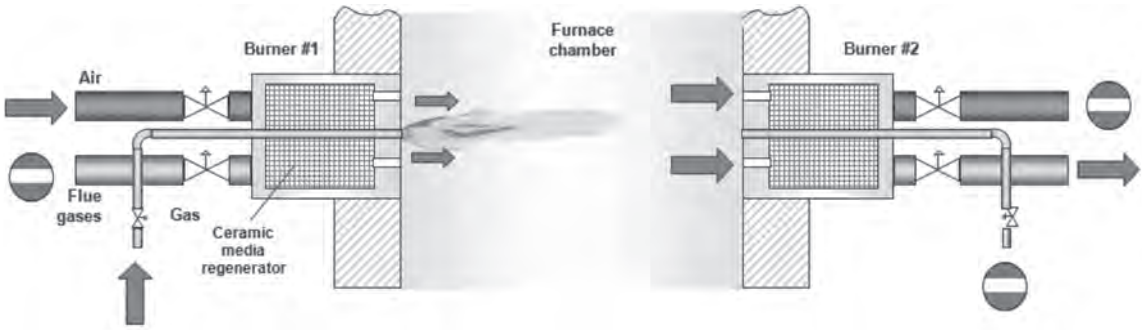

Fig. 8.11 Regenerative burners.

distribution of the air to the combustion zones or provide a return to direct the air into another bank of tubes for an additional pass. The more passes incorporated into the design, the hotter the combustion air preheat.

Recuperators usually require several protection systems that must be incorporated to protect against overheating the heat exchangers. The two most common are "dilution air" and "hot air bleed." Dilution air is cold ambient air that is injected into the waste gas stream to lower the incoming waste gas temperature in case it exceeds the design levels. A dedicated dilution air fan and control valve are provided to handle this duty. The other protection is called hot air bleed. During periods when the combustion air flow through the recuperator is not sufficient to remove heat from the tube banks, a controlled vent valve in the hot combustion air pipe is opened to bleed air and heat out of the system.

8.1.1.13 Regenerative Burners

An alternative energy recovery system used in some reheat furnaces involves regenerative burners. Regenerative burners are designed with a thermal media that can efficiently absorb heat from a stream of waste gases and temporarily store it. The media is typically made up of ceramic balls or honeycombs. After the media is sufficiently heated, the flow of gases is reversed and combustion air is blown across it, thus pulling the heat out of the media and returning it to the combustion process. Regenerative burners usually work in pairs, as shown in Fig. 8.11. In this example, burner No. 1 is in firing mode while burner No. 2 is in exhausting mode. Burner No. 1 is firing with its combustion air blowing across the already hot burner No. 1 media, resulting in air preheat temperatures of about 300°F less than the furnace chamber temperature.

Meanwhile, burner No. 2 is drawing the hot exhaust gases out of the furnace across the burner No. 2 media, heating up the media and cooling the exhaust gases. After a period of about 30–60 seconds, the burners switch. The high air preheat temperature makes the combustion process very efficient because the flames do not have to heat the combustion air to the furnace operating temperature.

A regenerative burner system involves the burners, ceramic media, media cases, switching valve, exhaust ductwork, and combustion air and exhaust blowers.

8.1.1.14 Cooling System

With the hot temperatures experienced inside of the reheat furnaces, certain components must receive water-cooling to retain structural integrity. The most significant such components are the horizontal skid pipes and cross pipes and vertical riser pipes of a pusher or walking beam furnace. Though they are usually lagged or covered with insulating refractory materials, it is essential that they be cooled to provide the required structural integrity to support and convey the product load through the furnace. Also, horizontal skids typically utilize a hot rider or rider bar. The purpose of this is to serve as the contact surface for the product resting on the skids. Rider bars for pusher furnaces must be able to endure the abrasion of the product sliding across its top surface. On walking beam furnaces, the hot rider is designed to lessen the transfer of heat from the product to the skid pipe cooling water and to minimize the cold spots (skidmarks) that form during heating.

The other commonly water-cooled components of a reheat furnace are "in-furnace" rolls used for charging or discharging product from the furnace. There are many different designs for the rolls, including the flow circuits and geometry. The key, however, for both the skids and the rolls is to ensure an adequate flow of cold, clean water. The flow needs to be clean so as to prevent fouling. If enough fouling develops inside of the components, the cooling heat transfer effect will be compromised, which will ultimately lead to a failure. The water must be also be cold and sufficient to carry water at a velocity to prevent localized boiling pockets which may result in a premature failure. This will also minimize the