Nov. 17, 1931. E. STEIN 1,832,151

APPARATUS FOR HEATING AND DRYING WALLS

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Fig. 1.

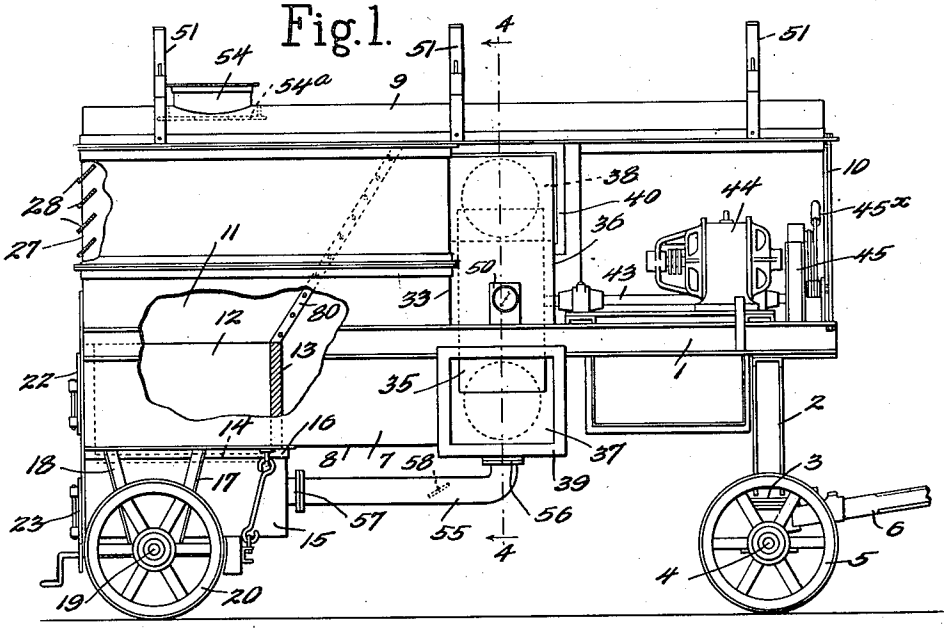
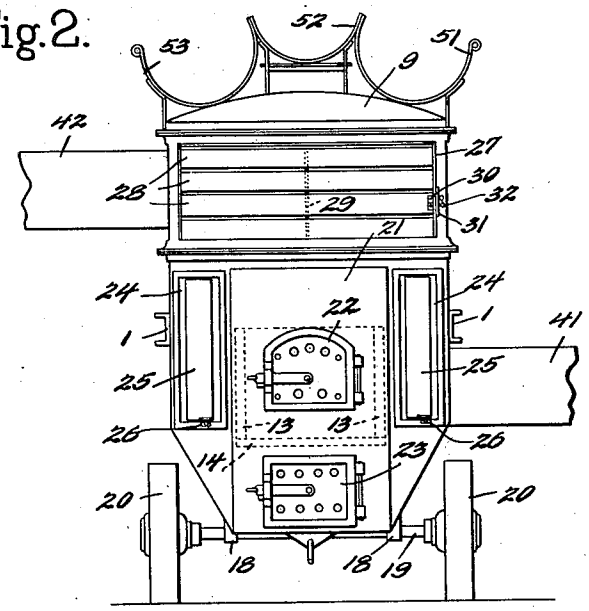


Fig. 2.



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APPARATUS FOR HEATING AND DRYING WALLS

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Fig. 3.

