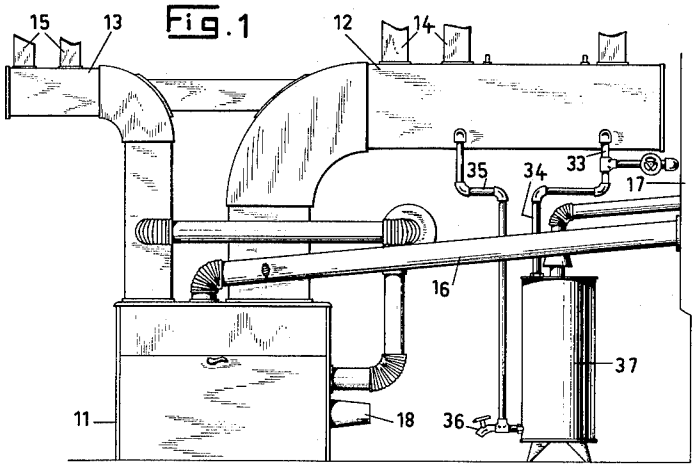
Aug. 3, 1965 H. GORDON 3,198,190

REGENERATIVE AIR HEATING SYSTEM

Filed Sept. 6, 1963

Fig. 1



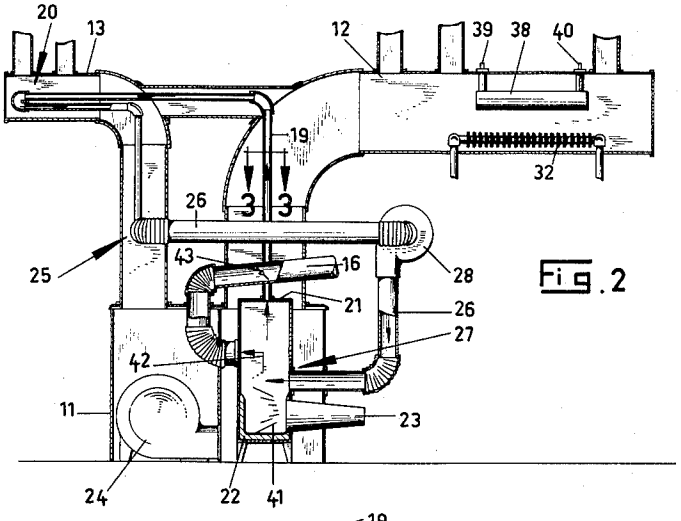
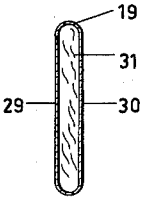


Fig. 2

Fig. 3



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REGENERATIVE AIR HEATING SYSTEM

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This invention relates to heating systems which utilize combustion chambers for burning fuel therein and are provided with a warm air heating system for distributing the heat throughout a dwelling or the like.

It is common practice to employ warm air heating systems for heating homes, small commercial buildings and the like. The furnace usually comprises a combustion chamber fitted with a fuel burner and a heat exchanger in conjunction with the combustion chamber, said heat exchanger projecting into a moving air stream whereby the heat from the products of combustion are distributed throughout the heating system. A disadvantage often found in using such systems is the fact that much of the heat from the products of combustion escapes up the vent or chimney.

Many prior types of systems and devices have been proposed having the main object the prevention of escape of this heat. Such prior devices normally employ a secondary heat exchanger whereby it is hoped that the additional heat from the products of combustion may be extracted before such products are vented to the chimney. One disadvantage of this prior method is the fact that very often the combustion gases are cooled to a temperature which is too low for proper ventilation of said gases to said chimney. In order to vent properly the fuel gases must be at a certain temperature in order to create sufficient draught within the chimney and cooling to a too low temperature will prevent proper venting.

Still other prior methods utilize many additional passages of air in and around the heat exchanger whereby it is hoped that the additional heat may be extracted from the flue gases. In most cases however, the chimney type is of such large diameter that the gases towards the centre of the pipe escape therethrough without losing too much heat to the surrounding heat exchanger. Attempts at reducing the flue pipe diameter result in poor venting and the backing up of dangerous carbon monoxide gases within the combustion chamber with the constant result that there is an increased danger of these poisonous gases escaping into the air system.

Accordingly, it is an object of the present invention to provide a regenerative heating system wherein economy of cost of operation is achieved while still permitting proper ventilation of the spent combustion gases.

It is a further object of this invention to provide a regenerative heating system wherein the amount of carbon monoxide within the flue gases is reduced to a minimum.

