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FURNACE FOR STEAM GENERATORS.

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NO MODEL.

FIG. 1.

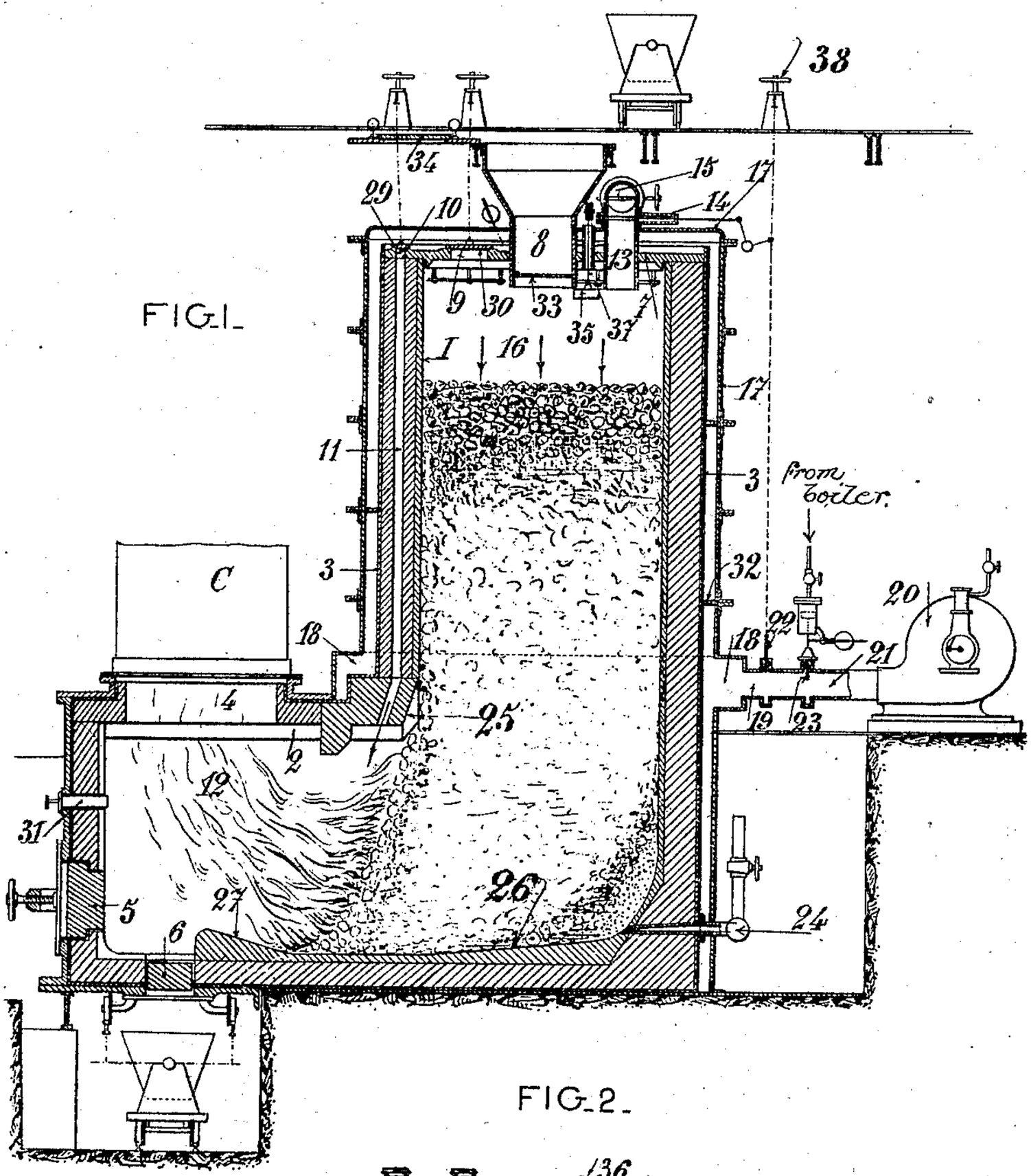
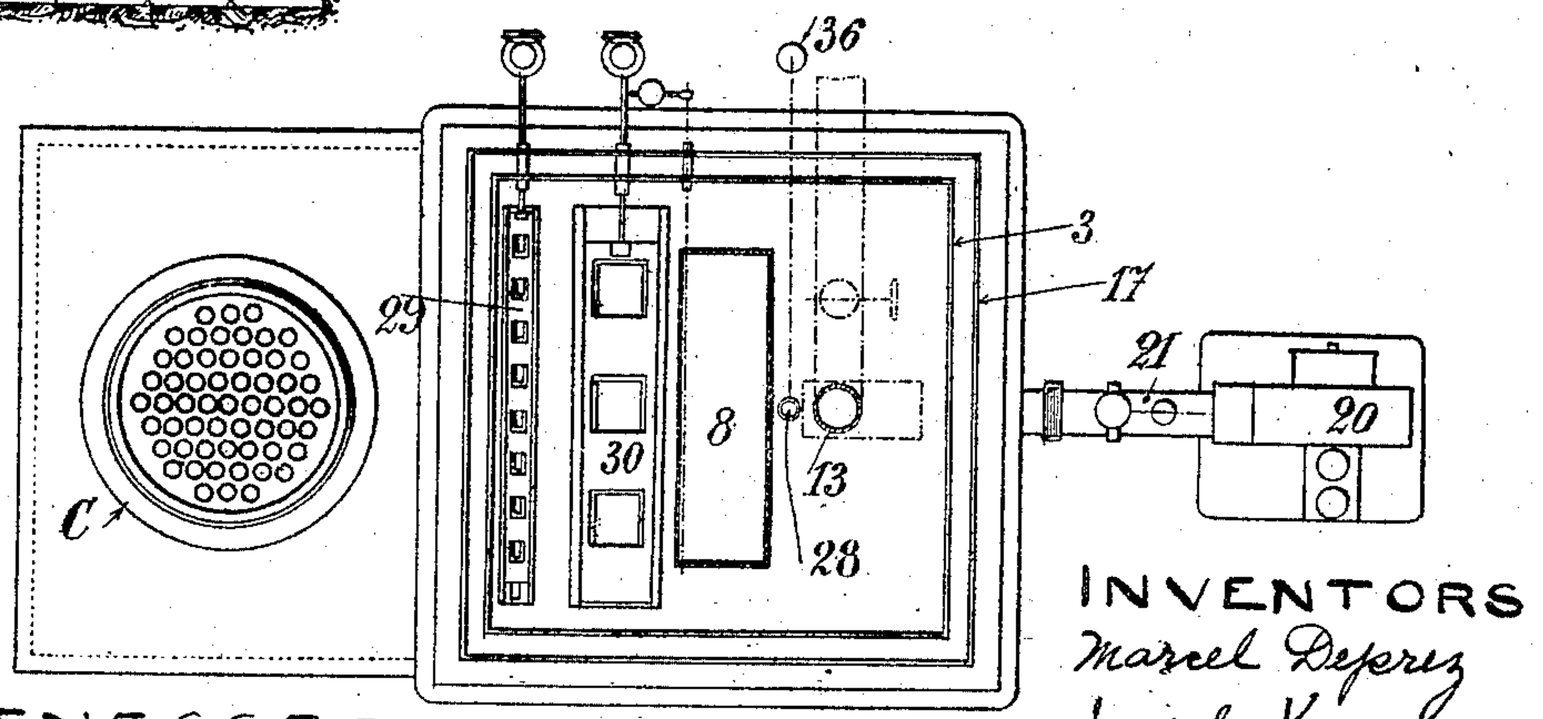