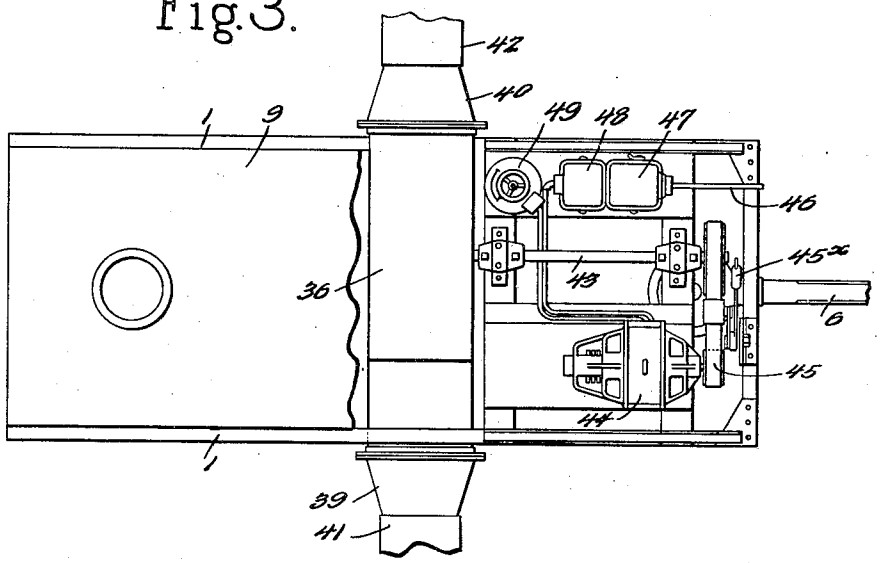
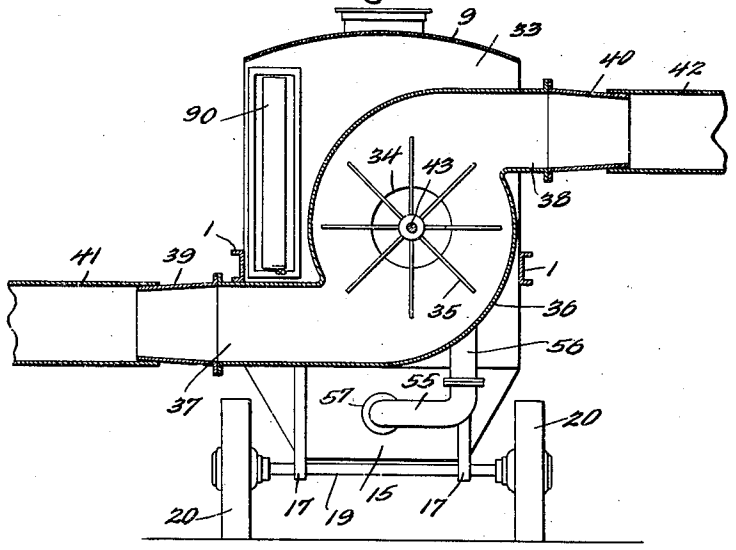


Fig. 4.



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APPARATUS FOR HEATING AND DRYING WALLS

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FIG. 5.

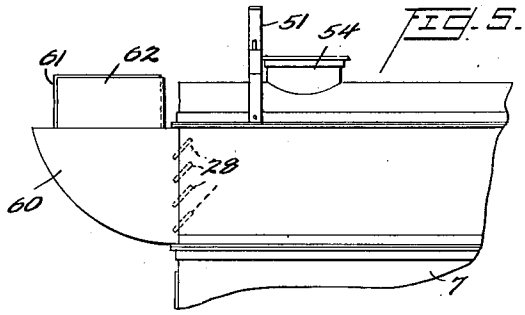


FIG. 6.

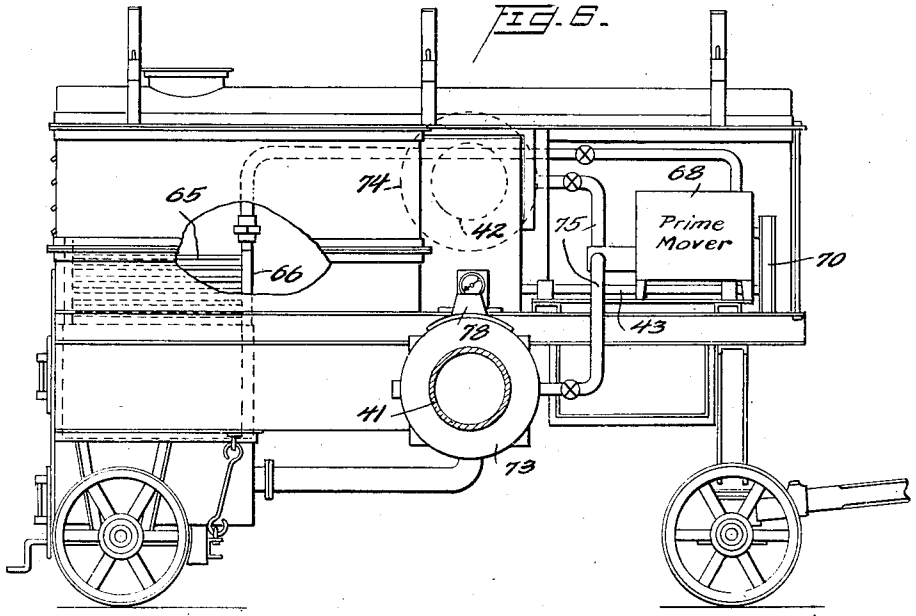
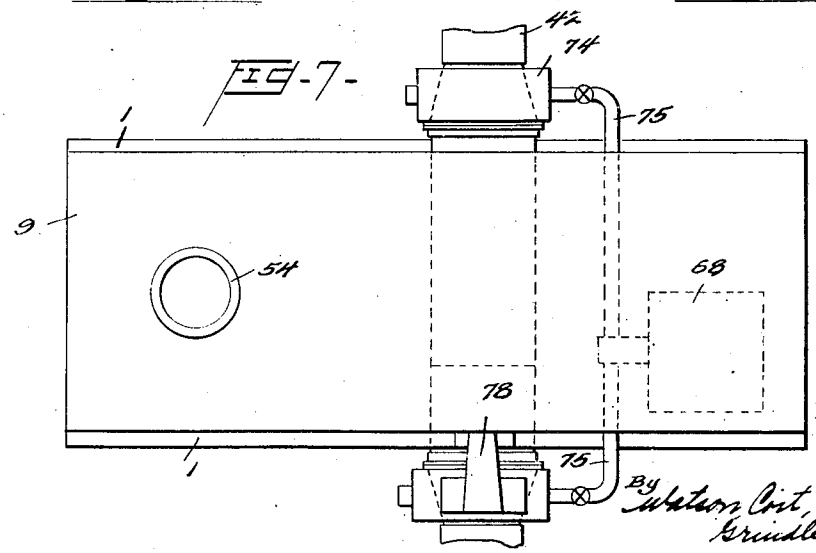


