Gas Oil Burner for Feuerhand Storm Lantern

by Dr. phil. Detlef Bunk
Essen, Germany 2001

Introduction

The objective is to modify a well-known burner of a cold blast storm lantern in that manner to burn cheap Diesel/Gas Oil in a well known small cold blast lantern which principles are described by Bruno Nier, Beierfeld / Saxony, Germany (1926, 1935) based on the lantern physics of air ventilation described by John H. Irwin, Chicago, Illinois, and New York, U.S.A. (1869, 1870). Said lanterns MUST be fueled with burning liquids which temperature have to range between 55 degree Celsius (°C) and 100 °C to be ignited (flame point). Such a fuel is kerosene which is also called paraffin oil in Asian countries, or Petroleum (pétrole) in continental Europe. Kerosine and gas oil are complex mixtures of paraffin, cyclic paraffin, and aromatic hydro carbon oils. Both fuels differ in two characteristics relevant for use as burning liquids in lanterns.

	Flame point	Boiling temperature
Kerosene	55-56 °C	170-250°C
Diesel fuel/Gas Oil	57 °C	170-390°C

The improved burner shall be a multi-fuel wick burner for either kerosene or gas oil, or any mixture of both fuels. I guess I have re-discovered a basic principle of lantern construction. To explain this I must refer to the theory of combustion mechanisms within non-pressurized flames. One can roughly distinguish four zones of different chemical/physical processes:

1. Blue aura at base = Hydrogen oxidation,
2. Central transparent core = vaporizing hydro-carbon molecules,
3. White-yellow light emitting zone = glowing oxidizing carbon-radicals of oil molecules,
4. Darker amber-brown zone at the flame tip = condensing of non oxidizing carbon particles (microscopic soot).

The objective was to modify the air flow within the cone around the flame. The air flow is caused by the 'falling down' chilled air within the side tubes which was warmed up by the dome and chimney (Irwing 1868, 1870) at the upper intake of the tubes. The space between the burner plate and the cone-slit is the air supply for the flame. The proportion of air which ventilates near the inner surface of the cone is a) responsible for the flame shape, and b) supplies flame zone 3 with oxygen.

Method

I cut half round plates from 0.3 mm brass sheet metal and perforated them with 3 rows of holes 2 mm of diameter. Said sieves were mounted parallel sideways at each side to the upper end of the wick tube at an angle of about 30 degrees from the vertical. The sieves were formed in that manner that a sickle-shaped space was left between the rim of the sieve and the inner cone surface. Said sieves let pass enough air for combustion in zone 1 and enhance airflow to zone 3 to facilitate the oxidation of longer carbon radicals which result from the 'heavier' oils in Diesel fuel hydro-carbon oil mixture. This hypothesis is derived from several lantern patents and also refers to research on combustion mechanisms. The construction should work on the Feuerhand Storm Lantern Nr.276 and comparable constructions. A crucial condition is the wick used which 'controls' the fuel supply of the flame: I got best results when using a medium dense woven 1/2" wick with a weight of about 0.12 gram per cm which is between 0.09 gr./cm for loose woven wicks and 0.17 gr./cm for dense woven Feuerhand wicks. I found those medium dense woven wicks in lanterns of Asian production.
For the experiments were used Diesel-Fuel (Gas-Oil) according to Deutsche Industrie Norm DIN EN 590 and standard kerosene.

Results

Parameters were measured as mentioned in the description of Bruno Nier's US-patent #2004826 (Nier 1935):
Lantern: Feuerhand Nr.276, recent production 1999 Nier Stamping Works, Hohenlockstedt/Germany,
Cross section of air tubes: ~180 square mm
Fount capacity: 340 cubic centimeters
Room temperature: 21 degrees Celsius (°C)

Measured temperatures in °C:
- **Combustion gases** underneath the chimney roof:

Diesel 265 °C, Kerosene 308 °C (for comparison Feuerhand 6 ½ inch Storm Lantern Nr.75 'Atom' 376°C
- **Chimney surface** shortly above the globe:
Diesel 109 °C, Kerosene 115 °C (for comparison Feuerhand 6 ½ inch Storm Lantern Nr.75 'Atom' 133°C)
- **Pre-heated fresh air** at upper intake of side tube:
Diesel 72 °C, Kerosene 91 °C (for comparison Feuerhand 6 ½ inch Storm Lantern Nr.75 'Atom' 109°C)

Light output in candle (cd), measured with a standard passive photometer (not battery supported technology) through a blacked light-sealed tube 3.5 cm of diameter, 21.5 cm long (distance to photo cell), horizontally measured at the flame level at 3.5 cm distance from the flame:
Diesel ~5.5 cd, Kerosene ~6 cd => in 25 cm distance.
Height of the maximum flame before sooting (distance burner plate to flame tip):
3.5 cm both fuels, no flicker.
Estimated relation of flame combustion zones 3 / 4, height in cm:
Diesel appr. 2.0cm/1.0cm, Kerosene appr 2.5cm/0.5cm (**Figure 1**).

Figure 1: Flames of approximately 5 cd of Gas Oil (Diesel) fueled Storm Lanterns Feuerhand Nr.276 with modified 5''' burners, 13 mm flat wick, and burner plate sieves of different shape.

