Nov. 14, 1933. A. G. BLANCHARD 1,935,346

GAS BURNER

Filed Dec. 16, 1932 2 Sheets-Sheet 1

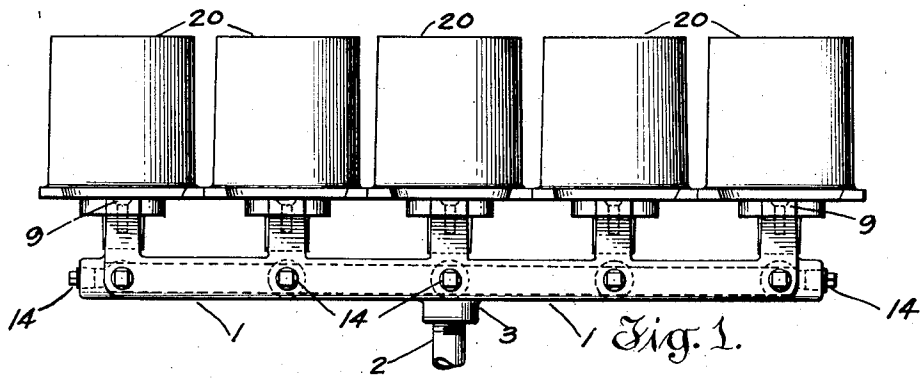


Fig. 1.

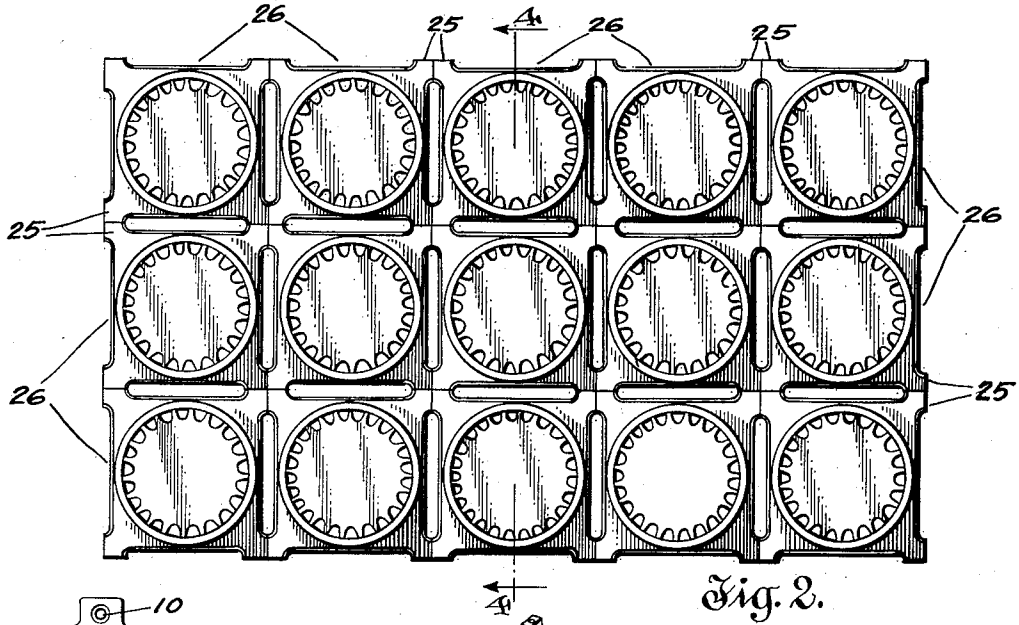


Fig. 2.

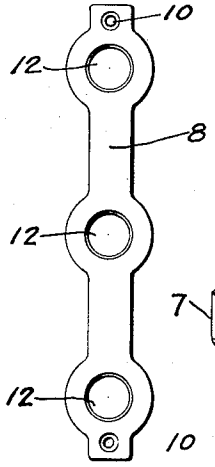


Fig. 7.

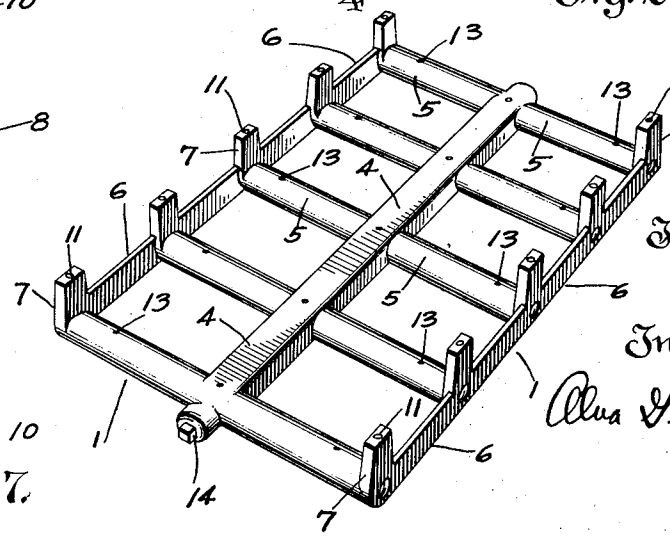


Fig. 3.

