

Nov. 19, 1940.

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2,221,995

GAS BURNER FOR INDUSTRIAL USE

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2 Sheets-Sheet 1

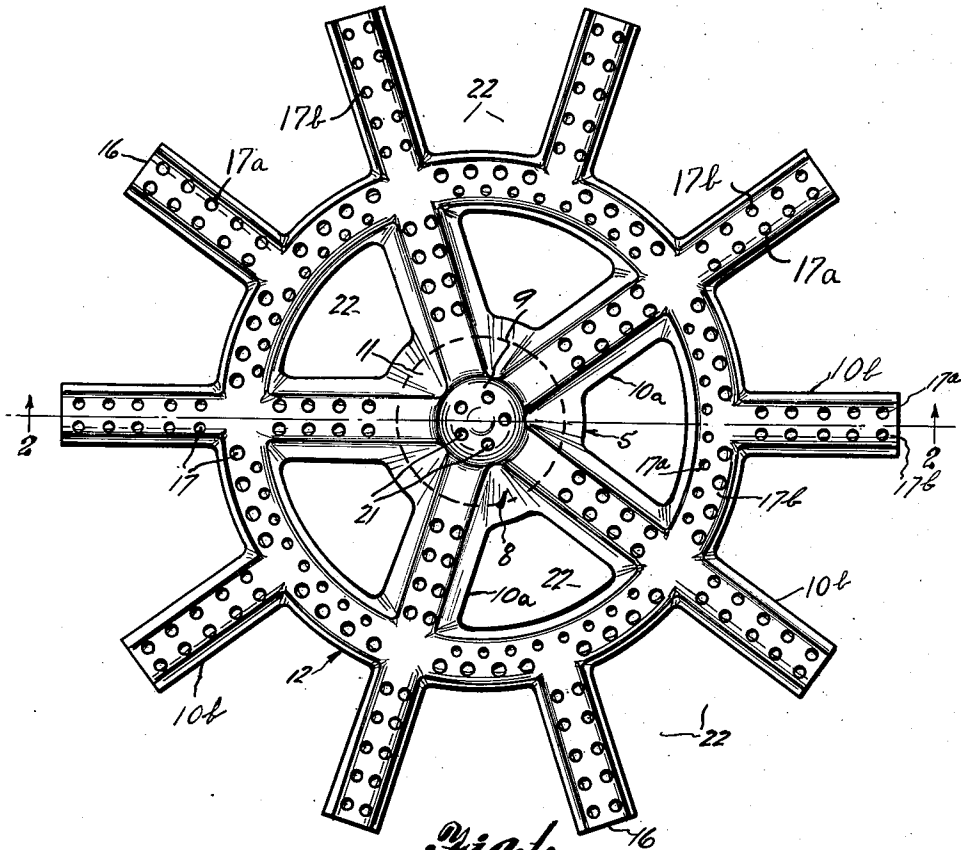


Fig. 1.

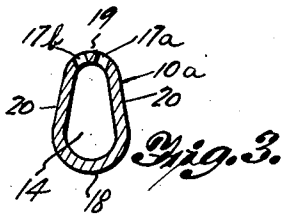


Fig. 3.

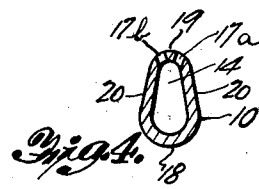


Fig. 4.

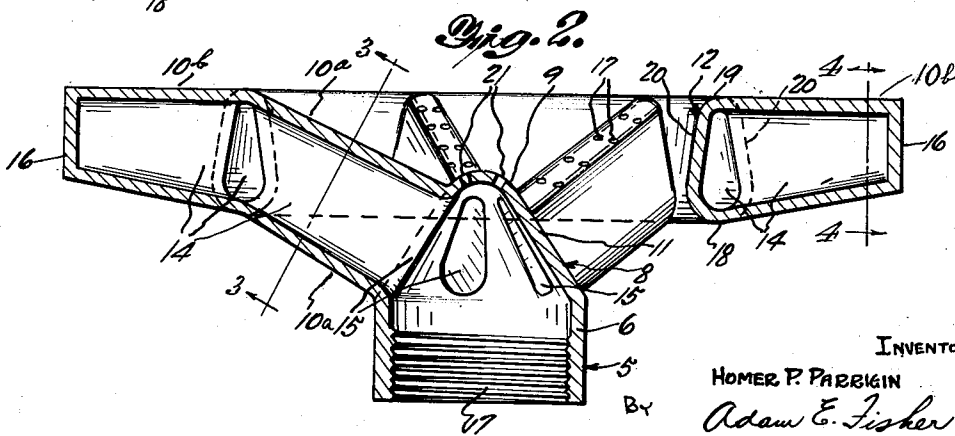


Fig. 2.