It is a still further object of this invention to provide a regenerative heating system having auxiliary means of maintaining the heat output of the system during the time in which the burner is in the off condition.

It is a still further object of this invention to provide a regenerative heating system which employs a second circulation system for combustion gases which, besides adding additional heat to the air circulation system of a furnace, also enables a reduction in the carbon monoxide content of the gases.

The invention seeks to achieve these and other objects and features such as will be apparent from the following detailed description and accompanying drawings in which like numerals refer to like parts by the provision of a combustion chamber, including heat exchanger, a chimney pipe defining an exit from said heat exchanger whereby spent products of combustion are vented to atmosphere, a plenum including an extension about said heat exchanger thereby to provide an air circulation system, a preheat pipe having a substantially flat, hollow configuration and extending from said heat exchanger and into said plenum extension to define a circulation system for hot gases from said heat exchanger, and pipe means connecting the distal end of said preheat pipe to said combustion chamber whereby said hot gases are recombusted to reduce carbon monoxide therein.

In the drawings:

FIG. 1 is an elevation view of a presently preferred embodiment of the invention and particularly illustrates the arrangement of the air circulation system and of the flue gas circulation system.

FIG. 2 is a side elevation of the system as illustrated in FIG. 1 and illustrates the flue circulation system in more detail and also shows the relationship of the auxiliary heating means.

FIG. 3 is a section along the line 3—3 in FIG. 2 and illustrates the configuration of the preheat pipe used in the gas circulation system.

Referring to FIG. 1 the instant invention comprises a furnace 11 provided with a hot air plenum 12 and a cold air plenum 13. Hot air plenum 12 is provided with a number of air distribution ducts 14 and cold air plenum 13 is provided with a number of air collection ducts 15. A horizontal connecting plenum interconnects the hot air plenum 12 with the cold air plenum 13 above furnace 11.

Furnace 11 is also provided with a chimney pipe 16 which vents into chimney 17 the products of combustion from a fuel burner 18 located in the base of furnace 11. Having reference to FIGS. 1 and 2 the combustion gas circulation system is illustrated and comprises a preheat pipe 19 extending vertically upward into hot air plenum 12 and horizontally through the connecting plenum. End 20 has a hair pin shape extending into the cold air plenum 13. Preheat pipe 19 is connected to the heat exchanger 21 within furnace 11, whereby the products of combustion may enter the preheat pipe 19 for circulation within the pipe thus giving off heat into the air in cold air plenum 13 and in warm air plenum 12.

Heat exchanger 21 is mounted on a combustion chamber 22 which also supports a fuel burner 23, said burner adapted to project burning fuel into the combustion chamber 22 to release heat into heat exchanger 21. As is conventional a fan 24 provides air circulation within the plenum 12 and 13 for distribution and collection by the ducts 14 and 15 as aforementioned.

The remote or distal end 25 of pipe 19 is connected to a return pipe 26 which is adapted to return the products of combustion into the combustion chamber at 27 whereby carbon monoxide still within the combustion gases is further broken down by the burning fuel from the burner 23. In order to ensure continuous circulation of combustion gases through the pipe 19 a blower 28 is provided on pipe 26 whereby forced circulation of the hot gases within the gas circulation system is ensured.

Referring to FIG. 3, the section of preheat pipe 19 is illustrated. It will be seen that pipe 19 is a substantially flat hollow configuration the sides 29 and 30 being comparatively close together whereby the hot gases 31 within the pipe 19 are forced to move quite close to either side 29 or 30 thereby affecting efficient heat exchange. The flat configuration of the pipe 19 as illustrated in FIG. 3 also enables the system to be installed within the plenums 12 and 13 with a minimum of restriction to the air flow therethrough.

Having further reference to FIGS. 1 and 2, it will be seen that a water filled radiator 32 is provided within the hot air plenum 12, said radiator being supplied with hot

water by means of pipe extension 33 from the hot water pipe 34. A return pipe 35 provides for recirculation of the cool water back into the lower connection 36 of the water heater 37 which was the conventional water heater for kitchen and bathroom supply. Thus during periods when the burner 23 is off, additional heat may be provided into the heating system by means of the hot water contained in the water tank 37. The hot water is maintained within the tank 37 for use at all times and thus would always be available to act as an auxiliary means of heating.

Upon the hot water not being available or upon such a system being desirable an auxiliary heater may be provided by way of the resistance heater 38 shown in FIG. 2, this heater being provided with electrical connections 39 and 40 and suitable switch means (not shown) whereby auxiliary heat may be selected at any time.