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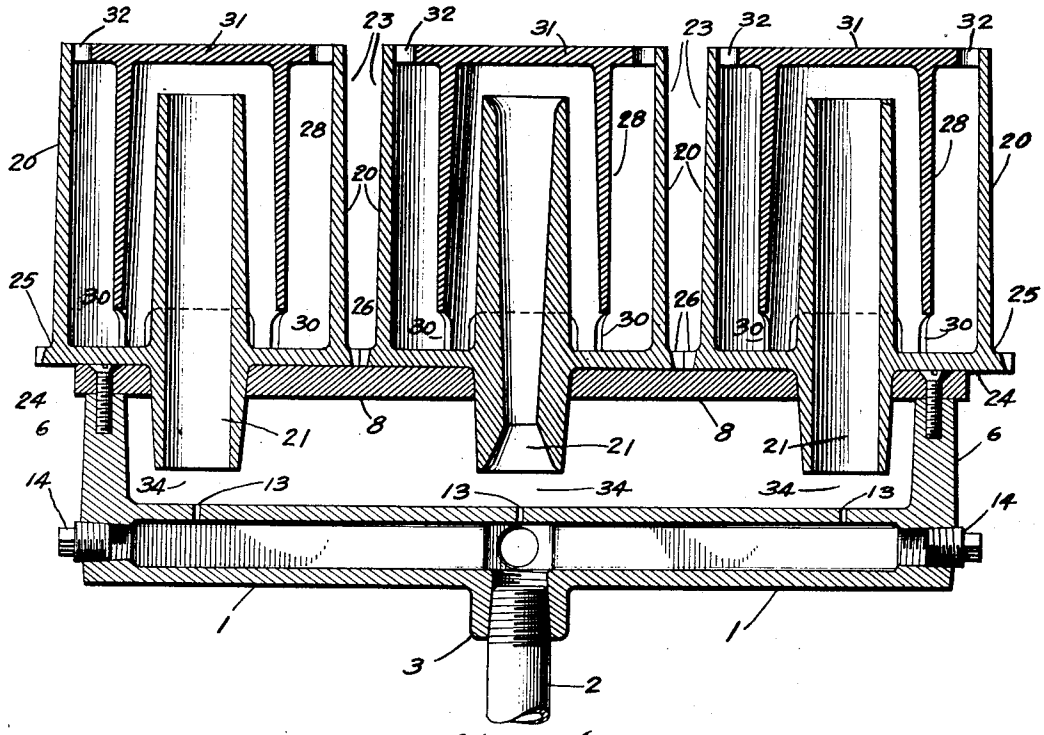


Fig. 4.

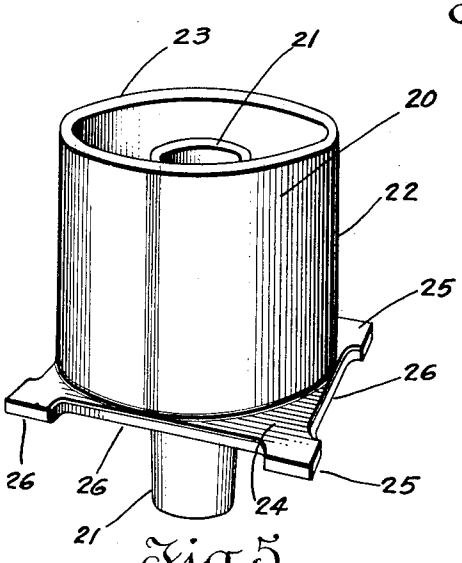


Fig. 5.

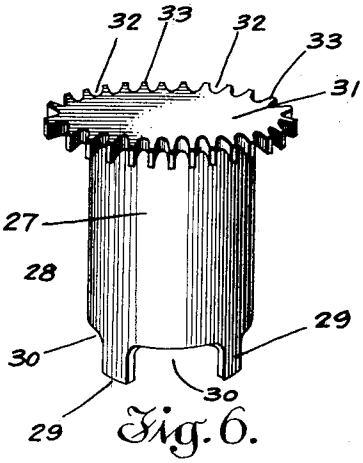


Fig. 6.