FIG. 2.

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## FURNACE FOR STEAM-GENERATORS.

SPECIFICATION forming part of Letters Patent No. 725,228, dated April 14, 1903.

Application filed December 1, 1902. Serial No. 133,518. (No model.)

*To all whom it may concern:*

Be it known that we, MARCEL DEPREZ, member of the Institut de France, and JOSEPH VERNEY, civil engineer, both citizens of the Republic of France, residing at 292 Rue St. Martin, Paris, in the Republic of France, have invented a certain new and useful Improved Furnace for Steam-Generators, of which the following is a specification.

This invention relates to a furnace for steam-generators in which the continuous stoking required by ordinary furnaces is dispensed with. The said furnace is without fire-bars and takes a large quantity of unpulverized fuel, coke, or anthracite placed in a high vertical column or stack and spreading out at its base and on one side, according to its natural slope, into a combustion-chamber, into which lead the boiler-tubes. A blast apparatus forces compressed air into the upper part of the furnace. The said upper part is closed while the furnace is working, and the greater part of the said compressed air passes through the fuel from the top to bottom and goes into the combustion-chamber. A smaller portion of the air passes directly through the walls of the furnace into the same combustion-chamber. The fuel is ignited at the top of the column, and the entire mass of fuel progressively becomes incandescent. The furnace is then in its normal working condition, since the whole of the fuel must always be incandescent. As soon as air is forced in at the top the hot gases, which are completely burned in the combustion-chamber by the second arrival of air, pass from the said combustion-chamber to the generator and a rapid production of steam ensues, which can be regulated at will by increasing or decreasing the pressure of the air forced into the upper part of the furnace. When the blast is stopped, the generation of steam ceases instantaneously, since the natural draft of the furnace acts upwardly, and the direction in which the heated gases travel is therefore instantaneously reversed and no part of the said gases continues to pass through the boiler. When the furnace is not at work, the fuel remains incandescent, but is not appreciably consumed, by reason of lack of air, since only very slight natural draft is allowed. The furnace thus allows of instantaneously increasing the generation of steam and also of instantaneously stopping the said generation, and it is unnecessary to continuously stoke the furnace, as is the case with ordinary furnaces. Stoking only takes place at very long intervals, and this is also the case with regard to cleaning, since no obstruction can be produced by the scoriæ and cinders, which in the absence of fire-bars accumulate directly on the sole of the furnace, where they do not in any way interfere with the circulation of the gases. These advantages render the furnace of very great service for a number of purposes.

In the annexed drawings, Figure 1 is a vertical section of a furnace incorporating our invention and applied to a stationary vertical boiler. Fig. 2 is a plan view with the upper wall of the jacket removed to show the air-inlet registers.

Referring to the drawings, the furnace essentially comprises a vertical chamber 1 of rectangular or circular cross-section placed on a horizontal chamber 2 of similar cross-section, but generally of less length, so that a tube of large cross-section is formed, the two angles of which are perpendicular to each other. This structure is of refractory material to enable it to withstand great heat, and it is surrounded and externally supported by sheet and cast iron jackets 3 3 3, suitably stayed and ribbed, for the purpose of rendering the two chambers completely air-tight. All parts of the sheet-iron or cast-iron are insulated from the refractory material by layers of asbestos shavings or the like in order to prevent contact in case the outer surface of the refractory material should become red-hot. The chamber thus formed is provided with several apertures. An aperture 4 in the lower part of the chamber admits the gases of combustion to a passage, which is as short as possible and conducts the said gases to the boiler C. The latter can be of any construction. One door 5 allows of inspecting the fire and cleaning the furnace, and another door 6 allows of removing the cinders and scoriæ.

The upper part of the furnace is closed by a metal plate 7, which is also provided with a number of apertures. A fuel-hopper 8 has at its lower end an oscillating door and at its

upper end an air-tight sliding door to allow of feeding the furnace without interrupting the draft. The upper door has an aperture covered with transparent material to allow of inspecting the upper part of the furnace. A regulatable aperture 9 gives passage to the air required for combustion or primary air. Another regulatable aperture, 10, gives passage to the secondary air required to complete the combustion. This aperture communicates with the space 12 above the fire by means of a passage 11, formed in the vertical wall of the furnace.

By means of an aperture 13, provided with two regulatable sliding doors 14 15, the space 16 above the fuel communicates with an uptake.

A gage 28 is provided, consisting of a chain, and a lump of iron can be let down into the furnace to determine the height of the fuel,

The entire furnace thus formed is completely surrounded by another sheet and cast iron jacket 17, suitably ribbed and consolidated and separated from the inner jacket by a very narrow space of from two to ten centimeters, according to the general dimensions of the furnace. At 18 18 this jacket is provided with a projecting part forming a distributing-crown around the jacket, which crown receives through a pipe 19 the air required for feeding the furnace and distributes or divides the said air evenly around the furnace. For this purpose suitably-arranged baffles 32 cause the said air to uniformly impinge on all parts of the jacket 3. The distributing-crown 18 communicates, by means of the pipe 19, with the ventilator or fan 20, which supplies the furnace with blast-air. A blast-pipe 21 from a ventilator is provided with two slide-doors 22 and 23, of which latter one, 22, is only used for starting or stopping the furnace, and the other, which may be automatic or regulatable by hand, serves to keep the pressure in the boiler uniform.