In summary, the burner is a multi-fuel wick burner for either kerosene or gas oil, or any mixture of both fuels. The burning time of the Diesel fueled model at maximum fount capacity approximately was 36 hours compared to 22 hours of the kerosene fueled model.
First experiments revealed that the Diesel flame can be whitened by speeding up the downward air ventilation within the tubes. The most surprising fact was that the Diesel-lantern produces significantly less odor than kerosene fueled model burning at the same flame height. I tested this twice at different days by lighting a Diesel-lantern in our living room two hours before my wife came home. She was significantly less upset of expected smell as for the case I used a kerosene fueled model. She even allowed me the Diesel to burn a little longer.

Summary/Conclusion

I believe that the first experiments and attempts were encouraging. The Diesel fueled flame with a modified burner produces less heat than a kerosene fueled flame with a well-known burner. The light output of the Diesel fueled flame is a little lesser than of a kerosene fueled flame, which can be recognized by comparing both flames through dark sun glasses.
Question for further research: How to speed up downward air ventilation within the tubes to enhance the oxygen supply of the flame?
The advantages of a Gas Oil fueled storm lantern are:
- The burner is a multi-fuel wick burner for either kerosene or gas oil, or any mixture of both fuels.
- Independence of kerosene supply lines, fuel available at each gas oil / Diesel station
- Low fuel cost, in Europe the price for Diesel fuel is significantly lower than that for kerosene or lamp oil
- Burns nearly odorless with a mild smell of a burning candle
- Burns ca. 25% longer because of higher caloric energy of gas oil compared to kerosene.

References

Irwing, J.H. (1869) Improvement in Lanterns. United States Patent Office No. 89770.

Irwing, J.H. (1870) Improvement in Lanterns. United States Patent Office No. 105083.

Nier, B. (1927) Lamp. United States Patent No. 1649178 (Deutsches Reichs-Patent,1926, Nr. 424458 'Sturmlaterne (Storm Lantern)').

Nier, B. (1935) Hurricane Lamp. United States Patent Office No.2004826 (Deutsches Reichs-Patent, 1933, Nr.461998 'Feuerhand Super Baby').

Appendix

Patents

UNITED STATES PATENT OFFICE.

J. H. IRWIN, OF CHICAGO, ILLINOIS.

IMPROVEMENT IN LANTERNS.

Specification forming part of Letters Patent No. 89,770, *dated May* 4, 1869.

To all whom it may concern:

Be it known that I, JOHN H. IRWIN, of Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Lanterns; and I do hereby declare and make known that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and the letters and figures marked thereon, which form part of this specification.

My said invention consists in a novel mode of constructing a lantern whereby the wind, instead of acting upon the flame in such a manner as to extinguish it, serves to support or sustain and prevent the extinguishment thereof.

To enable those skilled in the art to understand how to make and use my said invention, I will proceed to describe the construction and operation of the same, making reference in so doing to the aforesaid drawings, in which—

Figure 1 represents a vertical central section of my invention. Fig. 2 is a view of the under side of the flange marked 1 in Fig. 1, and Fig. 3 is a plan section taken at the line *x* in Fig. 1.

Similar letters of reference represent the same parts of my invention in the different figures.

A represents the oil-cup, which forms also the base of the lantern. There is no inclosure surrounding the same, and it is provided with a central tube, *a*, into which a removable burner is fitted, as shown.

B represents an annular plate arranged over the oil-cup, its edges turning down and uniting with the edge of the oil-cup, forming an air-chamber, B′, said plate B being provided with a short central tube, *b*, over which an annular flange upon the burner fits, as shown in the drawings.

It will be observed that the burner is provided with two flanges, D D′, the one fitting down upon the tube *b*, and the other fitting closely into the tube *a* of the oil-cup, said tubes sliding in the flanges simultaneously as the burner is secured.

A wick-tube, T, is arranged within the central flange of the burner D′, which communicates with the oil-pot, while perforations in the burner form a communication opening from the annular air-chamber B′ into the cone of the burner, as clearly indicated in Fig. 1.

Upon the top of the wick-tube is fixed a flange, *t*, which deflects the current of air passing into the burner, as hereinafter described, away from the root of the flame against the walls of the cone, by which the air is brought in contact with the flame at a short distance above the base of the flame, thus preventing the air-current from lifting the flame from the wick and extinguishing the light.

There is arranged upon the burner of the lantern a perforated plate or disk, E, of the same size as the bottom of the globe G, which may rest upon the same within a vertical rim, *e*, formed upon the circumference of said plate E, which thus admits the external air into the globe, through its perforations, freely and uniformly as desired.

Upon the top of the globe there is a metallic rim, *g*, sloping inward at the top, as shown, to which rim, and consequently to the globe, arms *d* are secured, whose upper ends are secured to an inverted saucer-like plate, I, which is thus held at a suitable distance above the top of the rim *g*, to allow the air and wind to pass freely in between the top of the globe and the said plate I.

The concave plate I is provided at its center with a flange, *h*, which fits closely upon a vertical tube, H, so as to slide up and down on said tube, to raise the globe G from the plate E when desired, said flange fitting to said tube closely, or being provided with a suitable spring or catch, to retain the globe at any required height, as may be desired.

At the top of the tube H two tubes, F F, are joined, which extend down, as shown, and open into the air-chamber B′, upon opposite sides of the same.