FIG. 7.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR HEATING AND DRYING WALLS

Application filed May 15, 1929, Serial No. 363,286, and in Germany February 9, 1929.

This invention relates to improvements in apparatus for heating a room and drying the walls thereof, and the principal object of the invention is to provide an apparatus comprising a furnace having a combustion chamber with means for burning fuel therein and means for causing currents of air from outside the room to pass through and also around the burning fuel, with means for delivering under pressure the air and the products of combustion of the fuel mixed therewith to the room.

A further object of the invention is to provide an apparatus of the type specified with means for regulating the relative proportions of the heated air and products of combustion and particularly the carbonic acid gas thereof delivered to the room.

A further object of the invention is to provide a portable apparatus of the character specified comprising a furnace having a chamber with a fireplace therein to contain fuel, such as coke, and having means to admit air at the bottom of the fireplace to support combustion of the fuel, and also having means to admit air into said chamber above or around, or preferably above and around the fireplace, and having a fan operable to produce currents of air through the fuel in the fireplace and through the chamber and to deliver the heated air and products of combustion to the room.

A further object of the invention is to provide a portable apparatus of the character specified with adjustable means, such as dampers or louvers, for regulating the relative amounts of air passing through the fireplace and through the chamber to control the relative proportions of air and carbonic acid gas delivered to the room.

The invention also contemplates providing a suitable motor for actuating the fan, with means for adjusting the speed of the motor, whereby the volume of the air delivered to the room may be regulated.

It is frequently found that electrical connections for the actuating motor are not available, particularly when the apparatus is used for drying walls in new buildings. In order to obviate this difficulty and to eliminate the additional labor and expense attending the use of oil or gasoline motors for this purpose, it is a further feature of the present invention to provide additional apparatus for utilizing the heat developed in the furnace for driving the blower. This apparatus may take the form of a steam generator associated with the furnace, the steam produced in the generator being used to drive a reciprocating engine or turbine. The heat remaining in the exhaust steam from the driving motor may then be used to further increase the temperature of the air supplied to the building.

These and other objects and features of the invention will more fully appear from the following description and the accompanying drawings and will be particularly pointed out in the claims.

A preferred embodiment of the invention is illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation of a portable apparatus for heating a room and drying the walls thereof, portions of the wall of the furnace being broken away to illustrate the interior construction thereof;

Figure 2 is a front elevation of the machine illustrated in Fig. 1, viewed from the left;

Figure 3 is a plan view, the front portion of the top being omitted;

Figure 4 is a vertical sectional view on line 4—4 of Fig. 3, viewed from the right toward the left;

Figure 5 is a fragmentary side view corresponding to Fig. 1, but showing a slightly modified construction; and

Figures 6 and 7 are side and plan views corresponding respectively to Figs. 1 and 3, and illustrating an alternative arrangement in which the heat from the furnace supplies the motive power for the operation of the blower.