In operation the burner 23 projects the burning fuel 41 into the combustion chamber 22, the products of combustion moving upwardly into the heat exchanger 21. The hot gases then move into the preheat pipe 19 and are circulated through the hair pin end 20 and returned via pipe 26 into the combustion chamber at the point 27. The gases then mix with the burning fuel 41 and are recombusted thereby to reduce the amount of carbon monoxide therein and thus add additional heat to the system by the burning of the carbon monoxide.

A proportioned amount of the spent gases as indicated by the arrows 42 are vented through the chimney pipe 16. In order to control the amount of gases which are vented through to the pipe 16 a damper 43 is installed therein and may be manually adjusted to control the amount of combustion gas escaping into the chimney 17.

During circulation of the hot gases within the pipe 19, air is circulated through the chambers 12 and 13 by means of the fan 24 thereby extracting heat from the surface of the pipe 19. This reduces the temperature of the gases which exit at the end 25 and thus the gases which pass through the blower 28 are reduced in temperature and for this reason will not tend to damage the blower 28. Also, the gases being of a lower temperature have increased density and thus provide a better burning mixture at the position 27 of the combustion chamber 22.

From the foregoing it will be seen that the present invention provides a means of increasing the economy of a heating system and at the same time reducing the likelihood of poisonous gases being generated or vented into the chimney. Besides extracting additional heat from the chimney gases the system also provides economy by burning the poisonous carbon monoxide gases thereby to gain additional heat.

It will be understood that although specific embodiments of this invention have herein been described and illustrated, the invention also contemplates such variations in design as may fall within the scope of the subjoined claims.

The embodiments of this invention in which an exclusive property or privilege is claimed are defined as follows:

1. A regenerative heating system for use with warm air heating systems of the fuel combustion type and comprising a combustion chamber, including a heat exchanger; a chimney pipe defining an exit from said heat exchanger, whereby spent products of combustion are vented to atmosphere; a hot air plenum and a cold air plenum, said hot air plenum including an extension about said heat exchanger, thereby to provide an air circulation system; a horizontal connecting plenum between said hot air plenum and said cold air plenum; a preheat pipe having a substantially flat, hollow configuration extending vertically upward from said heat exchanger into said hot air plenum extension and horizontally through said connecting plenum into said cold air plenum to define a circulation system for hot gases from said heat exchanger; and pipe means connecting the distal end of said preheat pipe to said combustion chamber, whereby said hot gases are re-combusted to reduce carbon monoxide therein.

2. A regenerative heating system for use with warm air heating systems of the fuel combustion type and comprising a combustion chamber, including a heat exchanger; a chimney pipe defining an exit from said heat exchanger, whereby spent products of combustion are vented to atmosphere; a damper valve in said chimney pipe to control the rate of venting said combustion products; a hot air plenum and a cold air plenum, said hot air plenum including an extension about said heat exchanger, thereby to provide an air circulation system; a horizontal connecting plenum between said hot air plenum and said cold air plenum; a preheat pipe having a substantially flat, hollow configuration extending vertically upward from said heat exchanger into said plenum extension and horizontally through said connecting plenum into said cold air plenum to define a circulation system for hot gases from said heat exchanger; and pipe means connecting the distal end of said preheat pipe to said combustion chamber, whereby said hot gases are re-combusted to reduce carbon monoxide therein.

3. A regenerative heating system for use with warm air heating systems of the fuel combustion type and comprising a combustion chamber, including a heat exchanger; a chimney pipe defining an exit from said heat exchanger, whereby spent products of combustion are vented to atmosphere; a hot air plenum and a cold air plenum, said hot air plenum including an extension about said heat exchanger, thereby to provide an air circulation system; a horizontal connecting plenum between said hot air plenum and said cold air plenum; a preheat pipe having a substantially flat, hollow configuration extending vertically upward from said heat exchanger into said plenum extension and horizontally through said connecting plenum into said cold air plenum to define a circulation system for hot gases from said heat exchanger; pipe means connecting the distal end of said preheat pipe to said combustion chamber, whereby said hot gases are re-combusted to reduce carbon monoxide therein; and a forced draft fan in said pipe means to force circulation of said hot gases in said preheat pipe.