Instead of two tubes F, arranged diametrically opposite each other, any other suitable even number of tubes F may be employed; but said tubes must be arranged in pairs directly opposite each other, and be arranged symmetrically at equal distances from each other, so that the force of the air-current, striking the flame on one side, shall be exactly counteracted by an equal force upon the opposite side, and thus keep the flame in an upright position, and prevent the extinguishment thereof when the lantern is swung or oscillated.

When the lantern is at rest and not blown upon by the wind, the air, heated by the flame at the burner, rises in the globe and passes into the tubes H and F F. These tubes present a large radiating-surface, and the heated air is thereby rapidly deprived of its caloric, so that the slight upward pressure of hot air in the tube H will be sufficient to insure a downward current of cooled air through the vertical portions of the tubes F F into the air-chamber B′ and interior of the burner-cone C to supply the flame with oxygen. Fresh air, in the meantime, passing up through the perforated plate E into the globe, tends to keep the glass cool, and mingles with the current from the tubes F F.

When the lantern is exposed to the wind the blast is distributed by passing through the perforated plate below; and, from the peculiar arrangement of the plate I over the globe, the wind passing into the space between the rim or flange *g* and said plate I is deflected upward into the tube H, where it mingles with the air heated within the globe, and so passes down the tubes F to supply the flame, while the flange *t* upon the wick-tube prevents the force of the blast from extinguishing it.

By making the rim *g* with its upper portion inclined inward, as shown, any current of air, entering between the plate I and rim *g*, would thereby be deflected upward toward the mouth of the tube H, and this deflection of a moving current of air would produce a current through the tubes F F in the absence of any other cause. Also, when the lantern is swung from side to side, or oscillated, the centrifugal tendency of the air in the tubes causes the air to rush into the mouth of the tube H from without, thus producing the required current at the burner.

From the above description it appears that there are three separate causes to produce a proper current through the tubes F F to the base of the flame, viz: the ascensive force of the air heated by the burner-flame, and the cooling of said heated air within the tubes; the pressure of a moving current deflected toward the mouth of the tube H; and the centrifugal effect of swinging or oscillating the lantern. And it will be observed that either the second or third causes will always be cumulative with the first, to produce an increased current at exactly the time when an increased supply is demanded in consequence of atmospheric disturbances in the immediate vicinity of the lantern.

Movable rings may be placed upon the tubes, where only two tubes are employed, or even if more tubes are used, to serve as a guard for the globe.

Having described the construction and operation of my improvement, I will specify what I claim and desire to secure by Letters Patent:

1. The combination of the concave plate I, rim *g*, or its equivalent, tubes H and F F, and the base A B of the lantern, substantially in the manner specified and shown.

2. The combination of the globe G, concave plate I, tubes H and F, and base A B of the lantern, arranged and operating substantially as and for the purpose shown and set forth.

3. The combination of the plate I, tubes F, flange *t* upon the top of the wick-tube, and the globe G, arranged to operate as set forth.

4. The combination of the perforated plate E, plate I, tubes H F, and the base A B of the lantern, arranged to operate as described, and for the purpose set forth.

J. H. IRWIN.

Witnesses:
W. E. MARRS,
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J. H. IRWIN.

Lantern.

No. 89,770. Patented May 4, 1869.

Fig. 1.

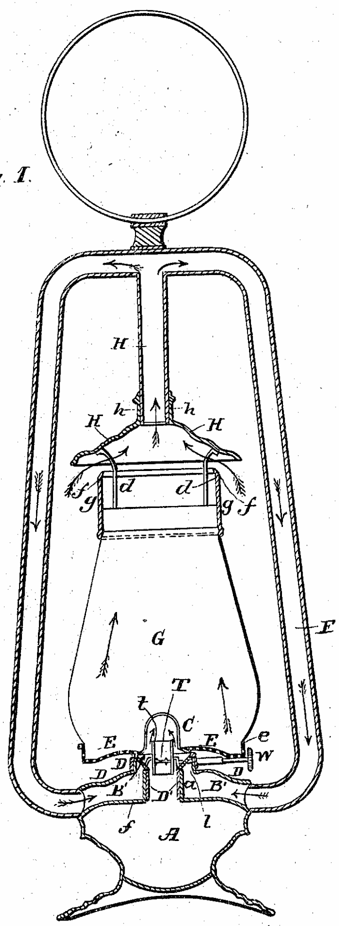


Fig. 2.

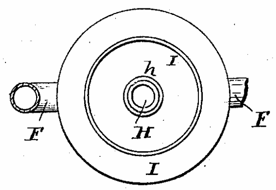
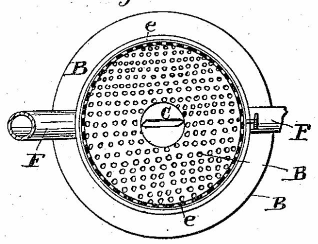


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN H. IRWIN, OF NEW YORK, N. Y.

IMPROVEMENT IN LANTERNS.

Specification forming part of Letters Patent No. **105,083**, dated July 5, 1870.

To all whom it may concern:

Be it known that I, JOHN H. IRWIN, of New York, in the county of New York and State of New York, have invented a new and useful Improvement in Lamps and Lanterns; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawing, in which the figure represents my invention in sectional elevation.