The present invention comprises apparatus adapted to perform the method of drying walls disclosed in the application of Albert Wagner, Serial No. 132,636, filed August 30, 1926, for method of drying moist rooms, buildings and the like, and is designed for

the purpose of causing fresh air from outside the room to pass through and around burning fuel and to force the heated air mixed with the products of combustion of said fuel into the room in sufficient volume to maintain the pressure thereof in the room sufficiently above atmospheric pressure to force a portion of the air through the walls of the room, and also to maintain continuously a rapid circulation of air throughout the room.

The apparatus further comprises means for varying the relative proportions of air and products of combustion, particularly carbonic acid gas (CO_2) so that the air introduced into the room may be relatively pure, when the apparatus is used for heating purposes, or may contain such proportion of carbonic acid gas as will rapidly and effectively harden the particular composition of the walls or of the plaster which is applied to the walls.

Usual drying of new walls or newly plastered walls of buildings has been effected by heat supplied through radiators placed in the room; by placing open fireplaces, such as iron baskets in the room, and burning therein coke or charcoal, the air for supporting combustion being taken from the room; or by projecting jets of air and the products of combustion from a burner against a local section of the wall of the room and thereafter removing the blast to a different section of the wall but so far as I am aware no means has heretofore been provided for causing currents of fresh air to pass through and around burning fuel and delivering the air and products of combustion of the fuel into the room in sufficient volume to maintain a substantial pressure above atmospheric pressure which will cause the air and carbonic acid gas in part to pass through the walls of the room.

It is well-known that the drying of a concrete or masonry wall, or a coat of plaster, ordinarily takes place entirely at the surface, it being necessary for the water in the interior layers to work its way to the surface by diffusion, where its evaporation is brought about by the heat supplied to the air of the room either naturally or artificially. The rate of drying under these conditions depends (1) upon the rate of diffusion of the water from the interior layers of the plaster, or other composition, to the surface thereof, and (2) upon the capacity of the air to take up and carry away this water in the form of vapor.

The rate at which the water can be brought from the interior layers to the surface depends upon the material itself and especially upon the condition of the surface. It is desirable that the initial drying should not proceed too rapidly as it might result in case-hardening the surface and thereby slowing up the rate of diffusion.

The capacity of the air to take up and carry away moisture depends upon its relative humidity, its temperature, and its velocity over the surface.

The evaporation of the water from the surface of a wall requires heat to supply the latent heat of evaporation and this can be most readily supplied and controlled by regulating the temperature of the air. As evaporation takes place, the air at the immediate surface of the plaster tends to become completely saturated and cooled under the action of evaporation. In order for evaporation to continue, this cooled, highly saturated air must be constantly removed from the surface and replaced by fresh, warm air of relatively low humidity.

By the apparatus forming the subject matter of the present invention, heated air is supplied in a regulated quantity to the room in sufficient volume to maintain a constant circulation of warm, dry air over the surface of the walls, thereby not only providing increased heat for evaporation and capacity for carrying off the moisture which exudes from the surface of the wall, but also serves to cut down the thickness of the very thin layer of practically motionless saturated air which all damp materials hold at their surfaces and through which any evaporated moisture must diffuse in order to reach the current of drying air.

Walls of rooms, whether of cement or masonry, or walls provided with a coating of plaster, comprise a considerable proportion of lime. The aging of the lime involves both a drying and a chemical change. When the wall or plaster is freshly constructed, the lime is in the form of calcium hydroxide $Ca(OH)_2$. In aging, this material reacts with the carbon dioxide in the air to form calcium carbonate, $CaCO_3$, and giving off water. The rate at which this aging can be accomplished depends first on the rate at which carbon dioxide can be brought into contact with the calcium hydroxide, not only on the surface of the plaster, but also throughout the entire thickness of the coat, and second, on the drying out of the water formed by this reaction in the manner heretofore discussed.

By the present invention hot air and carbonic acid gas may be delivered to the room in sufficient volume to maintain such substantial pressure in the room as to force a portion of the air and carbon dioxide through the walls, thereby greatly increasing the chemical action of the carbon dioxide upon the lime, and also to maintain such circulation within the room as readily to remove and evaporate the water resultant from the action of the carbon dioxide upon the calcium hydroxide. Furthermore, such rapid circulation of heated air prevents the maintenance of a practically motionless film of saturated air upon the sur-

face of the wall and the condensation of water from such saturated film upon the wall.

The preferred form of apparatus illustrated in Figs. 1 to 4 of the accompanying drawings comprises a portable furnace having a frame or chassis comprising side bars 1, preferably of channel iron, the front ends of which are supported upon an arch 2, the lower ends of which rest upon a cross girder 3 which has a central pivotal connection through a king bolt with an axle 4 upon which wheels 5 are mounted. The axle is provided with a tongue 6 by means of which the vehicle can be drawn.

The body of the furnace comprises vertical side plates 7 which are riveted or otherwise secured, to the side bars 1, a bottom plate 8 and a preferably slightly convex top 9 which desirably extends the full length of the side bars 1 and is supported upon suitable standards 10 at the front end of the vehicle.

The sides, bottom, and top of the furnace provide a large combustion chamber 11 in the lower front portion of which a fireplace 12 is located. The fireplace comprises a preferably annular wall 13 of fire-brick, or other refractory material, having at its bottom a grate 14. The diameter of the fireplace desirably is considerably less than the width of the combustion chamber 11 providing a considerable space on each side of the combustion chamber through which air may be circulated. Beneath the grate 14 is a substantially rectangular metallic receptacle 15 forming an ash pit. The receptacle 15 is of narrower width than the front wall of the furnace and suitable supporting bars, such as angle plates 16, underlie the overhanging portions of the bottom 8 of the furnace. Struts 17 and 18 are connected to and extend convergingly downwardly from the angle plates 16 and rest upon and are connected to the axle 19 of the rear wheels 20 of the vehicle.

The front wall of the furnace is composed of a central plate 21, preferably about the same width as the fireplace, having a doorway through which the fuel may be fed into the fireplace and provided with a suitable door 22. The front plate 21 also has a doorway leading to the ash pit which is provided with a suitable door 23. The front of the furnace desirably also is provided with doorways 24 located at opposite sides of the front plate 21.

Each of said doorways is provided with a door 25 which is pivotally mounted centrally at its upper and lower ends and provided at its lower end with a clamping member 26 by means of which the door can be locked in adjusted position to regulate the amount of air admitted into the chamber at the sides of the fireplace.

The upper portion of the front of the furnace is provided with a large, preferably rectangular opening 27 to admit air into the upper portion of the chamber 11. A series of dampers or louvers 28, which are pivotally mounted at their ends, provide an adjustable closure for this opening, the louvers being pivotally connected centrally to a rod 29 and one of the louvers having at its end an outwardly extending lever 30 provided with a laterally extending bolt which projects through an arcuate slot in a plate 31 and is adapted to be adjustably clamped at any desired position along said slot by a thumb nut 32 to adjust the position of the louvers 28 and thereby regulate the admission of air through the opening 27 into the chamber 11. This adjustment is of the usual type and detailed illustration thereof is not believed to be necessary.

The rear wall 33 of the furnace is provided with a central circular opening 34 leading to a fan 35 which is enclosed in a suitable fan casing 36. The fan casing is provided with a lower, preferably rectangular, outlet 37, and also upon the opposite side with an upper outlet 38, the walls of the opening being provided with rectangular frames 39 and 40 respectively to which are secured the sections of a conduit tapering from rectangular to cylindrical form.

Conductor pipes 41 and 42 are detachably connected to said outlet pipe sections and a sufficient number of other pipe sections may be connected to the pipes 41 and 42 to conduct the air to the room of the building through the windows thereof. The fan 35 is fixedly connected to a fan shaft 43 which is preferably driven by an electric motor 44 through any desirable power transmitting mechanism such as pulleys and a belt 45, which may be maintained taut by a suitable pivotally supported belt-tightening roll having a counterweighted arm 45x, or any other desired form of power transmission mechanism.

A screen or inlet 80 is preferably interposed between the combustion chamber and the fan and delivery outlets, in order to prevent the throwing of fuel and other foreign matter into the fan.

The electric current for actuating the motor may be supplied through a suitable cable 46 leading through a switch box 47 and fuse box 48 and rheostat 49 by means of which the current supplied to the motor may be controlled to regulate the speed of the fan.

Desirably a suitable thermometric device 50 is provided to indicate the temperature of the air within the fan chamber near the delivery outlet 37. As illustrated in the drawings, arcuate brackets 51, 52 and 53 are mounted upon the top of the machine to receive sections of pipe which may be used to conduct the heated air from the apparatus into the building.

The rear wall of the combustion chamber of the furnace may also be provided with a

door 90, similar to the doors or dampers 25, pivotally mounted centrally at its top and bottom with means for adjusting the door to permit air to enter the rear portion of the combustion chamber so that it does not pass over or around the fireplace.

By reason of this construction, the air thus drawn into the combustion chamber will have a cooling effect upon the air which is drawn through the combustion chamber, and being substantially free from carbonic acid will supply a relatively larger amount of oxygen to the room when the furnace is used for heating the room while workmen are employed in it. Furthermore, regulation of the air supplied to the combustion chamber by this damper provides an additional means of controlling the temperature of the air delivered into the room.

Where it is desired to heat the air delivered to the room to a high temperature, or to increase the supply of carbonic acid to the air, it is desirable that means shall be provided for delivering a "forced draft" to the fireplace. This is accomplished in the present apparatus by providing a by-pass pipe 55, one end of which is detachably connected to the end of a pipe 56 leading from the lower portion of the fan casing, and the other end of which is connected to an inlet pipe 57 extending rearwardly from the upper portion of the ash pit 15. A suitable damper 58 may be provided in the by-pass pipe 55 to regulate or to cut off the supply of air under pressure delivered from the fan chamber to the firebox.

In the operation of the device the apparatus is transported to a convenient location in proximity to the buildng, and sections of pipe are connected up to extend from the outlet 37, or outlets 37 and 38, preferably through the window openings of the building. The windows of the building are then substantially closed in any suitable manner, as by shutting down the usual window sash, or if such sash has not been installed, the window openings are covered with boards or any other suitable closure which will prevent rapid escape of air from the room.

A fire of coke, charcoal, or other suitable fuel, is placed in the fireplace and ignited. A suitable stack 54, beneath which a protective ring 54ª is supported, is located directly over the fireplace to permit the escape of smoke and products of combustion during the ignition and preliminary burning of the fuel in the fireplace. After the fuel is burning freely, the motor is started up to actuate the fan. The rotation of the fan draws air through its eye 34 from the combustion chamber 11 and the vacuum created by the fan produces air currents both through the grate and fuel and also through the openings in the front wall of the furnace. By regulating the louvers 28 and the doors or dampers 25, the relative proportions of air drawn through the fireplace and over or around the fireplace can be readily controlled.

It frequently occurs that a building to be dried is so located that no space is available for the drying machine on the exterior of the building, in which event the machine must be located within the building and the fresh air conducted to the combustion chamber from outside of the building. It is furthermore advisable, under certain conditions of operation, to return a portion of the air supplied to the building to the combustion chamber of the machine where it is reheated and again forced into the building.

A preferred arrangement for these purposes is illustrated in Fig. 5 of the drawings, in which a casing 60 is provided for enclosing the inlet to the combustion chamber in which the louvers 28 are located. This casing is provided at any convenient point with inlet pipes 61 and 62. In the event that the machine is located within the building, one or both of these pipes may be connected to the exterior of the building to supply fresh air for the drying of the walls. If the machine is located outside of the building, one of these pipes may be connected to the interior of the building, preferably in the upper portion thereof, for returning a portion of the air forced into the building to the machine.

As pointed out hereinbefore, when the machine is used for the drying of new and uncompleted buildings, it is frequently impossible to obtain electricity for driving the motor which operates the blower. Under such conditions, some other form of motor, such as an internal combustion engine may be used for this purpose. In order to reduce the expense of operation and to provide a machine which may be used regardless of the presence or absence of a convenient supply of electricity, the machine may be provided with additional apparatus for using the furnace as a source of energy to drive the blower.

This apparatus may take the form disclosed in Figs. 6 and 7 in which a steam generator 65 having a header 66, and connections to a steam engine or steam turbine 68 is provided. The steam generator may be located in the combustion chamber at any convenient point and in such a manner that the normal operation of the machine is not interfered with. The engine 68 serves to drive the blower shaft 43 either directly or through suitable gearing 70. The exhaust from the engine may then be utilized to increase the temperature of the air supplied to the building. One arrangement for using the exhaust steam in this manner is shown in the drawings and comprises steam jackets 73 and 74 located respectively on the outlet pipes 41 and 42 of the machine and enclosing the latter and provided with connections 75 to the exhaust passages of the steam engine. These jackets may

be provided with supporting brackets 78 located on the engine frame. This arrangement permits operation of the machine in the ordinary manner to control the proportions of carbonic acid gas and air supplied to the building and effects a considerable saving in the cost of operation of the apparatus. It will furthermore be apparent that this construction offers advantages in the operation of the machine for heating rooms where the introduction of carbonic acid gas is not desired or is detrimental since the door 90 may be opened to permit the introduction of fresh air to the blower, and this air may be heated to the desired temperature by the exhaust steam, it being unnecessary to pass the air over or through the fireplace in order to heat the same.

