

A. C. IONIDES, JR.
 MEANS FOR PREVENTING THE BACKWARD PROPAGATION OF FLAME.
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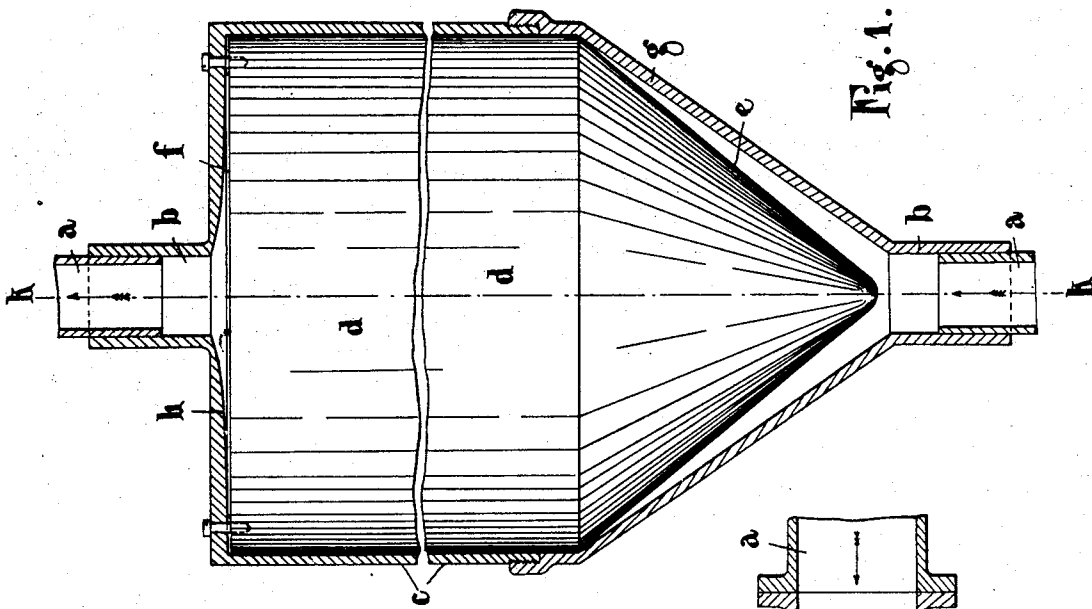


Fig. 1.

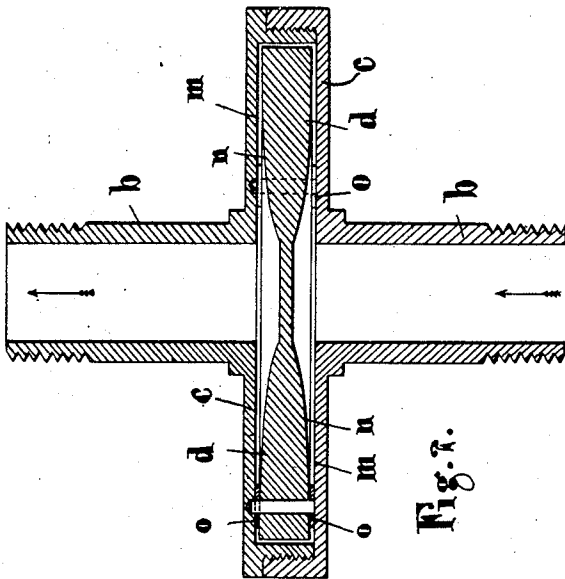


Fig. 2.

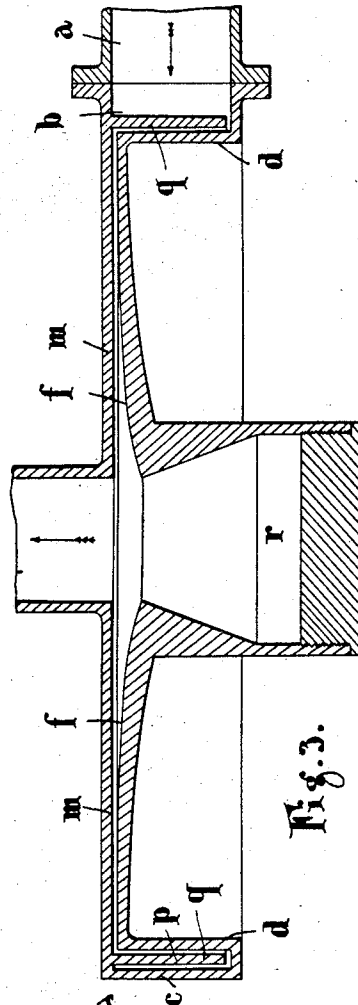


Fig. 3.

WITNESSES
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MEANS FOR PREVENTING THE BACKWARD PROPAGATION OF FLAME.