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UNITED STATES PATENT OFFICE

1,935,346

GAS BURNER

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Application December 16, 1932
Serial No. 647,615

5 Claims. (Cl. 158—104)

This invention relates to burners for the combustion of gas, primarily designed for use with industrial furnaces or boilers and particularly for use with and burning of natural gas in connection with the type of boilers ordinarily used in oil field operations.

The burner is of the type employing a mixing chamber containing axially extending baffles therein for the mixing of gaseous fuel with primary air.

The object of this invention is to provide a frame, and an assembly of a plurality of burner units of this type, which will be light in weight, economical to manufacture, strong and durable, easily assembled and disassembled for moving or repairs, and so designed that additional units may readily be added or taken away to facilitate enlargement or contraction of the assembly to meet the demands of the particular installation.

Another object is to provide a construction of the individual burner cups and a construction of the frame which cooperate to cause thorough and efficient mixing of the gas with primary air before reaching the point of combustion and with secondary air at the point of combustion and to control the relative quantities of air and gas so as to provide the most efficient ratio.

Another object of the invention is to provide a burner and frame assembly which will be economical to manufacture, easy to assemble and disassemble, light in weight, strong and durable and designed so that the burner cups assembled and held by it can be easily inserted, quickly assembled, and accurately held in alignment.

Another object of the invention is to provide individual burner cup units of economical construction.

Another object is the construction of a burner assembly frame containing gas passages integral therein and adapted to be easily cleaned for the removal of paraffin, water, sand or other extraneous matter in the gas which sometimes causes trouble in burners when gas is taken direct from the oil wells without being passed through separators for the elimination of impurities.

Another object is to provide a frame for such burner assembly so constructed as to provide a minimum of obstruction to the flow of air to the burners.

While this burner is primarily designed to operate with gas at low pressure, that is, at pressures less than one pound per square inch, it is nevertheless so designed that it operates with equal efficiency, using gas at higher pressures, that is, with pressures up to twenty-five or thirty pounds per square inch.

Figure 1 is a side elevation of the burner assembly showing the burner cups assembled to and held by the frame assembly.

Figure 2 is a view of the burner assembly above, showing the top and the projecting flanges of the burner bases. The frame, being beneath these, and out of view in this figure.

Figure 3 is a perspective view of the main body or bed of the frame.

Figure 4 is a cross section of the burner assembly taken upon line 4—4 of Figure 2.

Figure 5 is a perspective view of one of the burner cup shells.

Figure 6 is a perspective view of the insert which goes into the burner cup shell illustrated in Figure 5.

Figure 7 is a perspective view of one of the top cross members of the frame which support and properly align the burner cups in proper relation to the gas orifices in the frame.

The burner assembly is placed at the lower part of a furnace or fire box and a space below it is left open for the admission of the air required for combustion. A wall of fire brick or similar substance is built up to and beside the burner assembly so as to prevent the entrance of any air into the fire box except that which passes up through the burner assembly itself, either through the mixing chambers of the burner cups or between the burner cups and through the slots formed in and by the assembled burner cup bases.

The frame body, designated generally as 1, is a unitary structure consisting of ribs 4 and 5 and side members 6. These ribs 4 and 5 are of hollow tubular construction so that they serve also as ducts or conduits for the passage of gas. This reduces to a minimum the number of elements of the frame, making the construction more economical and leaving a greater amount of clear unobstructed space for the passage of air therethrough on the way to the burners.

Lugs 7, projecting upwardly from the side members 6, are in alignment with ribs 5 and support the cross members illustrated in Figure 7, and designated generally as 8, as illustrated in Figure 4. Each cross member 8 is exactly above and in alignment with rib 5. These cross members 8 are fastened to the lugs 7 by means of countersunk screw members 9, which fit into recessed holes 10 through the end of cross member 8 and in tapped holes 11 within the lugs 7. These screws hold the cross members 8 firmly in place and

maintain the alignment of the cross members 8 with the lateral ducts 5. Circular openings 12 in cross members 8 are above and concentric with orifices 13 located upon the upper side of the frame ribs 4 and 5. The burner cups or mixing chambers designated generally as 20 are carried by and upon cross members 8, the depending inlet tubes 21 of burner cup 20 passing through openings 12 in cross members 8 and projecting downward therefrom toward and in accurate alignment with gas orifices 13 in ribs 4 and 5.