This invention relates to an improvement in illuminating apparatus heretofore invented and patented by me, wherein the atmospheric air to support combustion is conducted by feeding-tubes from a point near the outlet of the chimney to the air-space beneath the burner-cone, and the effect of external atmospheric disturbances upon the flame is thereby neutralized, in the manner heretofore explained in the letters issued to me; and it consists in the arrangement of an annular chamber surrounding the chimney, and connecting with the air-feeding tubes, through which a current of air is induced by means of heat, and it is more particularly designed for use in a comparatively calm atmosphere, as for illumination indoors.

That others may fully understand the construction and effect of my invention, I will particularly describe it.

A is the oil-pot, and B is the burner-cone. Above the oil-pot, and communicating with the interior of the cone B, is an air chamber or space, through which the air passes to the burner-flame. Above the burner, and surrounding it, is a globe or chimney, C, the lower part of which is made of some transparent or translucent material, as is usual, and the upper continuation of which may be a metallic flue, D, which is surmounted by a cap-plate, E, and its orifice surrounded by a deflecting plate or flange, F, the purpose of which is to impart a slightly-upward deflection to a current of air moving across the open top of the chimney or flue D. An annular chamber, G, in form and length corresponding to the chimney D, is formed by the jacket H. The chamber G is open at the bottom, but closed at its top, and its bottom portion is made flaring outward, not only to conform to the shape of the chimney, but to present a more extended opening to admit an inflowing current of air. The feeding-tubes I I communicate with the upper end of the chamber G, and connect it with the air-space beneath the burner-cone B, so that all the air which passes upward through the flame-opening in said cone enters through the tubes I I and chamber G. The chimney D is heated by the hot products of combustion ascending from the burner-flame, and a large portion of said heat is imparted to the air within the chamber G. The air within said chamber, becoming thereby rarefied, ascends and flows off laterally through the tubes I I, where it loses a portion of its heat, and is conducted to the air-chamber beneath the cone B.

It will be readily perceived that the currents of air moving through the tubes or feeders I when the lamp is at rest are impelled by two independent forces—first, by the ascending current of hot products of combustion within the chimney C D, and, second, by the ascensive force of a column of air rarefied within the chamber G. Thus, while the ascending hot air within the chimney D would draw a current of cold air through the tubes I, the rarefied air within the chamber G would also force a similar current through said tubes, and the supply of air to the flame is much more abundant than would be effected by either of these forces alone.

Having described my invention, what I claim as new is—

A heating-chamber, G, formed by the chimney D and jacket H, or its equivalent, in combination with the feeding tube or tubes I I, to conduct fresh air to the burner B, substantially as and for the purpose set forth.

J. H. IRWIN.

Witnesses:

THOS. RICART,
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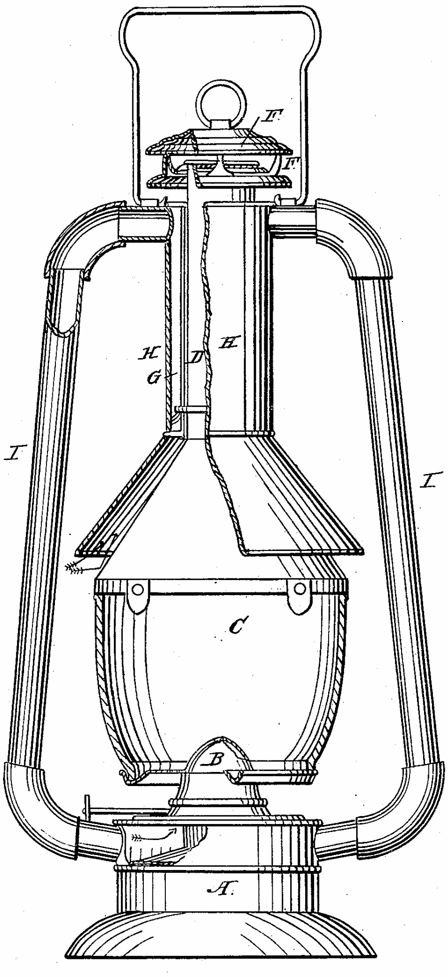
J. H. IRWIN.

Lantern.

No. 105,083. Patented July 5, 1870.



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Patented June 11, 1935

2,004,826

UNITED STATES PATENT OFFICE

2,004,826

HURRICANE LANTERN

Bruno Nier, Beierfeld, Germany

Application May 6, 1933, Serial No. 669,776
In Germany May 7, 1932

7 Claims. (Cl. 240—27)

Of the hurricane lanterns most widely employed, those with a fresh air supply have a luminous intensity of about 6 Hefner candle power. To produce this lighting power seven-line burners are used. These burners are lodged in lanterns of a certain size, and taking into consideration the entire space between the sieve-plate which carries the lamp chimney and the outlet for the combustion gases at the top of the lantern chimney, for the smallest lantern on sale nowadays and satisfying the requirements in question there is an air chamber of 870 cubic centimeters, that is to say, an air space of 145 cubic centimeters per Hefner candle, when the calculation is based on the generally observed luminous intensity of 6 Hefner candles. The total size of the lantern corresponds with this air space. Upon this depends the quantity of raw materials to be employed for the manufacture as well as the amount of expenditure upon wages and the like.