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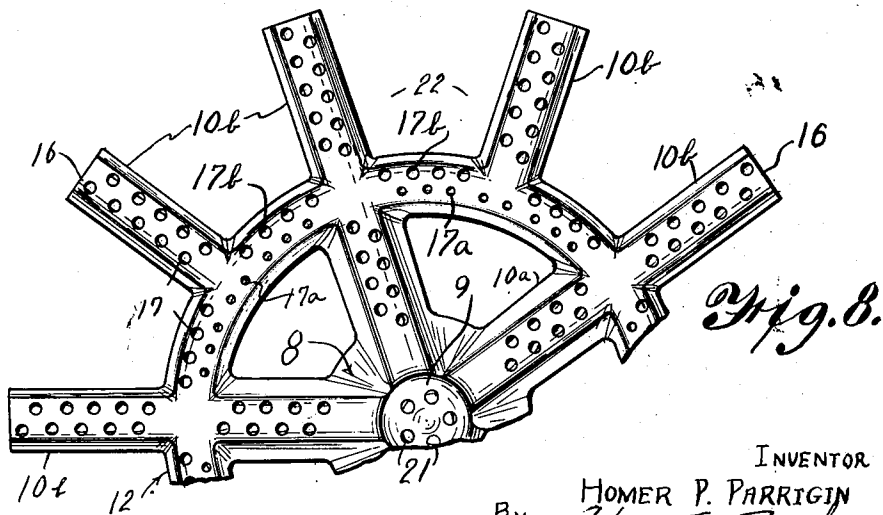
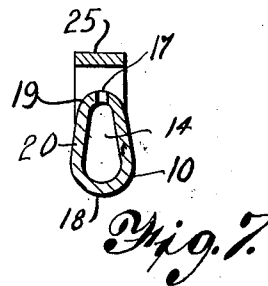
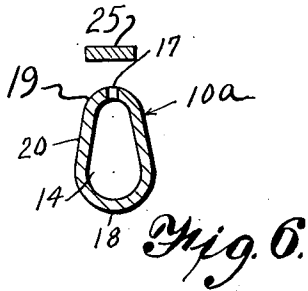
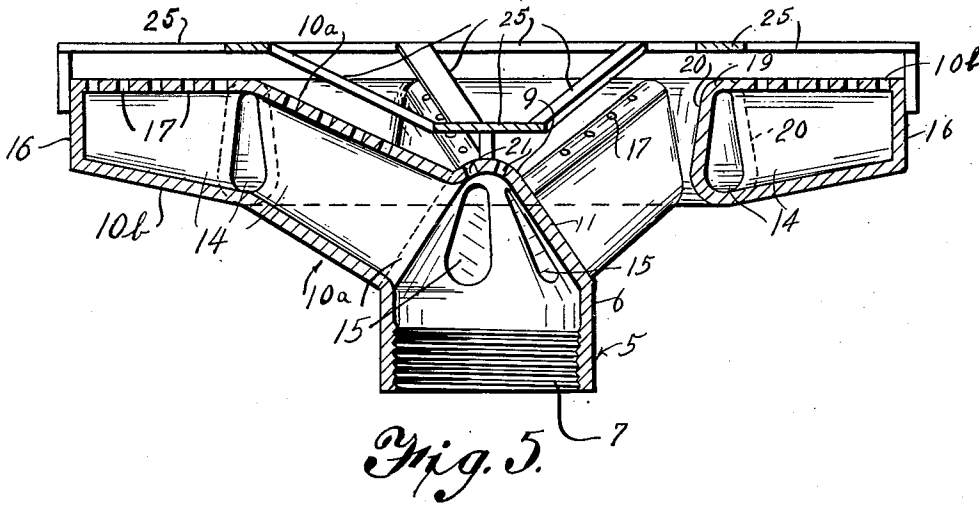
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## UNITED STATES PATENT OFFICE

2,221,995

## GAS BURNER FOR INDUSTRIAL USE

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Application January 12, 1939, Serial No. 250,474

2 Claims. (Cl. 158—116)

My invention relates to improvements in gas burners for industrial use.

