3 Sheets—Sheet 1.

# H. A. GOUGE.

## HOT AIR CAR HEATERS AND VENTILATORS.

No. 184,858. Patented Nov. 28, 1876.

Fig. 1

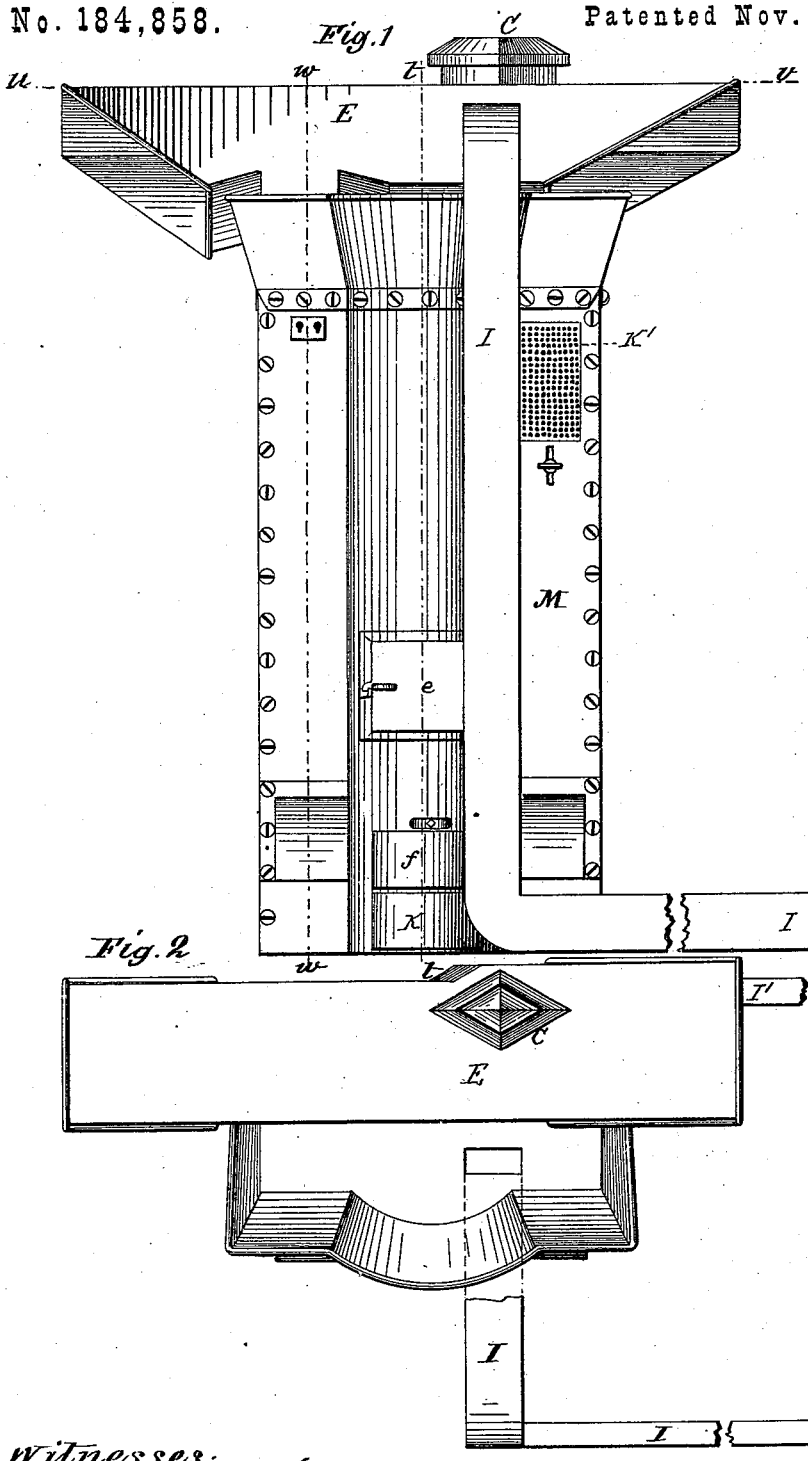


Fig. 2

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3 Sheets—Sheet 2.

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## HOT AIR CAR HEATERS AND VENTILATORS.