The quality of a hurricane lantern, however, is determined not only by a certain luminous intensity and by the cost of the manufacture and the selling price, but also by whether it burns without odor or not. It may be observed that a lantern of the construction hitherto usual, after burning for some time, evolves an obnoxious smell, a phenomenon which is to be attributed to the fact that these lanterns do not entirely consume the petroleum supplied by the wick.

The object of this invention is to obtain about the same normal luminous intensity as hitherto with a lantern which requires, for the production of 1 Hefner candle unit, an air space of not more than 120 cubic centimeters and which, on account of the complete combustion attained by it of all the substances contained in the petroleum, burns without odor.

The invention is illustrated by way of example in the accompanying drawings, in which:

Fig. 1 shows an elevation view of the lantern;

Fig. 2 shows a similar view of the burner hood thereof;

Fig. 3 is a similar view of the burner;

Fig. 4 shows a side view of the burner in a modified constructional form, partly in section;

Fig. 5 shows a plan of air-supplying means especially provided for this form of construction;

Figs. 6 and 7 show another somewhat modified form of construction of the burner in two sectional elevations at right angles to one another;

Fig. 8 shows a further constructional form of the burner in sectional elevation;

Fig. 9 shows a sectional elevation of this form taken at right angles to Fig. 8;

Fig. 10 shows in sectional elevation a modified form of the burner shown in Fig. 8;

Fig. 11 is a sectional elevation of this form taken at right angles to Fig. 10;

Fig. 12 shows a further form of construction in sectional elevation;

Fig. 13 shows yet another modified form of construction in sectional elevation;

Fig. 14 shows a section of this constructional form taken at right angles to Fig. 13;

Fig. 15 is a vertical sectional view of Fig. 1, showing the passages for air and for the products of combustion, and

Fig. 16 is a cross-sectional view of Fig. 15 on lines 16—16.

The lantern is built in the usual way. Fig. 1 shows a lantern using a 5-line burner only. An important feature, however, is that the lantern top 1 is about 15% less distant from the burner hood 2 than in the usual lanterns of the smaller size, having the normal luminous intensity of about 6 Hefner candle power.

A total air space of 420 cubic centimeters is created in the relatively small interior between the sieve plate 3 and the exit openings 7 of the chimney so that there is a space of only about 70 cubic centimeters per Hefner candle. The flame is thereby brought nearer to the lantern head which has become smaller, and this lantern head becomes more highly heated than with the known constructions even in the case of the smallest hurricane lanterns on the market. The increase of temperature compared with known lanterns here amounts to about 100° C. at the upper smoke-bell cover, and to about 10° C. at the junction of the air supply tubes 6 with the chimney top, so that at these places temperatures of 375 and 80 degrees, respectively, are obtained instead of 275 and 70 degrees, at outside temperatures of about 18 to 20 degrees. By this greater heating the air circulation is considerably increased, the masses of air inside the lantern chimney receiving considerably increased buoyancy. This upward urge brings about a quick flow of fresh air through the lower sieve plate 3 of the lantern, as well as a quick influx of fresh air into the lateral air-tube apertures. By these means an accelerated speed of circulation of the masses of air moved by the greater heating is caused, this air being noticeably preheated.

This preheated air which is conducted into the air chamber 5 situated underneath the burner hood 2 together with the increased air supply through the sieve 3 causes such a considerably greater intensity of combustion that with the small lantern the same candle power is obtained as with the usual combustion spaces which are about twice as large, the better combustion being evidenced by an entire absence of odor. The air supply tubes 6 must, of course, be of such a large cross-section that the air necessary for the intensive combustion may be able to pass through in an unobstructed manner.

Experiments have proved that a cross-sectional area of less than 100 square millimeters for the air tubes does not allow sufficient air to pass through, the best results being obtained with a cross-section of about 180 square millimeters. This upper limit need not be so strictly adhered to, since cross sections of 280 square millimeters still give serviceable results.

The success of this lantern structure arises from a proper proportioning as regards volumes of the two air spaces under consideration, namely the air space below the burner and below the burner hood and the air space above the burner hood, these two spaces being separated from one another by the burner hood itself and communicating with one another by way of the slot in the burner hood.

A hurricane lantern of the kind which is described burns steadily and without smoke in temperature zones, at atmospheric temperatures up to approximately 25° C., but is liable to smoke like other known lanterns if the surrounding temperature is appreciably above 25 degrees. It has now been found that this undesirable phenomenon can be caused to disappear if provision is made for an ample removal of the heat of combustion arising just at the end of the wick sheath as a result of the burning of the lantern. The means hereinafter described for removing this heat are also applicable to lanterns of ordinary dimensions, in which case they enable the candle power of such lanterns to be increased by increasing the air supply from underneath through the sieve plate 3, without rendering the flame liable to deposit soot as soon as any movement of the external air occurs, or even to become extinguished in the event of gusts of wind impinging upon the lighted lantern.

In the form of construction illustrated in Figs. 4 and 5, 11 is the head or hood of the burner which has an under portion generally designated by 12, fitted about the open top of the oil container 14, the upper part of which container constitutes a burner chamber 18.