1,061,847.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ALEXANDER CONSTANTINE IONIDES, Jr., a subject of the King of Great Britain and Ireland, and residing at 34 Porchester Terrace, in the county of London, England, have invented certain new and useful Improvements Relating to Means for Preventing the Backward Propagation of Flame along a Conduit Conveying Combustible Mixture, of which the following is a specification.

This invention relates to a device for preventing the backward propagation of a flame along a conduit conveying a combustible gas mixed with a supporter of combustion.

In such devices as have already been proposed, the flame is spread into a thin layer in an annular passage between two cylindrical surfaces forming a part of the conduit, and of the same sectional area as the latter. In order that such a device shall be effective it has been found necessary to spread the flame into an exceedingly thin layer, with the result that such a device offers considerable resistance to the flow of the gaseous mixture under normal conditions.

The object of the present invention is to overcome the above disadvantage.

This invention consists in a device in which the backward propagation of a flame along a conduit is prevented by spreading the flame radially in a passage of substantially constant cross sectional area.

The invention also consists in a device which prevents the backward propagation of a flame along a conduit by a radial spreading of the flame, but offers a minimum resistance to the normal flow of gas in the conduit.

The invention further consists in the improved device for preventing the backward propagation of a flame along a conduit as hereinafter described.

Referring now to the accompanying drawings:—Figures 1, 2 and 3 show in sectional elevation three forms of a device according to the present invention.

In carrying the invention into effect according to the construction shown in Fig. 1, there is provided in the main conduit, *a*, conveying for example a mixture of coal gas and air in the proportions necessary for complete combustion, a conduit part, *b*, of slightly greater sectional area than the main

conduit, *a*. Between the ends of the enlarged conduit part, *b*, there is a casing, *c*, forming a chamber of considerably greater sectional area than the main conduit or enlarged part, *b*. Within said chamber there is fixed a member, *d*, having a conical surface, *e*, at the end facing the direction of normal flow of the gaseous mixture, which is in the direction indicated by the arrows, but having a flat surface, *f*, at the other end. The casing surface, *g*, adjacent to the conical surface, *e*, is also conical and of such dimensions that between the two conical surfaces *e* and *g*, there is an annular passage which, as it diverges and consequently increases in perimeter, is correspondingly decreased in width so that the cross sectional area of the passage remains practically constant, and is equal to that of the enlarged conduit part, *b*. In flowing through such a passage the gaseous mixture is gradually spread into a layer of decreasing thickness until the annular passage between the cylindrical surface of the member, *d*, and the casing, *c*, is reached, which passage is also of the same sectional area as the enlarged conduit part, *b*. In this way the minimum resistance is offered to the mixture in flowing from a conduit part of smaller perimeter to one of larger perimeter. In order, however, to prevent the backward propagation of a flame along the conduit, that is in the direction opposite to that of the arrows, the casing wall, *h*, adjacent to the flat end, *f*, of the member, *d*, is curved in such a manner that the flame in passing backward along the conduit besides being subjected to a sudden change in its direction of travel, is spread radially into a thin layer, the sectional area of which always remains constant and equal to that of the conduit part, *b*. For this purpose, when the end surface, *f*, of the member, *d*, is flat, the adjacent surface, *h*, of the casing *c*, must be hyperbolic. The curve of the surface *h*, will therefore be such that the product of the distance of any point on the surface, *h*, measured from the axis, *k*, *k*, of the conduit into the distance from such point to the flat surface, *f*, is constant and equal to half the square of the radius of the enlarged conduit part, *b*. Obviously, the same result may be obtained by making the end surface, *f*, of the member, *d*, hyperbolic, while the surface, *h*, of the surrounding casing is flat.

According to the modified construction of

the device shown in Fig. 2, the chamber within the casing, *c*, in the conduit part, *b*, is cylindrical, and has flat end walls, *m*. The inserted member, *d*, is now in the form of a disk, and in order that the cross sectional area for the passage of gas throughout the enlarged conduit part, *b*, shall remain constant, the disk surfaces, *n*, are curved so as to maintain between these surfaces and the flat surfaces, *m*, a passage of constant cross sectional area in spite of its increasing perimeter, the disk surfaces being for this purpose substantially hyperbolic. Suitable distance pieces, *o*, placed between the flat surfaces, *m*, and the disk, *d*, maintain the latter in its correct position relatively to the casing, *c*. With such a modified form of the device, a flame passing in either direction along the conduit will have its direction of travel suddenly altered and at the same time be spread radially into a thin layer while maintaining a constant cross sectional area as in the previously described form.