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Fig. 3

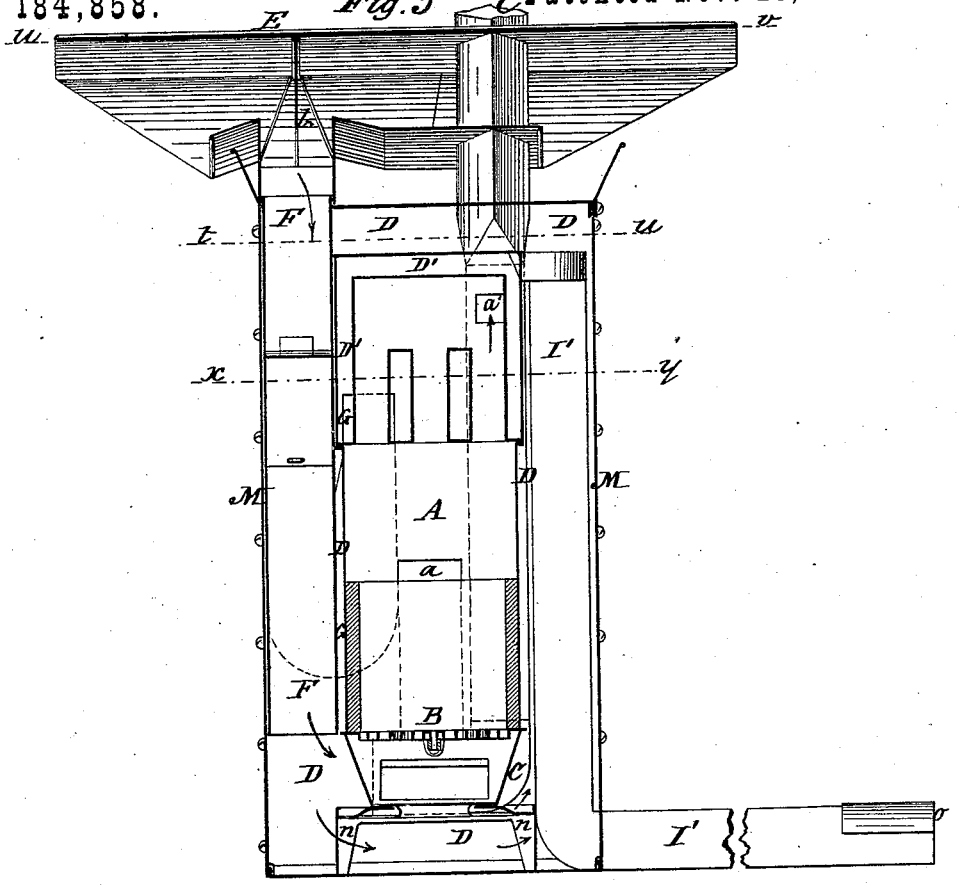
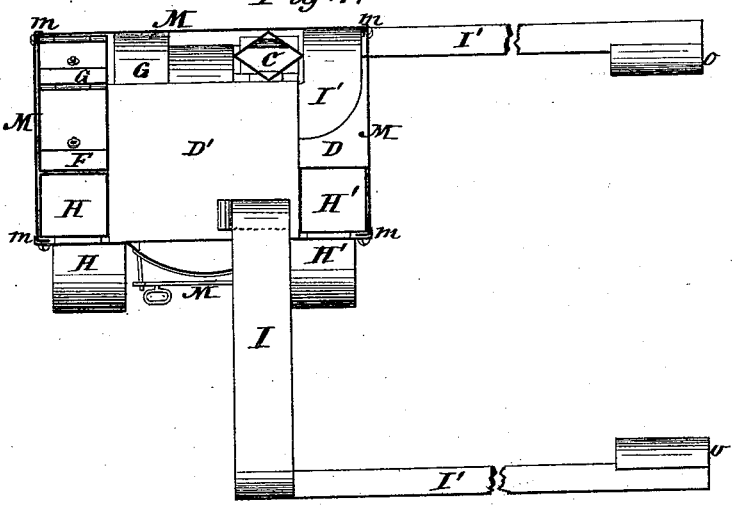



Fig 4.

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3 Sheets—Sheet 3.

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## HOT AIR CAR HEATERS AND VENTILATORS.

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Fig. 5

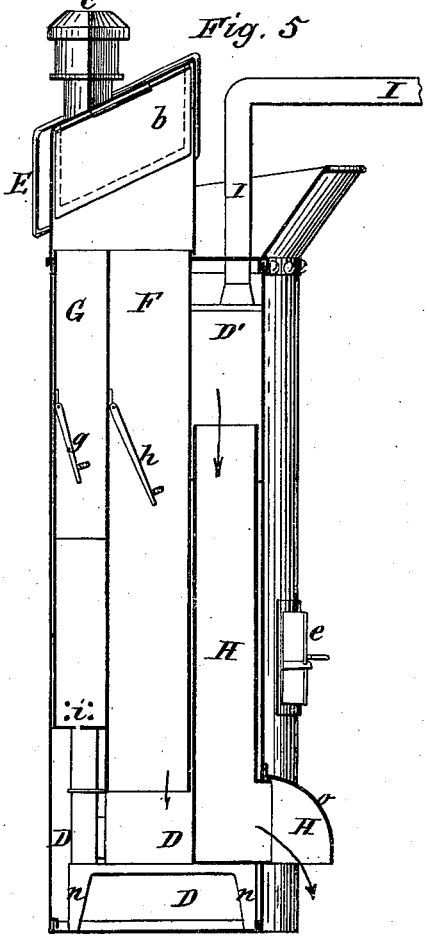



Fig. 6.

