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THE USING OF REGENERATIVE SUPPLY VENTILATION ELEMENTS TO ENSURE THE REQUIRED AIR EXCHANGE IN PREMISES BUILDINGS OF HIGH INTEGRITY

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In work questions of air supply ensuring of rooms in buildings of the increased tightness are considered. The description of a design, a way of installation and the principle of work of a recuperative affluent ventilating element are provided.

When designing residential buildings the increased sealing of the external protecting designs is provided. External walls, windows and overlappings have the high resistance to a heat transfer, and also low coefficients of air permeability. At installation of windows with a plastic profile air exchange of rooms doesn't meet sanitary standards. If it isn't enough to warm the building and/or not to provide necessary amount of the ventilated air, then condensate of warm internal air is formed. It leads to development of fungus and mold on internal surfaces of the cold protecting designs. The premises of such buildings almost miss the outside air due to infiltration through leakages in building structures.

Now at household gas supply the gas equipment, combustion of gas in which is carried out in fire chambers of devices of various designs (coppers, water heaters, heat capacious furnaces, etc.), and also in gas stoves, is used. The usage of this or that method of burning depends on the thermal power of the gas device determining quantity of the allocated combustion products. In case of an open method of gas combustion its products due to natural ventilation are diluted to safe concentration. In case of the closed combustion chamber products of combustion are removed from rooms by means of special ventilating channels.

The importance for ensuring safe use of household gas appliances is ensuring giving of enough air on burning of gas and complete removal of products of combustion from rooms in the atmosphere.

Natural ventilation through open windows, doors, lattices and other provided designs depends on weather conditions – differences of temperatures of internal and external air, wind speed. Removal of air from rooms is possible in the presence of a difference of pressure:

$$\Delta P = g \cdot h \cdot \left(\rho_{н} - \rho_{в}\right) \quad (1)$$

where g – acceleration of gravity, m/c^2;

h – vertical distance from the center of an exhaust lattice to the mouth of the exhaust mine, m;

$\rho_{н}$ – density of external air, kg/m^3;

$\rho_{в}$ – density of internal air, kg/m^3.

The air for burning, necessary for gas combustion is desirable to be given artificially. For 1 m^3 of natural gas about 10 m^3 of air are required. There are systems with installation of fans in the served rooms. Mechanical ventilation can provide the required quantity, however it consumes energy.

In case of operation of the gas equipment there can be adverse conditions of a microclimate of rooms connected with the increase in concentration of products of combustion in air of rooms. As a result of the requirement of sanitary standards for separate components aren't carried out.

This situation is aggravated during the cold period of a year when airing of rooms is almost impossible. Low temperatures of outside air lead to the increased discharge in chimney channels which in turn influences the stability of a flame and a completeness of gas combustion in cameras of boilers and water heaters.

Thus, the organization of the forced and exhaust ventilation with air supply to rooms where the gas-using equipment is installed is an important question of design.

In residential buildings with gas stoves with 4 torches air exchange has to make not less than 90 m3/h. In case of infiltration, according to the payment under regulating documents, accomplishment of this requirement is observed only for the ground three floors of a ten-storied building.

There is a design of the ventilating block for supply of external air to rooms given in figure 1. The Recuperative Affluent Ventilating Element (RAVE) allows to provide necessary air exchange for an optimum microclimate. RAVE is made of concrete in the form of a parallelepiped 100×100×300 mm with the openings with a diameter of 1,5–5,0 mm [1]. The number of blocks, number and diameter of openings is selected according to ensuring the required air exchange of the room.