The under member 12 of the burner has a perforated plate 15 which carries the burner hood 11. With the plate 15 is operatively associated an inner perforated plate 16. Fixed to the plate 16 about the perforations therein are a circular series of air conducting tubes 17, the upper edges of which engage in the perforations of the plate 15, so that the tubes in effect extend downwardly from 15 and are spaced relatively to each other as at 19. By the perforated internal plate 16 the admission of air to the burner hood is rendered possible. From the burner chamber 18 the air passes through the tubes 17 into the burner hood. Through the spaces 19 between the individual passages 17 air can also enter and cool the wick sieve in the zone 20 and at the same time cool the cover plate 21. Furthermore the passages 17 are hereby air cooled and the air supplied to the burner hood is thereby cooled simultaneously with the cooling of the under part of the burner at 20 and 21. The wick sheath is denoted by 25, the frame plate connected therewith by 26, and the perforated cover sieve by 24. It is to be noted that the plate 16 is formed with a central depression 13, the bottom of which is apertured to receive the wick sheath 25, the latter being in beaded engagement therewith.

The heat of combustion arising at the top of the wick sheath owing to the burning of the lantern can be rapidly removed by making the wick sheath or other constituent parts of the burner connected therewith of a material that conducts heat appreciably better than brass or sheet iron or tin plate, which have hitherto been used for this purpose. The first material that suggests itself for this purpose is copper. The parts that should be made of copper and like good conductors of heat for this purpose are shown in Fig. 6, namely the wick sheath 25, the flame plate 26, the perforated cover plate 21, the perforated cover sieve 24, the under portion 12 of the burner and also if desired the wick actuating means 27. One or another of these parts or several of them as required may be made of the better conducting material. Experiments have shown that it is especially important to make these parts of copper which are in direct contact with the wick sheath 25, or, of course, as already stated the wick sheath itself.

Alternatively separate metal strips may be inserted in the burner to conduct the heat away, either entirely in the interior of the burner, or better still, in such a way that they terminate outside the burner, and thus conduct the heat away from the under portion of the burner when it becomes hot. Thus, in Fig. 7 special supplementary copper strips 22 are connected with the wick sheath, one strip 23 being completely inside the burner, and the other strip 22 terminating outside the burner.

According to the invention, as has already been emphasized either the wick sheath 25 or the cover plate 21 or the perforated cover sieve 24 or else the under part 12 of the burner or finally the wick actuating means 27 may be made of copper. Any one of these parts if made of a material of sufficient thermal conductivity, especially copper, is adapted to enable the known burners hitherto employed to be satisfactorily used even at high external temperatures. The effect is particularly good if all the parts of the under member 12 of the burner which guides the wick are made of copper. It may, however, be emphasized that it is quite sufficient if one or another of these parts, preferably the wick sheath, is made of copper. A particularly satisfactory arrangement is to make the under part 12, the cover sieve 24, the flame plate 26 and the cover plate 21 of tinned sheet iron (tin-plate) and to make the wick sheath 25 of copper.

Instead of copper, copper alloys that are rich in copper such as pinchbeck and the like, or aluminum, may be employed. The decisive factor is primarily only the thermal conductivity, which must be so great that the heat evolved at the wick sheath when the lantern is burning is conducted away so quickly that there is no formation of smoke at the flame.

Another method of removing the heat of combustion arising at the top of the wick sheath is by directing an energetic current of air towards this point. Means for effecting this are illustrated in Figs. 8 to 12. In these and the succeeding figures the wick sheath is denoted by 31. In Figs. 8 and 9 the upper part of the wick sheath is surrounded by a jacket 32. This jacket is mounted with its lower edge upon the cover sieve 33. Between the upper edge 34 of the wick sheath 31 and the member 32 there is an aperture or gap 35, and between the member 32 and the wick sheath 31 there is an intervening space 36 which acts like a chimney and occasions a very energetic movement of air thereby producing a cooling effect.

In the form of construction illustrated in Figs. 10 and 11 the member 37 corresponding to the member 32 of Figs. 8 and 9 is somewhat bent or curved. Here again, however, the outer body 37 does not come close to the upper edge of the wick sheath but leaves a gap 35 between them, and the jacket 32 leaves an intervening space 36 between the two members, and this space again acts as a chimney.

In the constructional form illustrated in Fig. 12 the outer body or jacket 38 is not secured upon the cover sieve 33 but is directly fitted to the wick sheath by an especially perforated part 39.

As already stated there is a considerable cooling of the wick sheath in the constructional forms illustrated in Figs. 8 to 12, particularly at the upper edge thereof. Owing to the fact that part of the air ascending from the lower part of the burner through the cover sieve 33 traverses the space 36 while the remainder of it passes directly into the burner hood 40. The space 36 thus acts like a chimney and the burners made in this way are reliable in operation at all practicable external temperatures.

In many cases, however, it is sufficient if the cooling is brought about by an arrangement such as that illustrated in Figs. 13 and 14. In this case the wick plate or flame plate 41 is drawn perpendicularly downwards and thereby forms a wall 42. When the air flows in an upward direction the wall 42 located in this current of air and the whole of the flame plate 41 and therefore also the wick sheath are so energetically cooled that satisfactory burning of the lantern is ensured.

Fig. 15 illustrates the passages for air and the products of combustion. The full lined arrows indicate the inlet passages for air while the dash-lined arrows indicate outlet passages for the products of combustion.

