This invention relates to burners for use in heating apparatus and particularly to burners employing fluid fuel, and to methods of transferring heat from flames or hot fluids to surfaces.

The objects of this invention are to provide a burner of this kind with the jets or orifices through which the mixture of fuel and air is discharged and arranged in pairs, the jets of each pair being arranged for projecting flames at different angles, the flame from at least one jet of each pair impinging against the surface to be heated; also to provide a burner of this kind which projects two flames or sets of flames, one of which is directed at an angle against the surface to be heated to sweep away the film of dead air usually adhering to such surface, so that the heat from the two flames will be more readily transmitted to or through the surface; also to provide a burner of this kind having two sets of flames cooperating with each other so that any unburnt gases leaving one of the flames will be ignited by the other flames to ensure complete combustion of the fuel; also to methods of transferring heat to a surface; also to improve burners and heat transfer methods of this kind in other respects herein specified.

In the accompanying drawings:

Fig. 1 is a fragmentary sectional view of a heating device having a burner embodying this invention therein.

Fig. 2 is a top plan view thereof showing some of the radiant elements removed to show the burner.

Fig. 3 is a transverse section of the burner on an enlarged scale.

This invention may be used in connection with many different types of heating appliances, and the particular furnace or heater which is shown in the accompanying drawings is illustrated merely by way of example to show a complete installation of the burner. This furnace or heater includes the usual outer wall A and an inner wall B separated from the outer wall to form a circulating space in which water or other medium to be heated may circulate. C represents the burner which is arranged within the inner wall B and is provided with jets, orifices or burner tips through which fuel and air may be passed to form flame jets. This burner includes a compartment 10 into which a primary mixture of air and gas may pass, and an air chamber 11 into which secondary air enters from a conduit or duct 12 connected with the air chamber 11 by means of passages 13. Two jets or burner tips 15 and 16 also extend into the secondary air chamber 11 and are adapted to receive fuel mixed with primary air from the space or compartment 10 of the burner. These jets or burner tips terminate at slight distances from openings 17 and 18 in the walls of the chamber 11 so that the mixture of fuel and air discharged from the jets of burner tips 15 and 16 will mix with secondary air from the chamber 11 in passing through the openings 17 and 18. The burner tips 16 as shown are arranged at such an angle that the flames produced by these burner tips will strike against the furnace or heater wall B at an angle. The burner tips 15 are arranged at a different angle and in this particular construction are shown in substantially upright positions.

The burners illustrated in the drawings are formed in units extending lengthwise of the furnace walls but it will be understood that the burner may be of any other suitable or desired form to fit other types of furnaces or heaters and it will also be understood that burners of other constructions than those illustrated in the drawings may be employed, this invention relating not to the details of burner construction but to the relative arrangements of the jets so as to project flames in the manner described.

In the particular burner described elements or baffles D of material capable of radiating heat, are also shown as used in connection with the burner, these elements D being made of a suitable refractory composition and being supported at their lower ends on the burner C and being inclined so that their upper ends rest against the wall B of the furnace or heater, the upper ends of these elements being provided with recesses or notches 20, or other means through which the products of combustion may escape from.
the combustion space confined between the burner, the side wall B and the refractory elements D. These elements are so disposed that the flames from the upright jets will strike the refractory elements and heat the same to a high temperature at which these elements will radiate heat to the inner walls B of the furnace.

As a result of the arrangement of the two sets of jets described and in accordance with my improved method, it will be evident that the inclined jets produce flames which impinge against the inner wall B of the furnace, so that the flow of burning gases has a scrubbing or scouring effect on the inner wall B of the furnace. It is well known that a thin film of dead air ordinarily adheres quite tenaciously to any surface, and this dead air film offers a high resistance to the passage of heat therethrough. By removing this film of dead air by means of the flame from the burner tips, heat will be more readily conducted to the wall B and also the heat of convection from the flames of the burner tips will more readily penetrate the wall B of the furnace. Consequently the efficiency of the heating apparatus is improved by the joint use of these two sets of flames, and this is true even if no refractory elements are used, although the efficiency of the burner is greater if such refractory elements are employed.