When, therefore, the louvers and dampers at the front of the furnace are substantially closed, the greater proportion of air which is drawn through the fireplace and the coke or other fuel therein will produce a relatively larger percentage of carbonic acid gas than will be produced in the combustion chamber when the louvers 28 and/or the doors 25 are opened to a wider extent.

By virtue of such regulation the amount of carbonic acid gas required most effectively to product the chemical change of calcium hydroxide into calcium carbonate can be readily controlled. If the louvers 28 and/or the doors 25 are widely opened, a much greater proportion of the air will be drawn directly through the combustion chamber, heated and delivered to the room and the carbonic acid content thereof will be relatively small. Thus the apparatus can be employed for heating the room without inconvenience to the workmen who are employed within the room.

It will also be apparent that the proportions of carbonic acid gas and air introduced into the room may be separately or further varied by manipulation of the door 90, which permits the introduction of fresh air to the rear of the furnace adjacent the fan. Additional regulation of the mixture may also be made by adjustment of the damper 58 in the by-pass 55, since the return of a portion of the mixed gas and air to the fireplace serves to further increase the carbonic acid gas content by reason of the union of the returned air with the burning fuel.

By reason of the fact that a large quantity of air in excess of that required to support combustion of the fuel is passed through the combustion chamber, such complete combustion of the fuel is produced that no trace of carbon monoxide is found in the air which is delivered to the room and by suitable regulation the amount of carbon dioxide which is carried into the room may constitute such a small percentage of the large volume of air delivered to the room as not to be appreciable, or in any way injurious to the workmen in the room. The apparatus is, therefore, adapted to deliver sufficient heat to the room in freezing weather to permit walls to be plastered conveniently and without danger that the plaster will freeze, thus enabling a room to be plastered without delay in the winter time.

By regulating the speed of the motor, the volume of air delivered to the room may be accurately controlled and such pressure maintained in the room above atmospheric pressure as may be desirable to produce the most effective action upon the walls of the room.

In order properly to dry the wall of a room it is desirable that not too high a temperature shall be maintained in the room during the early stages of the drying operation, in order to prevent case-hardening of the plaster. By properly regulating the volume of air supplied, the temperature of the air delivered to the room may be controlled, and at the same time a sufficiently rapid circulation of the air within the room maintained to absorb the moisture exuding from the wall. During the subsequent stages of the drying, the temperature and the rapidity of circulation of the hot air may be increased to such extent as may be found desirable to complete the drying of the wall in the shortest time possible without causing case-hardening or cracking, or otherwise injuriously affecting the surface or body of the plaster.

The heated air from the combustion chamber may be introduced into the room at one or both ends of the room in such manner as to maintain a continuous rapid circulation throughout the room thereby not only increasing the rate of evaporation of moisture from the walls of the room, but also preventing the formation and maintenance of a film of saturated air upon the walls of the room which otherwise would prevent the dissipation through the face of the wall of the moisture resulting from the chemical reaction of the carbonic acid and calcium hydroxide.

By reason of the present invention, therefore, the drying of masonry walls or plaster coating upon the walls of a building may be greatly facilitated and it has been proven in commercial practice that a large room having a thick coat of new plaster can be thoroughly dried, ready for painting, or other treatment, within a period of three days, and further that the plaster or wall dried in the manner aforesaid will be harder because of the substantially complete transformation of the calcium hydroxide thereof to calcium carbonate within this short period of time than would be accomplished in months or years of usual air-drying.

It will be understood that the particular form of apparatus disclosed herein is of an illustrative character and that various changes in form construction and arrangement of parts may be made within the scope

of the claims, and that whereas coke and charcoal have been described as a preferred fuel, any suitable fuel or fuel-burning apparatus may be employed to produce the results herein described.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent is:

1. A portable apparatus for heating a room and drying the walls thereof comprising a furnace having a substantially rectangular air-heating chamber, an annular fireplace within said chamber and spaced from certain of the walls thereof, means for admitting air beneath the grate of said fireplace, adjustable means for admitting air to said chamber above and in front of said fireplace, a fan at the rear of said chamber having its intake communicating with said chamber, means for actuating said fan, and means for conducting the air delivered by said fan to the room.

2. A portable apparatus for heating a room and drying the walls thereof comprising a furnace having a substantially rectangular air-heating chamber, an annular fireplace within said chamber and spaced from certain of the walls thereof, means for admitting air beneath the grate of said fireplace, the front wall of said furnace having an opening substantially above the fireplace to admit air to said chamber, louvers in said opening, means for adjusting said louvers to regulate the amount of air admitted to said chamber, a fan at the rear of said fireplace having its intake communicating with said chamber, means for actuating said fan, and means for conducting the air delivered by said fan to the room.