4. A regenerative heating system for use with warm air heating systems of the fuel combustion type and comprising a combustion chamber, including a heat exchanger; a chimney pipe defining an exit from said heat exchanger whereby spent products of combustion are vented to atmosphere; a hot air plenum and a cold air plenum, said hot air plenum including an extension about said heat exchanger, thereby to provide an air circulation system; a horizontal connecting plenum between said hot air plenum and said cold air plenum; a preheat pipe having a substantially flat, hollow configuration extending vertically upward from said heat exchanger into said plenum extension and horizontally through said connecting plenum into said cold air plenum to define a circulation system for hot gases from said heat exchanger; pipe means connecting the distal end of said preheat pipe to said combustion chamber, whereby said hot gases are re-combusted to reduce carbon monoxide therein; and auxiliary heating means in said hot air plenum.

5. A regenerative heating system for use with warm air heating systems of the fuel combustion type and comprising a combustion chamber, including a heat exchanger; a chimney pipe defining an exit from said heat exchanger, whereby spent products of combustion are vented to atmosphere; a hot air plenum and a cold air plenum, said hot air plenum including an extension about said heat exchanger, thereby to provide an air circulation system; a horizontal connecting plenum between said hot air plenum and said cold air plenum; a preheat pipe having a substantially flat, hollow configuration extending vertically upward from said heat exchanger into said plenum extension and horizontally through said

connecting plenum into said cold air plenum to define a circulation system for hot gases from said heat exchanger; pipe means connecting the distal end of said preheat pipe to said combustion chamber, whereby said hot gases are re-combusted to reduce carbon monoxide therein; a water filled radiator in said hot air plenum; and circulating pipes connecting said radiator to a hot water supply, thereby to aid in heating said air.

6. A regenerative heating system for use with warm air heating systems of the fuel combustion type and comprising a combustion chamber, including a heat exchanger; a chimney pipe defining an exit from said heat exchanger, whereby spent products of combustion are vented to atmosphere; a hot air plenum and a cold air plenum, said hot air plenum including an extension about said heat exchanger, thereby to provide an air circulation system; a horizontal connecting plenum between said hot air plenum and sair cold air plenum; a preheat pipe having a substantially flat, hollow configuration extending vertically upward from said heat exchanger into said plenum extension and horizontally through said connecting plenum into said cold air plenum to define a circulation system for hot gases from said heat exchanger; pipe means connecting the distal end of said preheat pipe to said combustion chamber, whereby said hot gases are re-combusted to reduce carbon monoxide therein; and an electric resistance type heater in said hot air plenum to further heat said air.

7. A regenerative heating system for use with warm air heating systems of the fuel combustion type and comprising a combustion chamber, including a heat exchanger; a chimney pipe defining an exit from said heat exchanger, whereby spent products of combustion are vented to atmosphere; a hot air plenum and a cold air plenum, said hot air plenum including an extension about said heat exchanger, thereby to provide an air circulation system; a horizontal connecting plenum between said hot air plenum and said cold air plenum; a preheat pipe having a substantially flat, hollow configuration extending vertically upward from said heat exchanger into said plenum extension and horizontally through said connecting plenum into said cold air plenum to define a circulation system for hot gases from said heat exchanger; pipe means

connecting the distal end of said preheat pipe to said combustion chamber, whereby said hot gases are recombusted to reduce carbon monoxide therein; a water filled radiator in said hot air plenum; circulating pipes connecting said radiator to a hot water supply, thereby to aid in heating said air; and an electric resistance type heater in said hot air plenum to further heat said air.

8. A regenerative heating system for use with warm air heating systems of the fuel combustion type and comprising a combustion chamber, including a heat exchanger; a chimney pipe defining an exit from said heat exchanger, whereby spent products of combustion are vented to atmosphere; a damper valve in said chimney pipe to control the rate of venting said combustion products; a hot air plenum and a cold air plenum, said hot air plenum and including an extension about said heat exchanger, thereby to provide an air circulation system; a horizontal connecting plenum between said hot air plenum and said cold air plenum; a preheat pipe having a substantially flat, hollow configuration extending vertically upward from said heat exchanger into said plenum extension and horizontally through said connecting plenum into said cold air plenum to define a circulation system for hot gases from said heat exchanger; pipe means connecting the distal end of said preheat pipe to said combustion chamber, whereby said hot gases are re-combusted to reduce carbon monoxide therein; a forced draft fan in said pipe means to force circulation of said hot gases in said preheat pipe; a water filled radiator in said hot air plenum; circulating pipes connecting said radiator to a hot water supply, thereby to aid in heating said air; and an electric resistance type heater in said hot air plenum to further heat said air.

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