Fig. 16 shows a cross-section of Fig. 15 on line 16—16.

I claim:

1. A hurricane lantern of the wick type burning liquid fuel, comprising a glass chimney, a sieve plate carrying the glass chimney, and a lantern head located above the glass chimney and formed with apertures for the escape of the gaseous products of combustion, the space between the sieve plate and the apertures in the lantern head not exceeding 120 cubic centimeters per Hefner candle power produced.

2. A hurricane lantern as claimed in claim 1, further comprising a wick sheath, and means for facilitating the rapid renewal of the heat generated at the wick sheath by the burning of the lantern.

3. A hurricane lantern burner comprising a wick sheath, and strips of copper connected at one end with the top of the wick sheath, the said strips of copper extending transversely to the current of air flowing upwardly around the wick sheath and being adapted to conduct away rapidly the heat generated at the wick sheath by the burning of the lantern.

4. A hurricane lantern burner comprising a wick sheath, and a large flame plate surrounding and secured to the upper part of the wick sheath, the margin of the flame plate being so bent downwardly as to form a closed jacket surrounding the upper part of the wick sheath and leaving an annular space between itself and the wick sheath, and the jacket being open at the bottom so that the current of air flowing upwardly around the wick sheath impinges strongly upon the said jacket to remove the heat therefrom.

5. A hurricane lantern burner adapted to be mounted in an oil container, the upper part of which constitutes a burner chamber, comprising a wick sheath, a burner hood extending over and around the upper end of the wick sheath, a plate perforated with a ring of apertures of substantial size surrounding the under portion of the burner and carrying the burner hood, means for admitting air for combustion to the burner chamber, vertical metal tubes of the same cross-section as the apertures in the perforated plate, these tubes extending downwardly from the said apertures and communicating at their lower ends with the burner chamber, so that air for combustion can pass from the burner chamber through the tubes into the burner hood, the external surfaces of the tubes being exposed to the atmosphere and being spaced apart so that atmospheric air can have free access between them so as to cool the tubes, the under portion of the burner and the part of the wick sheath extending below the perforated plate.

6. A hurricane lantern, as claimed in claim 1, in which the sieve plate carrying the chimney is made of metal, the lantern further comprising a metallic wick sheath, a metallic flame plate secured to the upper end of the wick sheath, a metallic cover sieve surrounding the central part of the wick sheath, and metallic wick actuating means, some of the said metallic parts, including the wick sheath, being made of a metal which is a very good conductor of heat such as copper.

7. A hurricane lantern of the wick type burning liquid fuel, comprising a glass chimney, a metallic sieve plate carrying the glass chimney, a lantern head located above the glass chimney and formed with apertures for the escape of gaseous products of combustion and including a metallic wick sheath, a metallic flame plate secured to the upper end of the wick sheath, a metallic cover sieve surrounding the central part of the wick sheath, and metallic wick actuating means, the wick sheath being made of a metal which is a very good conductor of heat such as copper.

BRUNO NIER.

June 11, 1935. B. NIER 2,004,826

HURRICANE LANTERN

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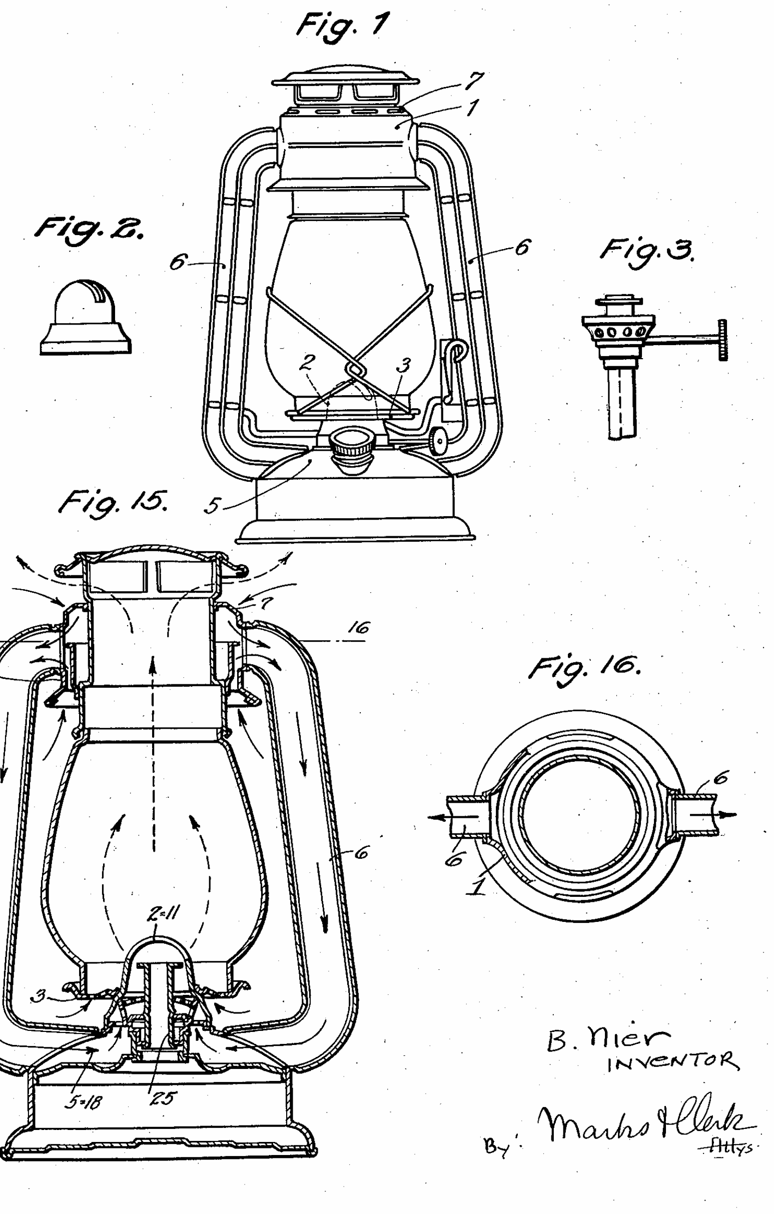