Gas burners of the type herein referred to comprise basically two elements, the burner itself wherein I make improvement by my invention, and the aspirator or mixer which is located between the gas supply and the burner and serves to admit a certain amount of what is termed the primary air to the burner. The remaining necessary amount of air for proper combustion, this being termed the secondary air, is then provided by circulation directly around the burner itself. The burners for industrial use differ from those for domestic use (aside from size) in the relative differences in the amount of primary and secondary air used and provided for by the aspirator and burner. As an example of the way these burners are now operated, in the domestic burner from 60 to 100 per cent of the air used for combustion is taken through the aspirator (primary air) while the slight remainder, if any, is taken from circulation around the burner (secondary air). Opposed to this is the industrial burner wherein the primary air supplied by the aspirator is only from 20 to 40 per cent of the whole and the remaining 60 to 80 per cent is taken in as secondary air around the burner itself. It follows therefore that a domestic burner requires very little circulation around the burner while the opposite is true for the industrial burner. Attempts have been, and are being, made to furnish a burner for industrial use in which adequate air circulation at the burner is provided for but up to the present without success, this being in fact the major limiting factor of the heating capacity of present burners.

With the foregoing in mind it is the main object of my invention to provide a burner which by its shape, configuration and construction will permit and facilitate the circulation of air through and around the burner to form complete combustion no matter how large the burner may be and how many flame jets are employed.

Another object is to provide a burner of what might be termed a double radial or spoke type and wherein two sets of hollow or tubular arms or spokes are used, an inner set radiating from a common hub which feeds the gas to these arms and an outer set radiating from a hollow ring at the ends of the inner arms and from all of which arms and ring the gas emerges from jets or ports in their frontal sides, the "segmental" spaces formed between the arms being thus quite evenly

subdivided and thus providing for a rapid and even circulation of air through the burner as necessary to cause a rapid commingling action with the gas or gas-air issuing from the jets, and form a proper combustible mixture at the front of the burner.

Another object is to provide a burner of this type in which inner and outer sets of radially arranged arms are joined outwardly of the hub with a hollow ring mounted concentrically with the hub and communicating with the arms and provided like the arms with gas emitting jets or ports to increase the capacity of the burner, the ring supporting a larger number of short radially and outwardly turned hollow auxiliary arms located in equi-spaced relation around the outer side of the ring and likewise provided with jets to further increase the burner's capacity.

Another object is to provide a burner as above wherein the arms and ring are all of ovate cross section with the smaller or narrower edges turned forwardly or to the flame side of the burner, the result being that the sides of the arms and ring taper, converge or slope off forwardly and lead the air into commingling relation with the gas emerging from the jets which are of course located along the said frontal edges. Furthermore the jets themselves are or may be located in spaced and staggered relation each side of the center line of the arms and ring whereby they open at a diverging angle in an interlacing relation, and being set back around the rounded edges somewhat, the gas emerging is thrown outward into the front of the aforesaid spaces between the arms and around the ring and into the direct path of the secondary air as it passes through between the arms of the burner. This of course facilitates the perfect mixing of the air and gas.

A further object is to provide a burner wherein the hub member supporting the arms and from which they radiate, itself serves as a gas inlet for the arms and for this purpose is hollow and has ports leading into the arms, the nose or frontal end of the hub being tapered which disposes the arms forwardly and outwardly at an angle and at the same time facilitates the circulation of air inwardly around the frontal end of the hub wherein are provided several gas jets forming flames at that point. The forward and outward inclination of the arms facilitates the flow of gas from the hub outwardly into the arms.

Still another object is to provide a burner of a

radial or spoke type, the arms or spokes of which are pierced along their frontal sides with a plurality of gas emitting jets or ports, and there being deflector strips mounted along the several arms immediately outward of the said jets, upon and against which strips the jets of gas play and are thoroughly broken up and intermixed with the surrounding air for providing a suitable and perfect combustible mixture.

With these and other objects in view the invention resides in the novel construction and arrangement of parts as hereinafter fully set forth and claimed, reference being had to the accompanying drawings as showing a preferred embodiment of my invention for purposes of exemplification.

In the drawings:

Figure 1 is a frontal elevation of my improved burner.

