MULTINOZZLE GAS BURNER FOR LARGE AND MEDIUM HEAT TREATMENT FURNACE

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The gas burners used for large and medium-size heat treatment furnaces are not constructed to allow desired changes in temperature. Some of the burners must be turned off to decrease the temperature and turned on to increase the temperature. Such a method of controlling temperature leads to irregular heating of the metal, complicates the work of the personnel, and also makes it difficult to automate heating furnaces.

We have developed a new gas burner* in which the gas and air pressures remain constant and independent of the load all the way through the furnace. This arrangement ensures a rather high rate of flow, stable burning, and good regulation of the temperature.

The burner works in the following way (see Fig. 1). The gas is admitted into chamber 4 and the air into chamber 2. Then air and gas (each along six different channels) flow to the head of the nozzle 6 and then to the hood 7. For better mixing of the gas and air, they leave the nozzles at angles of 34° to each other. From the hood 7 the gas-air mixture arrives in the tunnel 8 where burning occurs. Sectional gas shutters 5 and air shutter 3 are fixed on the shaft 1. When the shaft turns, the shutters gradually close the openings 9 and 10, varying the supply of gas and air. The outlets 9 are shaped so that there is a proportionality between the expenditure of gas and the angle of rotation of the shutter. The outlet 10 of the air chamber is not shaped, since the cross sections of the air channels are the same along the entire length, and the rate of flow at the outlets is very high.

*Author's Certificate No. 153993, Byulleten' izobretenii, 1963, No. 8.
Tests with an experimental burner showed that the expenditure of the gas and the air is low (Fig. 2).

The sockets of the shutters are made of anti-friction cast iron and rotate together with the section; to avoid misalignment, they move freely along the shaft 1 of the burner (see Fig. 1). The shutters are spring mounted.

The diameters of the nozzles are selected so that 20% of the gas and air pass through the open channels. This ratio between the cross sections ensures fine regulation (angle of rotation of the shutter) at low temperatures. This is particularly important, since the dependence of the stabilized temperature of the furnace on the amount of fuel consumed is not linear.

Stable burning at low temperatures is ensured by increasing the length of the cylindrical front part of the burning tunnel 8, since burning occurs at this point in the case of low output.

The structure of the burner is such that one can maintain a constant gas pressure and air pressure in the chambers and regulate the efficiency within a wide range. This is done by regulating the amount of gas passing through the channels with the shutters; the channels allow 20% of the main amount of gas and air to pass when the other channels are completely closed.

Tests showed that burning is steady when the output is regulated at 1 : 18 (ratio between the minimum and maximum amounts of gas and air spent). A constant temperature can be maintained in the combustion chamber at temperatures between 1100 and 350°C (Fig. 3). A constant temperature of 1100°C corresponds to 60% of the maximum output, i.e., there is a reserve for forced conditions in case an increase in temperature is wanted. Thus, the use of these new burners makes it possible to maintain constant temperatures between 1100 and 350°C without turning off the burner.

Aside from regulating the output, this burner ensures a constant gas-air ratio under all working conditions (see Fig. 2) if the gas and air pressures in the supply lines are constant. This is possible with the use of natural gas if the department has central distribution and individual pressure regulators.

For automatic or remote control, each burner has a pneumatic actuating mechanism 11 (see Fig. 1). The rod of the actuating mechanism is connected to the lever 12 of the shaft of the burner. The burner can be controlled by hand if necessary; the rod of the actuating mechanism is then disconnected.

Twenty such burners were installed in one of the large heat treatment furnaces of the Novo-Kramatorsk Machine Construction Plant in place of the turbulent burners of the GNP type. The technical characteristics of the burners for this furnace are as follows: