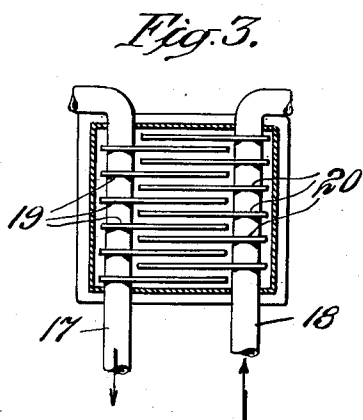
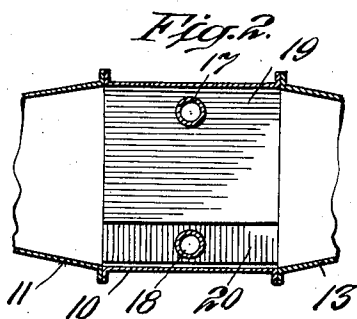
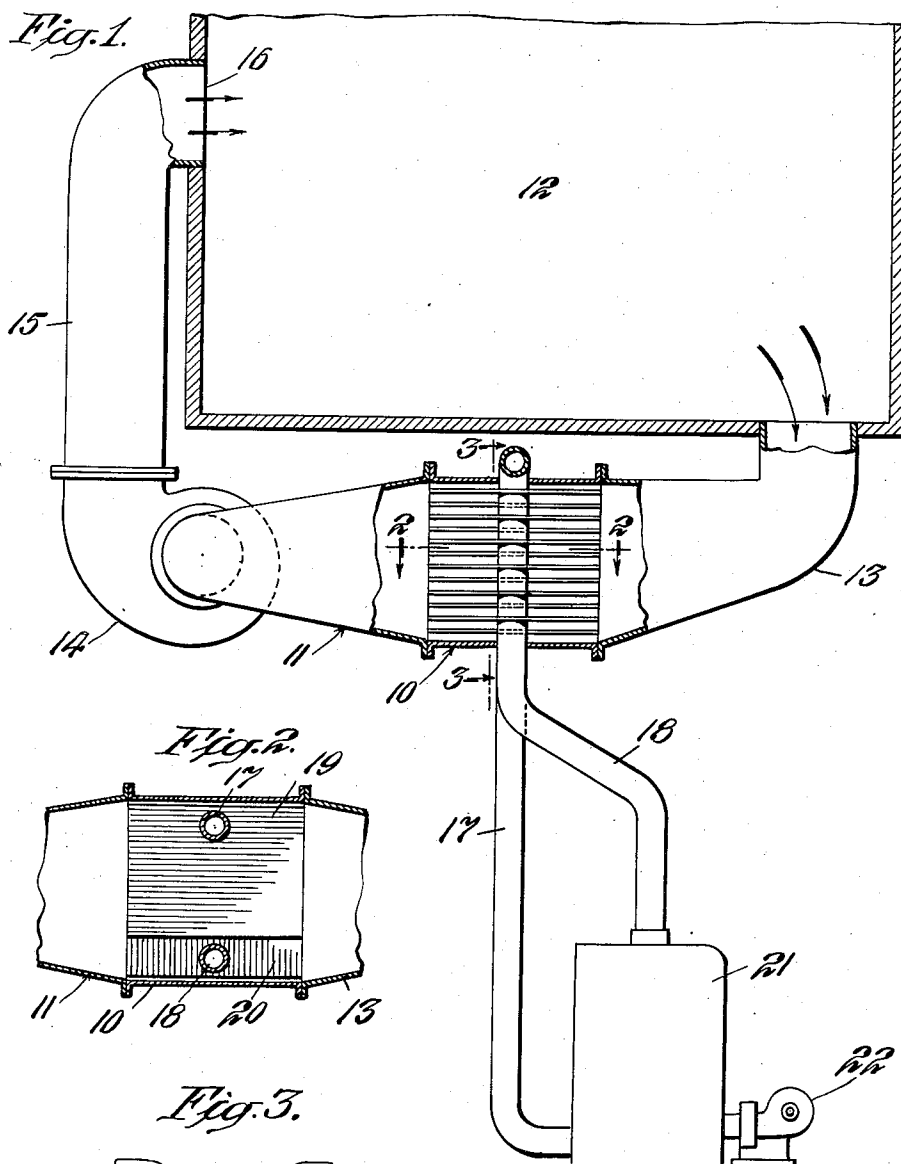


