, but moderate additions and subtractions, as by the entrance of fresh air, and the exit of that limited quantity, which was not required for combustion, and had escaped with the hot products of combustion. The body of air thus retained within the protector is maintained at a usefully high temperature, because it is permeated by the direct, and the reflex heat rays; and hence said body of air, serves and operates as a heat conserver, or reservoir, and as a heat governor, as follows:

First, the fresh cool air normally entering at the base, outside of the burner and mantle, is promptly merged with a portion of the circulating hot air; as fairly indicated at the hot air arrow $i^3$, and the cold air arrow $i^4$, and hence said entering bodies of cold air, cannot chill the mantle, and reduce its incandescence; secondly, a possible abnormal entrance of cold air, as during strong drafts in a room, is promptly met by the reserved body of hot air, and a free exchange of temperature occurs, said reserved body being very large in proportion to the normal entering body of cold air; thirdly, the exit aperture being already almost throttled, and the hot air being under more or less tension, it follows that no undue excess of cold air can readily enter at the base of the protector, and, fourthly, the maintenance of this body of highly heated air, in intimate environment of the incandescent mantle, is in itself materially conducive to a constant and uniform maintenance of luminous incandescence, and especially when supplemented by the described control and concentration of the reflex heat rays.

It will be obvious, that with this organization, and its mode of operation, and with these results, a maximum of light, with a minimum expenditure of fuel is reasonably indicated; also, that abrupt variations in incandescence are largely if not absolutely obviated; that this avoidance of sudden expansion and contraction, is conducive to the effective life of the mantle; also that the supply of atmospheric oxygen being dependent upon the discharging capacity of the throttled exit, as described, the mantle will not be liable to be raised to a destructive degree of incandescence, and self combustion; and also, that with the uniform distribution of heat, as described, within the protector, the liability of its breakage is reduced, because the maintained reservoir of heated air within, affords a prompt conduction through the glass for checking outside chilling effects, to which any outer portion of the globe may be exposed; and also, that in the event of breakage, there is but little liability of contact with the mantle, of falling fragments of glass.

Now considering my globular protector with respect of its performance of chimney duty, it is unlike any true chimney, whether the latter be employed as a part of an incandescent gas lamp, or as a part of an oil or gas Argand lamp; or as a part of an ordinary kerosene lamp; and whether said true chimneys be straight, or tapered, or have contracted throats, or have bulbous bases; in that my globular protector admits of no such forcibly driven compact columnar bodies of air adjacent to, and above the luminous element, as are inevitable, with organizations embodying true chimneys.

In considering my protectors with reference solely to mere shading duty, it will be obvious, that they are no more than any other shade, in any lighting apparatus. I know of no prior lighting apparatus of any kind embodying an open globe of any kind, which occupies such relations to a luminous element, (whether this be a luminous flame, or an incandescing structure,) that substantially all of the heat rays will be reflected to and upon the luminous element; and I know of no connection in which that concentration of heat would be of value, except in an incandescent gas lamp. Nor do I know of any prior lighting organization in which a globe, or similar structure, has been so combined with any form of luminous element, that it could effectively and usefully perform the described heat governing functions, of my globular, or spheroidal protector.

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

1. In an incandescent gas lamp, the combination substantially as hereinbefore described, of a suitable gas burner; an incandescing tubular mantle; and a spheroidal protector or globe, having apertures at its base and top, and having said top aperture, so far restricted in area, as to be but little greater than is necessary for the free exit of the column of hot products of combustion rising from the lighted burner and from the incandescent mantle, and the interior of the globe, affording concave reflecting surfaces, from which substantially all of the direct heat rays will be reflected toward and upon the mantle, and the upper inner surface of the globe, adjacent to the top aperture, serving when the lamp is in operation, as a downward deflector of portions of the air entering at the base, as and for the purposes specified.

2. The combination substantially as hereinbefore described, of a suitable gas burner; an incandescing tubular mantle in appropriate relation to said burner, and an inclosing globular protector, having at its top a restricted aperture for the passage of hot products of combustion, and having adjacent to said aperture, an interior surface operating as a downward deflector, whereby, with the lamp in operation, a body of highly heated air will be retained and circulated within the protector, for securing uniformity in the incandescence of the mantle, by guarding against the chilling effects of air admitted at the base of the protector.

In witness whereof I have hereunto set my signature in the presence of two subscribing witnesses.

WILLIAM E. BARROWS.

Witnesses:
C. A. CONKLE,
OTIS EGAN.