3. A portable apparatus for heating a room and drying the walls thereof comprising a furnace having a substantially rectangular air-heating chamber, an annular fireplace within said chamber and spaced from certain of the walls thereof, means for admitting air beneath the grate of said fireplace, adjustable means for admitting air to said chamber at the sides of said fireplace, a fan at the rear of said fireplace having its intake communicating with said chamber, means for actuating the fan, and means for conducting the air delivered by said fan to the room.

4. A portable apparatus for heating a room and drying the walls thereof comprising a furnace having a substantially rectangular air-heating chamber, an annular fireplace within said chamber and spaced from certain of the walls thereof, means for admitting air beneath the grate of said fireplace, adjustable means for admitting air to said chamber above and in front of said fireplace, a fan at the rear of said chamber having its intake communicating with said chamber, a motor for actuating said fan, means for regulating the speed of the motor, and means for conducting the air delivered from said fan to the room.

5. In an apparatus for heating a room and drying the walls thereof, the combination with a furnace having a combustion chamber, of means for burning fuel in said chamber, means on one side of said chamber for admitting currents of air from outside the room into the chamber for passage through and around the burning fuel, means located adjacent another side of said chamber for delivering the heated air and products of combustion under pressure to the room, and regulatable means adjacent said last named means for introducing fresh air into the heated air and products of combustion.

6. In apparatus for heating a room and drying the walls thereof, the combination with a furnace having a combustion chamber, of means for burning fuel therein, means located at the front of the furnace for admitting air from outside the room into the chamber, a fan at the rear of the furnace for delivering heated air and the products of combustion to the room, and regulatable means disposed between said fan and said chamber for admitting fresh air to the heated air and products of combustion to reduce the temperature and to increase the oxygen content of the mixture delivered to the room.

7. An apparatus for heating a room and drying the walls thereof comprising a furnace having a combustion chamber, means for burning fuel therein, means for causing currents of air from outside the room to pass through and around the burning fuel, means for delivering under pressure said air and the products of combustion of said fuel to said room, and means for returning a portion of the delivered mixture and causing the same to pass through the burning fuel to create a forced draft and to insure complete combustion of the fuel.

8. An apparatus for heating a room and drying the walls thereof comprising a furnace having a combustion chamber, means for burning fuel therein, means for causing currents of air from outside the room to pass through and around the burning fuel, means for delivering under pressure said air and the products of combustion of said fuel to said room, means for returning a portion of the delivered mixture and causing the same to pass through the burning fuel to create a forced draft and to insure complete combustion of the fuel, and means for regulating said last mentioned means to control the draft produced thereby and concurrently, the proportions of carbonic acid gas and air delivered to the room.

9. In an apparatus for heating a room and drying the walls thereof, the combination with a furnace having a combustion chamber and means for burning fuel therein and having an aperture for admitting air into the chamber above the burning fuel, of

means of admitting air for passage through the burning fuel to support combustion thereof, means for delivering heated air and products of combustion under pressure to the room, and means for conducting fresh air from outside of the room and for returning a portion of the air from the room to the said aperture.

10. A portable apparatus for heating a room and drying the walls thereof comprising a furnace having a chamber with a fireplace therein to contain fuel, means to admit air at the bottom of said fireplace to support combustion of the fuel, means to admit air to said chamber, a fan operable to produce currents of air conjointly through said fireplace and said chamber, means for conducting the air and products of combustion from said fan to the room, and means actuated by the heat from the burning fuel for driving said fan.

11. A portable apparatus for heating a room and drying the walls thereof comprising a furnace having a chamber with a fireplace therein to contain fuel, means to admit air at the bottom of said fireplace to support combustion of the fuel, means to admit air to said chamber, a fan operable to produce currents of air conjointly through said fireplace and said chamber, means for conducting the air and products of combustion from said fan to the room, means for generating steam from the heat produced by the burning fuel, and means actuated by said last named means for driving said fan.

12. A portable apparatus for heating a room and drying the walls thereof comprising a furnace having a chamber with a fireplace therein to contain fuel, means to admit air at the bottom of said fireplace to support combustion of the fuel, means to admit air to said chamber, a fan operable to produce currents of air conjointly through said fireplace and said chamber, means for conducting the air and products of combustion from said fan to the room, means for generating steam from the heat produced by the burning fuel, a prime mover operated by the generated steam, and means for utilizing the exhaust steam from the prime mover to further heat the air and products of combustion delivered to the room.

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