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AIR CLEANING AND CONDITIONING
BY THERMAL PRECIPITATION
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AIR CLEANING AND CONDITIONING BY THERMAL PRECIPITATION

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2 Claims. (Cl. 183—32)

This invention relates to a method of and apparatus for cleaning and tempering air or other gases.

Solid particles suspended in a gas or air stream in which a temperature gradient exists are subject to molecular forces which tend to cause the particles to move in the direction of decreasing air temperature. This phenomenon is explained by assuming that the particles are bombarded on one side by hot rapidly moving air molecules and on the other side by colder molecules moving at somewhat slower velocities. Where temperature gradients exist in the air, dust and smoke particles tend to be precipitated on nearly cold surfaces. This phenomenon is known as thermal precipitation. In accordance with this invention, I have devised a method and apparatus employing this phenomenon for simultaneously cleaning and heating or cooling air or other gases.

The invention together with its objects and advantages will be readily apparent from the following detailed description taken in conjunction with the accompanying drawing, in which:

Fig. 1 is a more or less schematic illustration of an air conditioning apparatus embodying my invention;

Fig. 2 is a horizontal section taken on line 2—2 of Fig. 1; and

Fig. 3 is a vertical section taken on line 3—3 of Fig. 1.

Referring now to the drawing, a precipitator 10, to be referred to in more detail hereinafter, is mounted in a ventilating duct 11 for conditioning air supplied to a room or enclosure 12. One end 13 of the duct 11 is shown connected to an outlet from the room 12 and the opposite end of the duct is connected to a fan or blower 14. A conduit 15 connects the blower 14 to an inlet 16 for the room 12.

In accordance with my invention, the precipitator 10 includes primarily a conduit 17 for flow of a cooling medium, a conduit 18 for flow of a heating medium, and a plurality of flat metal heat transfer fins 19 and 20 connected in good thermal contact with the conduits 17 and 18, respectively. The fins 19 and 20 are interleaved and are so spaced as to form shallow air passages therebetween. For clarity of illustration, the spacing of the heat transfer fins 19 and 20 is exaggerated in Figs. 1 and 3. When used with domestic air conditioning, for example, the opposing faces of the fins 19 and 20 should be spaced from 0.050 to 0.20 inch. The spacing of the fins, of course, is governed by a particular installation. It is essential, however, that there be no direct thermal contact between the fins 19 and 20.

As an illustration of one practical embodiment of the invention, the inlet of conduit 17 is open to outside air and the outlet of this conduit is connected to deliver air for combustion to a source of heat, such as a combustion chamber 21. The inlet of conduit 18 is connected to receive hot products of combustion from the combustion chamber 21 and the outlet of conduit 18 discharges to the outside air. The arrangement is such that flow of the hot products of combustion through the conduit 18 causes flow of outside air into and through the conduit

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17. A fuel burner 22 supplies fuel, either liquid or gaseous, to the combustion chamber 21. As shown, the conduit 17 is connected to the combustion chamber 21 in a manner to supply secondary air to the burner 22. However, the conduit 17 may be connected directly to the burner 22 so as to supply primary air thereto.