Figure 2 is a cross section along the line 2—2 in Figure 1.

Figures 3 and 4 are cross sections along the lines 3—3 and 4—4 in Figure 2.

Figures 5 to 7 are views similar to Figures 2 to 4, showing however the gas ports or jets 17 pierced straightly or perpendicularly in through the frontal wall of the ring and arms, instead of angularly as in Figures 2 to 4, and deflector strips mounted along the frontal faces of the arms, and ring, spaced above the ports, for intercepting, breaking up and laterally deflecting the gas-air mixture as same is emitted from the jets, for more thoroughly mixing same with "secondary air."

Figure 8 is a plan view of arms 10a—10b as shown in Figures 1 to 4, with the gas ports or jets 17 however of parallel rows on the arms, arranged in a staggered relation transversely.

Referring now with more particularity to the drawing my burner comprises a hollow hub 5 having a tubular inlet end 6 interiorly threaded at 7 for the reception of the feed pipe (not shown) through which the gas is led to the burner. At the opposite end the hub 5 tapers off to a conical shape as indicated at 8 terminating in a rounded extremity or nose 9. This is hereinafter, for convenience in description, termed the frontal end of the hub and frontal direction of the burner as a whole (being the side from which the flame burns) though it is of course understood that the burner may be operated in any position desired.

A plurality of hollow arms, or spokes constituting an inner set of arms 10a radiate or extend in even spacing outwardly from the hub 5 and are formed integrally with the tapering side walls 11 of the conical frontal end of the hub. These arms 10a extend then substantially at right angles to the plane of these side walls 11 for a purpose hereinafter explained, and are thus inclined forwardly at an obtuse flaring or diverging angle and position relative to the axis of the hub 5 as shown. As here shown there are five arms in this inner set, although there might be more or less, as desired.

A hollow ring 12 circumferentially connects the outer ends of the inner set of arms 10a and communicates interiorly therewith at the inner side of the ring. An outer set of ten hollow arms 10b (as here shown) are connected to the ring 12 at its outer side, in equi-spaced relation, communicating also interiorly with the ring, and extending out radially therefrom in a common plane. Thus the outer arms 10b extend at right angles to the axis of the hub, for a purpose later to be

pointed out. As a matter of course the outer arms might be extended at the same angle relative to the axis of the hub as the inner arms, if desired. The outer and inner arms are here shown as of about the same length. If desired the inner arms may be somewhat larger in cross-section as shown, and the outer arms may be tapered towards their outer ends, for equalizing the flow of gas through the inner arms and the more numerous outer arms.

By properly increasing the number of outer arms over the inner arms, as here shown, the surrounding area of open space between the arms of the burner is substantially evenly divided, thus affording an even flow of secondary air to the burner.

As stated, the hub 5, arms 10a—10b and ring 12 are all hollow and intercommunicate one with the other through continuous passage ways 14 for the free circulation of gas in the burner. The gas is led to these passage-ways as a whole by openings 15 cut through the hub sides 11 and communicating with the interior of the arms 10a at their junctions with the hub. The outer ends of the arms 10b are closed as indicated at 16 to prevent the escape of gas therefrom. Then along the frontal sides of the arms 10a—10b and the ring 12 a plurality of jets or ports 17 are formed, opening into the interior of these parts, and the gas as it enters the burner, will then emerge from these jets and may be burned at the face of the burner.

The arms 10a—10b and ring 12 are all of ovate cross section as shown with the broader edges 18 turned rearwardly and the narrower or sharper edges 19 turned forwardly. The sides 20 of these parts thus converge or taper forwardly giving what might be termed a "streamlined" effect to the burner. As shown in Figures 1 to 4 of the drawings the aforesaid jets 17 are located in these sharper frontal edges 19 of the arms and ring and are arranged in parallel rows 17a—17b spaced on each side of the center line of the said arms and ring. Also these ports 17 are cut at an angle extending inwardly toward the center from which these rounded ends 19 are struck and thus the ports, given a radiating position, cause the gas to issue in diverging streams from the arms and the ring as will be understood. The nose 9 of the hub 5 also has several jets or ports 21 which are spaced equally therearound and open outwardly at a diverging angle as shown.