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HURRICANE LANTERN

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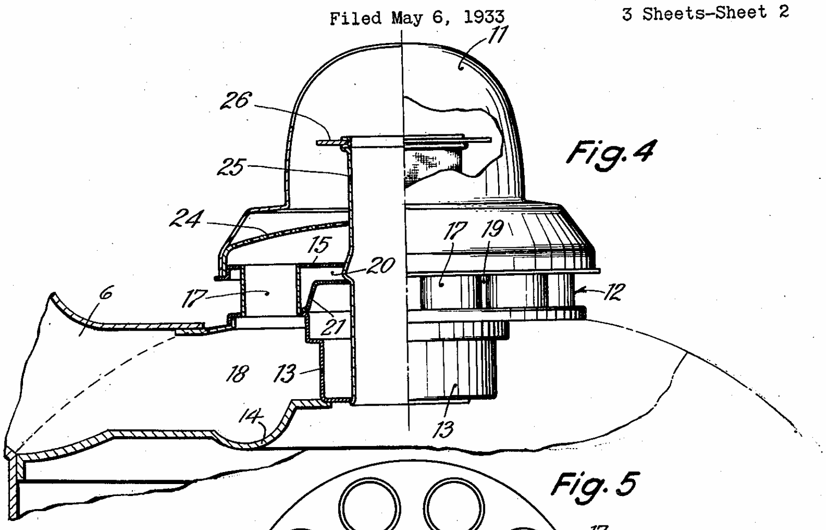


Fig. 4

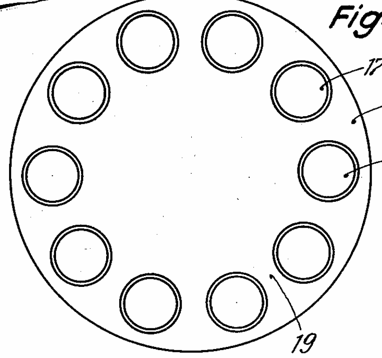


Fig. 5

Fig. 6

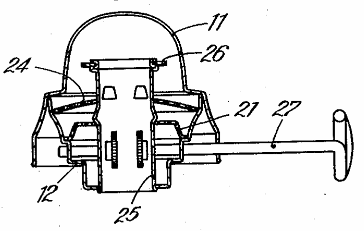
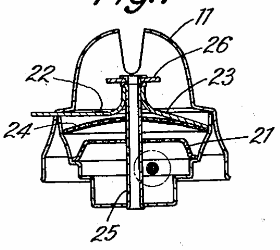


Fig. 7



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HURRICANE LANTERN

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Fig. 8

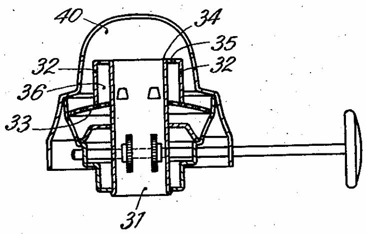


Fig. 9

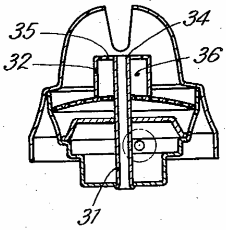


Fig. 10

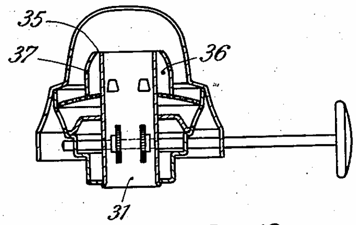


Fig. 11

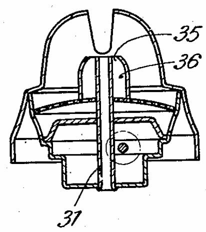


Fig. 12

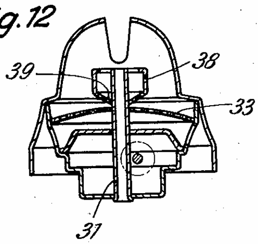


Fig. 13

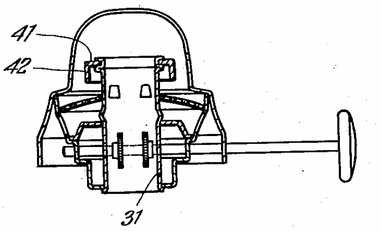
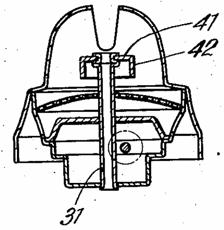


Fig. 14



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