In operation, outside air to support combustion is drawn through conduit 17 to the combustion chamber 21 and the hot products of combustion pass from the combustion chamber through the conduit 18 to the outside. In this way, the heat transfer fins 19, which are connected to conduit 17, are cooled to a moderate temperature and the heat transfer fins 20, which are connected to the conduit 18, are heated to a relatively high temperature. Any heat leakage between the two sets of fins 19 and 20 serves to preheat the air flowing to the combustion chamber 21. Assuming that the blower 14 is in operation, the air to be cleaned and tempered passes from the enclosure 12 through the duct 13, the precipitator 10, the duct 11, the blower 14 and the conduit 15 back to the enclosure 12. The cooling of the fins 19 and the heating of the fins 20 establishes sharp temperature gradients through the air between these fins. The air to be cleaned and tempered passes through the shallow channels between the fins 19 and 20 and so sharp temperature gradients are established through this air stream. Wherefore, the air, in the particular illustration in the drawing, is heated by the hot fins and dust and smoke particles are precipitated on the cold fins. The dust and smoke particles may from time to time be removed from the cold fins by any suitable means, not shown. The air velocity through the channels formed by the fins 19 and 20 should be quite low. For example, in the illustrated embodiment of my invention, the air velocity through these channels should be of the order of one foot per second.

Whether the air to be conditioned is heated or cooled in passing through the precipitator 10 will depend upon the temperature of the heating and the cooling media that flow through the conduits 18 and 17, respectively. In the embodiment illustrated in the drawing, hot products of combustion flow through conduit 18 and outside air flows through conduit 17, therefore the air that is circulated between the room 12 and the precipitator 10 will be heated. If, however, the heat transfer fins 19 be maintained at a relatively low temperature, as by a refrigerating apparatus, and the heat transfer fins 20 be maintained at a moderate temperature, as by outside air, then the air circulated between the room 12 and the precipitator 10 will be cooled. The precipitator 10 will operate just as well on summer cooling as on winter heating, for as long as there is a sufficient temperature gradient through the air that is being conditioned, whether it is obtained through heating or refrigeration, the dust and smoke will precipitate on the cold surface.

It is to be noted that in the illustrated embodiment of my invention, the source of heat—the combustion chamber 21—is connected to the cold heat transfer fins 19 through the conduit 17, and the same source of heat is also connected to the hot heat transfer fins 20 through the conduit 18. In other words, the heat source draws cold air through conduit 17 to cool the fins 19 and the same source of heat delivers hot products of combustion through conduit 18 to heat the heat transfer fins 20. In this manner, the air that is necessary to support combustion of the fuel—gas or oil—delivered to the burner 22 is used to cool the heat transfer fins 19, and the hot products of combustion are used to heat the heat transfer fins 20. With this arrangement a considerable saving in heat is accomplished.

While I have illustrated but one embodiment of my invention, it is evident that the invention may be employed to heat or cool a small amount of fresh outside air for

mixture with a larger amount of the circulated air. It is also evident that the cold surfaces may be kept cold, for example, by the use of cooling water, by the circulation and rejection of cold outside air, or by refrigeration, and the hot surfaces may be heated by steam, waste heat, warm outside air, or the like, depending upon the particular installation and upon whether it is desired to heat or cool the air that is being conditioned.

Various other modifications and changes may be made within the scope of the invention as set forth in the following claims.

I claim:

1. In an apparatus for cleaning air, a duct for flow of air, a plurality of interleaved heat transfer surfaces arranged in said duct for flow of air therebetween, and means for heating certain of said heat transfer surfaces and for cooling certain other of said heat transfer surfaces for maintaining alternate of said heat transfer surfaces at different temperatures whereby a temperature gradient is established in the air passing between said heat transfer surfaces, which air is heated by the warmer of said surfaces and cooled by the cooler of said surfaces, and dust and smoke particles are precipitated on the cooler of said surfaces.

2. In an apparatus for cleaning air, a duct for flow of air to be cleaned, a plurality of closely spaced heat transfer surfaces arranged in said duct for flow of air there-

between, a combustion heater thermally connected to one of said surfaces to maintain such surface at an elevated temperature, a second duct independent of said first duct for conducting in a separate path of flow air to said heater for combustion, and said second duct being thermally connected to another of said surfaces closely adjacent said one of said surfaces to maintain said another surface at a lower temperature, the temperature differential between said closely adjacent surfaces causing thermal precipitation of dust and smoke particles on the lower temperature surface.

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