The angular arrangement of the inner set of arms 10a, relative to the axis of the hub 5 causes the streams of gas issuing from the jets to assume a staggered relationship across the intervening air spaces between the arms. As to the outer arms 10b, the ports 17 in parallel rows on the arms, may be arranged either in transversely positioned pairs as shown in Figures 1 to 4, or they may be arranged in a staggered relationship, transversely as shown on the ring 12 in Figure 1, and in Figure 8. Or, as shown in Figures 5 to 7, the ports or jets 17 may be drilled straightly and perpendicularly into the arms and ring and then deflector strips 25 mounted along the crowns of these arms in spaced relation immediately over the ports 17, for intercepting, breaking up and laterally deflecting the streams of gas-air from the jets, and more thoroughly mixing the same with the "secondary air" around the burner.

The arms 10b all taper gradually in size from their inner to their outer ends as above stated, thus reducing the effective area of the chamber 14 as the volume of the gas therein drops toward

the outer side of the burner whereby the gas emerges at all ports at about the same velocity.

In operation the gas under pressure is fed to the burner through the hub 5 and passing through the openings 15 enters the arms 10a, the ring 12 and arms 10b. The gas then issues from the jets 17 and 21 and when ignited will form flames thereat. The radial spread and distribution of the inner and outer sets of the arms, together with the ring tends to form an even fire face over the whole burner but at the same time a free circulation is provided for the secondary air hereinbefore referred to through the large and evenly divided segmental spaces 22 between the arms. Also the aforesaid taper of the sides 20 of the ovate arms and ring leads the air to flow forwardly around these parts into direct commingling relation with the gas emerging from the jets, the staggered arrangement of the jets, the outwardly flaring position of the jets and the deflector strips mounted over the perpendicular jets further facilitating this action since these devices direct the gas laterally out into the front of the said spaces 22. In fact these arrangements cause the gas streams on each arm to actually interlace and mix with the streams from the arms to each side and from the adjacent part of the ring 12.

The outwardly and forwardly inclined or flaring position of the inner arms 10a, connecting with the hub 5 at less than a right angle, facilitates the flow of gas thereinto, since an abrupt turn between the hub 5 and these arms is obviated. Furthermore the center of the burner being thus "depressed" or cupped in a rearward direction causes a concentration of the heat toward the center of the burner where the number of jets is necessarily fewer than around the outer portion of the burner. The ports or jets 17a forming the inner row upon the ring 12, as shown in Figures 1 and 8, are smaller than the ports or jets 17b forming the outer row for the sake of better distribution and mixing of the fuel and flame, since the smaller streams issuing through ports 17a will travel at a different rate of speed than the streams through the ports 17b. This variation in the streams is thought to produce better mixing—a more even flame, and better combustion, because of the resultant varying velocities and discharges of the streams.

As a matter of course any desired form of control may be employed for regulating the inflow of primary air into the burner.

The deflector strips 25 above referred to, may be made angular in cross section instead of flat as shown, and mounted with their apices turned downward centrally over the rows of gas orifices, so as to deflect the gas streams to either side. This arrangement is obvious and hence not shown in the drawings.

While I have herein set forth certain preferred embodiment of my invention it is understood that I may vary from the same in minor structural details so as best to provide a practical device for the purposes intended, not departing from the spirit of the invention and within the scope of the appended claims.

I claim:

1. A gas burner including a hollow hub portion, said hub portion comprising a cylindrical lower portion and a tapered upper portion, said tapered portion having slots through its wall and having a rounded perforated extremity, upwardly inclined hollow arms radiating from said tapered portion and communicating with the interior thereof through said slots, and a hollow ring connecting the outer ends of said arms, said arms and ring having upwardly converging side walls and perforated frontal walls, the interiors of said arms and ring being intercommunicating and said hub portion having a gas inlet adapted to admit gas to said arms and ring.

2. A gas burner including a hollow hub portion, said hub portion comprising a cylindrical lower portion and a tapered upper portion, said tapered portion having slots through its wall and having a rounded perforated extremity, upwardly inclined hollow arms radiating from said tapered portion and communicating with the interior thereof through said slots, and a hollow ring connecting the outer ends of said arms, hollow arms extending radially from said ring opposite the first-named arms, other hollow arms extending radially from said ring intermediate the second-named arms, said arms and ring having upwardly converging side walls and perforated frontal walls, the interiors of said arms and ring being intercommunicating and said portion having a gas inlet adapted to admit gas to said arms and ring.

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