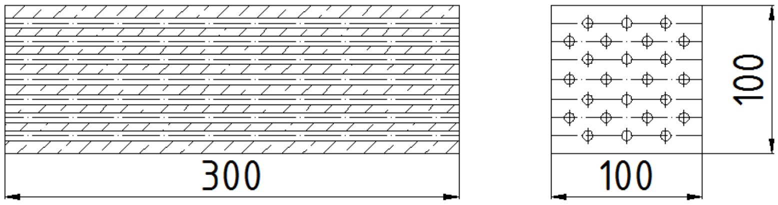
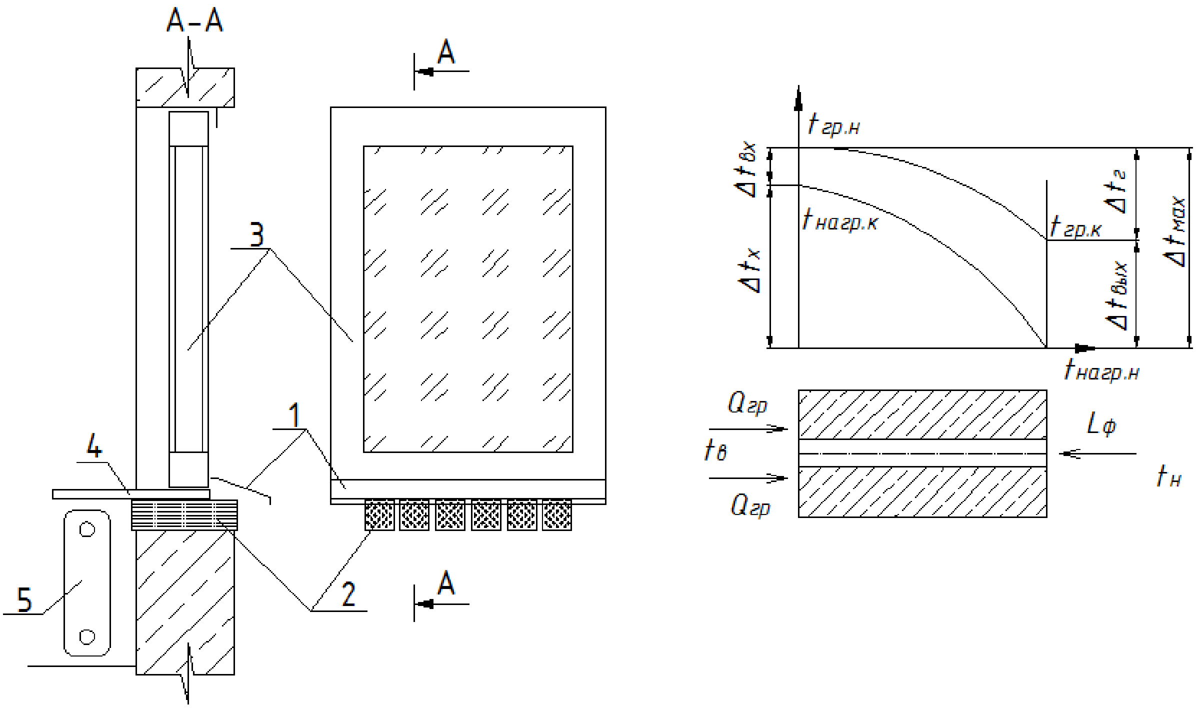


Fig. 1 – Design of a recuperative affluent ventilating element

The block is installed in an external wall under a windowsill plate and works as the heat exchanger (Fig. 2, *a*). The thermal stream moves in the direction to an opposite direction of the movement of external air. Longitudinal openings are the heat exchanging surfaces. External air gets in the room and at the same time there is its heating. Thus, observance of the required air exchange without considerable costs for heating of external affluent air is indoors provided. The process flow diagram of the RAVE counter flow heat exchanger and the schedule of change of temperature in it the heat exchanging environments along the surface of heating is provided on Fig. 2, *b*.



a *b*

Fig. 2. The scheme of the RAVE installation on an external wall of the building and schedules of temperature changes in RAVE: 1 – window outflow, 2 – affluent ventilation block RAVE, 3 – window frame, 4 – windowsill plate, 5 – heating device.

The heatmass-exchanged processes proceeding in the recuperative affluent ventilating concrete block (RAVE) have a significant effect on formation of a microclimate of rooms. The directed filtration of cold external air in RAVE channels arising under the influence of the main thermal and additional wind pressures, intensifies heat exchange and causes the shift of the temperature field in comparison with a thermal condition of an external protection in the absence of filtration [2].

Considering the supply unit RAVE as the heat exchanger working according to the counter flow diagram in case of varying duties it is difficult to define an average difference of temperatures Δt_{cp} of the heat exchanging heat carriers since their temperatures t_{in} and t_{out} are unknown. For the solution of this task the method of calculation of heat exchange devices for dimensionless complexes is used [3].

The usage of RAVE blocks as air affluent devices provides a required consumption of affluent air to the ventilated rooms of the increased integrity and economy of energy resources due to recovery of transmission warmth, and also allows to reduce risk of emergence of the raised gas contamination of rooms with the gas-using equipment.

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