The mixing chamber or burner cup assembly designated generally as 20 in Figure 4 consists of a burner cup shell, illustrated in Figure 5 and designated generally as 22, and of a burner cup insert, illustrated in Figure 6 and designated generally as 27.

These burner cups or mixing chambers are preferably cylindrical in shape and circular in cross section, although this is not essential and they might be square, hexagonal, octagonal or any other desired shape in cross section, without departing from the spirit of this invention.

The mixing cup shell designated generally as 22 consists of an outer wall 23, which is preferably cylindrical, and of a bottom 24, which with flanges 25 forms a square base which fits and cooperates with the bases of the other burner cups in the assembly. On each side of this square base is an elongated notch 26 for purposes to be explained presently. Projecting through the bottom of the burner cup shell is a tubular member 21 which serves as an inlet passage for gas and primary air which are subsequently to be thoroughly mixed during passage through the mixing chamber. This tubular member extends downwardly from the bottom of the burner cup far enough to pass through the openings 12 in the cross members 8 and to reach down almost as far as ribs 4 and 5 of the frame. It extends upward axially and concentrically in the burner cup shell almost to the upper end, but terminates far enough down to leave a space beneath the top end of the burner cup insert when it is placed within the burner cup shell.

The burner cup insert is illustrated in Figure 6 and is designated generally as 27. It consists of a wall or shell which is preferably cylindrical in shape and circular in cross section, though it may be of any other shape to conform to the shape chosen for the sectional area of the burner cup shell. At the lower end are lugs 29 which serve as supports or legs and which between them leave clearance spaces or notches 30 which occupy the greater part of the periphery of the insert wall. At the upper end is a top wall which completely closes the inside of the cylinder 28 and which projects beyond this cylinder to form a circular flange and top 31. Around the periphery of this flange are a number of semi-circular notches 32 having teeth 33 between them. The purpose of these notches and these teeth as well as of the lugs and notches upon the lower end will be set forth subsequently.

The gas inlet tube 21 may be of a constricted or Venturi shape, as shown in the center burner of Figure 4, or straight as shown in the two side burners of that figure. The constricted passage is preferred as it facilitates the entrainment and mixing of primary air by the gas jet issuing from orifices 13.

The burner cup insert 27 rests inside the burner cup shell 22, as shown in Figure 4, with the top of 27 approximately level with the top of 22. Also as explained before and as illustrated in Figure 4, the burner cup assembly rests upon and is carried by the cross members 8 with the gas inlet 21 projecting through the openings 12 and depending below the cross members 8 and in alignment with orifices 13 in the frame members 4 and 5.

Gas enters the frame assembly 1 through gas pipe 2 and inlet 3 and completely fills and passes through gas ducts 4 and 5, issuing from them through orifices 13. The small size of orifices 13 causes the gas to issue therefrom with considerable velocity and projects it towards and into the burner cup assembly through the entry passage 21. In passing through the air gaps 34 between the frame and the entrance 21, the gas by virtue of its velocity is impelled to pick up and carry with it and entrain a considerable amount of air, which is forced along with the gas into the burner cup or mixing chamber. This is called primary air and the purpose of all gas burners is to secure as thorough as possible a mixture of gas and the primary air before they reach the place of combustion, that is, the area in which the gas is finally consumed. The completeness and the uniformness with which this mixture is accomplished determines in very large degree the quality of the flame which will be produced when this mixture is mixed with secondary air and burned. The ideal condition is to secure very thorough mixing of the gas and primary air and to entrain and mix with the gas as primary air an amount of air almost but not quite sufficient to support combustion, so that very little additional or secondary air is required when the place of combustion is reached. This form of burner has proven very efficient in that regard. The gas and the entrained primary air pass up through the entering chamber until they come in contact with the top 31 of the gas burner insert which deflects them downward again along the inside of the gas burner insert wall 28 which serves as an annular baffle within the mixing chamber. Proceeding downwardly along the inside of this wall they reach the bottom or base of the burner cup shell 22 and are deflected outwardly through the notches or openings 30 and then proceed upwardly through the annular space between the wall 28 and the wall 23 until they reach the openings or notches 32 and emerge from the mixing chamber or burner cup. The long circuituous route through the burner cup and the number of obstacles and baffles encountered on the way therethrough causes exceedingly thorough mixing of the gas and the primary air. The general principle of such mixing chambers is not original to this device, but certain features of the construction in the present instance are novel and original and serve to secure improved results superior to those obtained with prior designs of this class of mixing chamber, and also serves to secure economies in manufacture. For instance, the long circumferential notches or slots 30 at the lower end of the burner cup insert wall 28 are more economical to manufacture and provide a longer path for the mixture of gas and primary air than would a number of holes through this wall, as is furnished in some prior designs of burners of this general type, and the notched construction 32 of the periphery of the top 31 of the burner cup insert 27 is much more economical than a number of holes around the top adjacent to the periphery as is found in some burners of this type and is much more conducive to efficient combustion than are annular slots, either continuous or non-continuous, which are used