In a device according to the present invention, the backward propagation of the flame is prevented by spreading the flame into a layer of such a thickness that cooling causes the flame to be extinguished. The amount of spreading to which the flame be thus subjected in order to effect this, depends upon the constituents and the proportion thereof in the combustible gaseous mixture. For a mixture of petrol vapor and air in the proportion giving complete combustion of the former, it has been found that backward propagation of the flame is prevented if the latter be spread into a layer of about one-sixteenth of an inch in thickness, while if the mixture is a self-burning one of average coal gas and air the former will be extinguished if spread into a layer of about one-fiftieth of an inch in thickness.

Although the amount of spreading must be determined for different mixtures, it may be greatly reduced by slightly modifying the device in the manner illustrated in Fig. 3. In this modification the mixture under normal conditions flows in the direction of the arrows shown, and on entering the casing, *c*, by the conduit part, *b*, it passes into an annular passage, *p*, formed between the casing wall, *c*, and an inner wall, *q*, concentric therewith. The passage, *p*, is continued between the member *d*, and the other side of the concentric wall, *q*, and thus corresponds to the passage between the casing, *c*, and cylindrical member, *d*, in the device shown in Fig. 1. The mixture thereafter enters the spreading passage between the flat surfaces, *m*, and the hyperbolic surface, *f*, at the narrowest part of said passage, and thereafter passes radially with respect to the member, *d*, and outward to the conduit part, *b*. Opposite the latter is arranged a chamber, *r*, the length of which is usually variable

but of such magnitude that on the occurrence of a back fire, the high pressure gases traveling in the direction opposite to that indicated by the arrows shall strike the end walls of the chamber, and thereby be completely reversed in their direction of travel. In this way a considerable amount of the initial energy of the back fire is absorbed, and consequently the further propagation of the flame is prevented by spreading the flame to a lesser degree than hitherto. This form of the device offers the advantage that the valve by which the flow of mixture is controlled can be placed in the outgoing conduit part, *b*, and arranged with its spindle parallel to the axis thereof so that the valve can be operated from the side of the device on which the chamber, *r*, is situated.

It will be understood, of course, that in a device such as shown in Figs. 1 and 2 the area of flow throughout the device may be made equal to that of the main conduit, *a*, instead of that of the enlarged conduit, *b*, although the latter arrangement is preferable as the device then offers less resistance to the normal flow of the mixture along the conduit.

Many modifications, it will be seen, can be made in the manner of carrying the invention into effect without in any way departing from the spirit of the same.

I claim—

1. A device for preventing the backward propagation of flame, comprising in combination a conduit conveying combustible gaseous mixture, a part of said conduit of greater cross sectional area, annular surfaces connecting said enlarged part with the remaining part of the conduit, a cylindrical member inserted within the enlarged part, said member having an end surface co-acting with one of said annular surfaces to form a passage at right angles to the main conduit, the product of the width of which passage into the corresponding radial distance from the axis of the conduit is constant for all such distances, whereby a backwardly propagated flame on entering said passage is spread in a plane substantially at right angles to the conduit, while maintaining a constant cross sectional area.

2. A device for preventing the backward propagation of flame, comprising in combination a conduit conveying combustible gaseous mixture, a part of said conduit of greater cross sectional area than the remaining part, annular surfaces connecting the enlarged part with the remaining part of the conduit, a cylindrical member inserted within the enlarged part, said member having an end surface co-acting with one of said annular surfaces, one of the two co-acting surfaces being flat and the other concave but hyperbolic radially, thereby

forming a radial passage situated in a plane at right angles to the conduit, and of constant cross sectional area.

5 3. A device for preventing the backward propagation of flame, comprising in combination a conduit conveying combustible gaseous mixture, an enlarged part of said conduit of greater cross sectional area than the remaining part, annular surfaces connecting said parts, a member inserted in said enlarged part, said member having a concave end surface co-acting with one of said annular surfaces which is flat, the concave surface being radially convex and hyperbolic
10 so as to form between said co-acting surfaces a passage in which the flame is spread in a plane at right angles to the conduit, while its cross sectional area is maintained constant.

20 4. A device for preventing the backward propagation of flame, comprising in combination a conduit conveying combustible gaseous mixture, said conduit having a cylindrical part of increased cross-sectional area,
25 a disk inserted within said part, and having

a substantially hyperbolic surface which co-acts with the flat surface of the cylindrical part to form a radially extending passage of substantially constant cross-sectional area.

5. A device for preventing the backward propagation of flame comprising in combination a conduit conveying combustible gaseous mixture, an enlarged part of said conduit of greater cross sectional area than the remaining part, flat annular surfaces connecting said parts, a disk inserted in said enlarged part, said disk having concave faces which radially are convex and hyperbolic, whereby said faces co-act with the flat annular surfaces to form passages in which the flame is spread in a plane at right angles to the conduit while maintaining a constant cross sectional area.

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

ALEXANDER CONSTANTINE IONIDES, JR.

Witnesses:

O. J. WORTH,
CARL R. LOOP.