Another advantage resulting from the use of the two sets of flames is that owing to the fact that the wall B quickly conducts heat to the relatively cool water or air flowing between the walls A and B, the wall will be of comparatively low temperature with reference to the temperature of the flame. This results in the cooling off of the flames from the jets or burner tips when they strike the furnace wall, and this cooling off interrupts combustion, so that a considerable amount of unburnt gases such for example, as carbon monoxide, leave the flame. These unburnt gases consequently pass upwardly with other products of combustion into proximity to the flames from the jets or burner tips which ignite these unburnt gases, and this insures complete combustion of the fuel at all times, thus enabling the burner to operate at maximum efficiency. When refractory elements are used in connection with this burner, these elements and are then deflected and mixed with any unburnt gases escaping from the flames of the burner tips, thus completing the combustion of such unburnt gases. The baffles also cause a second scrubbing or scouring of the dead air space from the wall by deflecting the flame or products of combustion from the flames from the jets together with the flames or products of combustion from the jets to impinge against the wall B.

My improved method of transferring heat from flames therfore includes the step of first directing a flame at an inclination against a wall or surface to which heat is to be transferred, to scrub or scour away the dead air film adhering to the surface. The method also includes providing a second flame, arranged so that the first flame will be between the wall and the second flame, and thus enabling heat from the second flame to be more readily transferred to the surface of the wall because of the removal of the dead air film. The final step in the process includes the bringing together of the unburnt gases discharged from the first flame and the second flame, so that complete combustion takes place. When refractory baffles are used, the baffles deflect the second flame toward the path of any unburnt gases that may be discharged from the first flame. Deflecting the products of combustion from the two flames against the wall by the refractory baffles results in a further scrubbing and scouring of the wall so that heat from the two flames is readily transferred to the wall.

Claims:

1. The combination with a heat exchanger wall, of a burner arranged with a discharge jet for directing a flame at an angle against a said wall to cause a removal of dead air film from portions of said wall contacting with said flame, a second jet arranged at a slight distance from said wall, an inclined baffle against which the flame from said second jet impinges and which deflects the flame from said second jet toward the products of combustion escaping from said first flame to consume gases unburnt because of the chilling action of said wall, said baffle becoming heated by the flame from said second jet to cause heat from said baffle to be radiated to said heat exchanger wall.

2. The combination with a heat exchanger wall, of a burner arranged with a discharge jet for directing a flame at an angle against a said wall to cause a removal of dead air film from portions of said wall contacting with said flame, a second jet arranged at a slight distance from said wall, an inclined baffle against which the flame from said second jet impinges and which deflects the flame from said second jet toward said wall, said baffle deflecting flames and products of combustion against said wall to cause removal of dead air film therefrom above the portion of said wall from which dead air film is removed by said flame from said first jet, and radiating heat to said heat exchanger wall.

3. The combination with a heat exchanger wall, a burner having cooperating jets for heating said wall, one of said jets being arranged to impinge against said wall, a baffle of refractory material arranged at an inclination to said wall, a second flame from said burner which is directed upwardly to im-
pinge against said baffle to heat the same and to cause the flame to be deflected laterally toward said wall to cause combustion of unburnt gases from said first flame, said baffle radiating heat derived from said second flame to said wall and breaking up said second flame to insure complete combustion of fuel supplied to said second flame.

4. A method of heating a heat exchange member, including deflecting a flame at an angle against said member to scrub the dead air film therefrom, providing another flame adjacent to said first flame and deflecting said second flame toward said member by means of an inclined baffle to cause heat from the second flame to be deflected to said heat exchange member and to ignite unburnt gases from said first flame, and heating said inclined baffle by said second flame to radiate heat therefrom to said heat exchange member.

5. A method of transferring heat to a surface of a heat transfer member, including directing a flame at an angle against said surface to heat the same, providing another flame adjacent to said first flame and deflecting the same laterally by an inclined baffle against said surface at a point above which said first flame is projected against said surface to cause said second flame to ignite unburnt gases discharged by said first flame, and radiating heat from said inclined deflector to said surface.

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