in some burners because the barriers or teeth 33 between the notches 32 provide openings through the jets of mixed gas and primary air issuing from the notches 32 and the secondary air drawn up through slots 26 can pass through these spaces to get at all sides of the burning jets and thereby provide more rapid and uniform combustion. Experience has proven that the flame is shorter and of somewhat better color with this arrangement than when the outlet opening is made continuous or when a lesser number of longer slots are used. Both the flame height and the better color of the flame prove that the combustion is more complete and efficient with this arrangement. Also the shorter flame height will usually fit better into the fire boxes of boilers or furnaces in which these burners are installed.

At the end of each of the gas ducts 4 and 5 of the frame 1 is a removable plug 14, which may be unscrewed and removed to provide access for the cleaning of these ducts. This is particularly important in oil field practice because frequently the gas is run directly from an adjacent oil or gas well to the burner through a short length of pipe, without cleaning or separation of the extraneous matter from the gas, such as particles of oil, water, sand, sludge, or waxy material such as paraffin which gum up or clog up the gas passages in the burner. These are usually deposited in the first passages encountered and are not apt to pass up into the burner proper and cause trouble there if the passages in the frame are frequently cleaned out.

What I claim is—

1. In an apparatus for the efficient combustion of gas, a frame and multiple burner assembly, burner cups with a combustion area encircling the upper periphery of each, gas supply ducts below said cups, air spaces between burners to admit secondary air in proper quantity uniformly throughout the entire combustion space at points adjacent to the combustion area of each burner unit, a frame assembly adapted for holding said burner units in proper spaced relation to each other and to the gas supply ducts, said frame assembly consisting of a unitary body portion, and of removable cross members containing holes for the insertion and holding of corresponding members of the individual burner units, the central portion of said frame consisting solely of said gas distribution members thereby providing a minimum resistance to the flow of air into and around said cups.

2. In an apparatus for the efficient combustion of gas, a frame and multiple burner assembly, burner cups with a combustion area encircling the upper periphery of each, air spaces between burners to admit secondary air in proper quantity uniformly throughout the entire combustion space at points adjacent to the combustion area of each burner unit, flanged bases at the lower part of said burner cups shaped to cooperate with the bases of other cups and to fill in a part of the space between them to reduce the amount of secondary air drawn therethrough.

3. In an apparatus for the efficient combustion of gas, a frame and multiple burner assembly, burner cups with a combustion area encircling the upper periphery of each, air spaces between burners to admit secondary air in proper quantity uniformly throughout the entire combustion space at points adjacent to the combustion area of each burner unit, square flanged bases at the lower part of said burner cups shaped to cooperate with the bases of other cups and to fill in a part of the space between them to reduce the amount of secondary air drawn therethrough, elongated notches on all four sides of said square bases which cooperate with corresponding elongated notches in adjacent bases to form slots for the admission of secondary air.

4. A multiple burner assembly including a frame with longitudinal side supports, tubular transverse members and an intermediate longitudinal tubular member connected with said transverse members, cross plates spaced vertically above said transverse members and having spaced openings therein, upwardly extending cups having an axial tube in each cup projecting above and below the bottom of the cup, a deflecting insert in said cup surrounding said tubular member, a radial flange at the upper end of said insert with marginal notches therein for the passage of gas between the same and said cup, said tubular members fitting tightly within the openings in said plates and the bottoms of said cups resting upon said plates to firmly support said cups in position, said tubular connecting members having openings for gas below said axial tubes.

5. A frame, a transverse plate thereon having spaced openings therein, burner cups each having an axial tube therein projecting above and below the bottom of the cups, said bottom projecting portion fitting closely in said openings, a rectangular base plate on each cup fitting against the adjacent base plates and seated on said transverse plates, said base plates being recessed to provide air passages around said cups, an inverted cup-shaped insert in each cup surrounding said axial tube, the lower margin of said insert being notched, a notched flange on said insert contacting the inner surface of said cup, and means to support said frame and deliver gas into said tubes.

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