The ventilator or fan 20 can either be operated by the steam-engine to which the furnace belongs or by an auxiliary engine, according to circumstances.

The furnace is completed by a blast apparatus 24 for air or steam for the purpose of removing the cinders which accumulate at the base of the furnace.

Inside the furnace is to be noted the special shape of the outlet-piece 25 for the secondary air, by which choking up is prevented, and also the slant of the furnace-bottom, which with the elevation 27 forms a kind of shallow basin. The furnace is charged at its upper part by means of trolleys or in any other suitable manner.

In the lower part of the furnace, at the side at which the gases pass out, the fuel forms an incline and gradually fills the vertical part up to a level close to the upper closing-plate. Onto the fuel thus introduced into the furnace burning substances are thrown, and the hopper 8 is then closed, whereupon the blast is put into operation by means of the ventilator or fan 20, which is moved by hand in the case of comparatively small furnaces and by means of a special motor in the case of large furnaces. The fuel gradually becomes ignited in successive layers, beginning at the top.

Once ignited, the furnace is not intended to become extinguished again except in the case of repairs being necessary or of prolonged interruption of work.

While the furnace is becoming ignited the pressure in the boiler rises until after a length of time, dependent on the intensity of the mechanical draft, the said pressure is sufficient to revolve the ventilator or fan by means of an auxiliary machine. The boiler-pressure is then brought to its normal height, whereupon the principal steam-engine is started, and in a few minutes the entire furnace will be in a state of incandescence. At this moment the proportions of primary air and secondary air are regulated by means of the two respective plates or slides 29 and 30. This regulating operation is completed when the temperature in the space 12 above the fire reaches a maximum. If the quantity of secondary air is thereafter further increased by opening the slide 29 in excess, the air will cool the gases of combustion and the temperature will fall. If, on the other hand, the quantity of secondary air is reduced, the carbon monoxid and other combustible gases which have been formed by the passage of the primary air through the fuel will not be burned, owing to the lack of oxygen, and the temperature will also be reduced. If no pyrometer is available, the gases can be analyzed. When this regulation is completed, it is only necessary to regulate the pressure of the air-current which enters the furnace in such a manner that the boiler-pressure will remain constant whatever quantity of steam is used. For this purpose either the working of the motor which drives the ventilator or fan can be regulated automatically or by hand, or the slide 23, which controls the air-passage, can be thus regulated.

The arrangement shown in the drawings as an example comprises a cylinder with a piston which is connected to the said slide 23. By moving upward and downward in the cylinder the said piston respectively opens and closes the air-supply pipe. The cylinder is in permanent communication with the boiler. A balance weight or spring balances the pressure on the piston, and the dimensions of the said piston and of the balance-weight are so calculated that on a very slight variation of the pressure above or below the normal the slide will completely open or almost completely close the air-pipe. It is essential that the closing of the pipe should never be complete in order to prevent the explosion which might be produced by the sudden arrival of air in the space 16 above the fuel after a total interruption of the draft. During the entire pe-

riod of its working this special furnace, in combination with the variable supply of air, allows of varying at will and within very wide limits the quantity of heated gases which leave the furnace, and consequently the quantity of steam generated. Thus when no more blast-air is supplied to the furnace the generation of steam will be completely and instantaneously stopped, since the heated gases which strive to escape will immediately pass toward the upper part of the furnace and will no longer pass through the boiler. On the other hand, if at any given moment while working with average production it is desired to double the said production it is only necessary to double the quantity of air which feeds the furnace. This is done by increasing the draft and rendering it four times as intense.

No delay can occur in attaining the new rate of production, since the whole of the fuel is in a state of incandescence. Further, the passage of the air is not obstructed by scoriæ and cinders, since the waste accumulates in the lower part of the furnace and can be easily removed at the outlet.

To stop the production of steam, the following series of operations must be performed in the proper order: First, the draft is reduced, either by reducing the speed of the ventilator or fan or by moving the slide 23. Thereupon an endless screw 38 is operated, which gradually closes the slide 22 and opens a slide 14, the throttle 15 being completely open. The purpose of this operation is to absolutely prevent explosions, which might be caused by an oscillation of the column of gas of the furnace coming into contact with the fresh air contained in the space 16 above the fuel by sweeping through this space and expelling therefrom the gases through the conduit 13. Immediately this operation is completed the generation of steam completely ceases, since, as stated, natural draft is substituted for forced draft and acts in the opposite direction, so that no heated gas passes through the boiler. The natural draft is reduced by means of slide-doors 15 and 31, which are very slightly opened in order to admit exactly that quantity which is sufficient to prevent the fuel from becoming extinguished. The shutters or slide-doors 29 and 30 are then closed to prevent the return of heated gases to the jackets of the furnace.

If it is desired to maintain the boiler under pressure, the draft of air is moderated to a very feeble degree—just sufficient to combat the loss of heat due to radiation, shafts, &c.

The stoppage of the steam-engine is generally utilized for recharging and cleaning the furnace. For this purpose the vertical part of the furnace is of such a capacity that the quantity of fuel it contains corresponds with the normal expense of fuel during the period of work without stoppage.

In order to effect the recharge during the working, it is necessary to know the height of fuel in furnace. The knowledge of this height is, however, always useful to render account and verify the rapidity of combustion each time desired. For this purpose a sounder or tester 35, composed of a mass of cast-iron suspended by a chain 37, poised the other side by a counterweight 36, can be let down onto the surface of fuel, and thus ascertain the quantity burned and the movement of recharge.

The cleaning of the furnace is effected by opening the doors 5 and 6 by means of poker and rake passed through opening 5. The accumulated scoriæ or slag in runners or cakes is dropped through opening 6 to bottom of furnace. Before opening 5 and 6 care must be taken to bring the cinders forward in the furnace by means of the blowers 24. It is then easy to evacuate them through 6.

Having now described our invention, what we claim as new, and desire to secure by Letters Patent, is—

1. A furnace for steam-generators comprising a tubular chamber bent at right angles with a vertical portion 1 closed at the upper part and a horizontal portion 2 communicating with the fire-tubes of the boiler, in combination with a sole 26 forming the bottom of the chamber, a compressed-air blast 20, a distributing-crown 18 for compressed air communicating with the blast and surrounding the portion 1, a jacket 17 surrounding the portion 1 above the crown 18 so as to provide for an air-chamber around the portion 1, a slide 30 controlling the compressed-air inlet at the top of the portion 1 above the fuel, a vertical passage 11 formed in the walls of the portion 1 and leading at the bottom to the portion 2, and a slide 29 controlling the compressed-air inlet in the passage 11, substantially as and for the purpose set forth.

2. A furnace for steam-generators comprising a tubular chamber bent at right angles with a vertical portion 1 closed at the upper part and a horizontal portion 2 communicating with the fire-tubes of the boiler, a compressed-air blast 20, a slide 30 controlling the compressed-air inlet at the top of the portion 1 above the fuel, a passage 11 leading to the portion 2, a slide 29 controlling the compressed-air inlet in the passage 11, a slide-door 22 arranged in the pipe for compressed air leading to the furnace, a conduit 13 connecting the vertical portion 1 with the chimney, a sliding door 14 arranged in the conduit 13, and a connection between the sliding doors 22 and 14, substantially as and for the purpose set forth.

3. A furnace for steam-generators comprising a tubular chamber bent at right angles with a vertical portion 1 closed at the upper part and a horizontal portion 2 communicating with the fire-tubes of the boiler, a compressed-air blast 20, a slide 30 controlling the compressed-air inlet at the top of the portion

1 above the fuel, a passage 11 leading to the portion 2, a slide 29 controlling the compressed-air inlet in the passage 11, a slide-door 22 arranged in the pipe for compressed air leading to the furnace, a conduit 13 connecting the vertical portion 1 with the chimney, a sliding door 14 arranged in the conduit 13, a connection between the sliding doors 22 and 14, a second sliding door 15 arranged in the conduit 13 above the door 14 and a slide-door 31 arranged in the wall of the portion 2, substantially as and for the purpose set forth.

It witness whereof we have hereunto set our hands in presence of two witnesses.

MARCEL DEPREZ.
JOSEPH VERNEY.

Witnesses:
EDWARD P. MACLEAN,
ANTOINE LAVOIX.