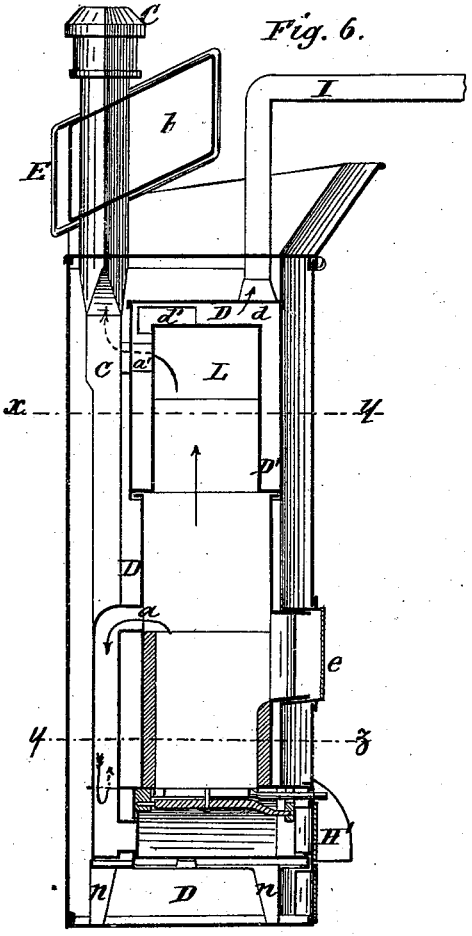



Fig. 7.

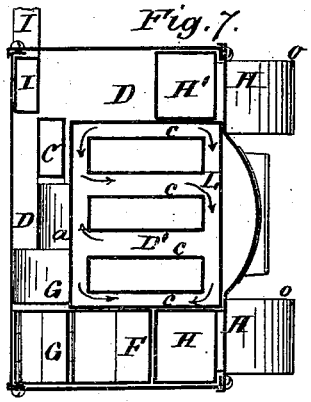
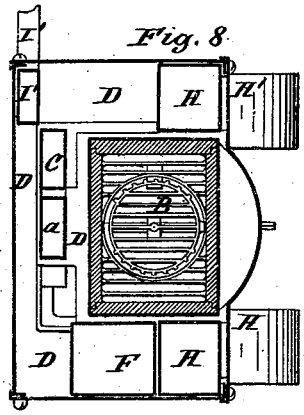



Fig. 8.

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# UNITED STATES PATENT OFFICE.

HENRY A. GOUGE, OF NEW YORK, N. Y., ASSIGNOR TO SAMUEL SHETHAR AND EDWARD A. NICHOLS.

## IMPROVEMENT IN HOT-AIR CAR HEATERS AND VENTILATORS.

Specification forming part of Letters Patent No. **184,858**, dated November 28, 1876; application filed August 25, 1876.

*To all whom it may concern:*

Be it known that I, HENRY A. GOUGE, of the city, county, and State of New York, have invented certain new and useful Improvements in Hot-Air Car Heaters and Ventilators; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description thereof.

My improved apparatus belongs to that general class of hot-air car-heaters which are supplied with air under pressure, and which, when not required for heating, are serviceable for ventilation.

So far as my knowledge extends no hot-air car-heater having a single fire-chamber has heretofore been constructed so that it possessed a capacity for delivering heated air at both ends of a car. It has been usual to employ two separate heaters, one at each end of a car. One object of my invention is to provide a heater, which, although having but one fire-chamber, has a capacity not only for discharging heated air locally or adjacent to the heater, but also at points within a car remote from the heater.

It is essential that heated air which is discharged remotely from the heater should be of a higher temperature on leaving the heater than air which is discharged locally, because the radiation from the long conducting-tubes would otherwise be liable to so far reduce the temperature of the air when finally discharged therefrom as to render it of little service. The air delivered through long ducts from my heater has a temperature closely approximating to the temperature of the air which is discharged directly from the heater.

For the attainment of these ends one feature of my invention consists in the combination of the following elements, to wit: A fire-chamber, an air-heating chamber, one part of which is more highly heated than the remainder, two cold-air ducts, one of which communicates with the hottest portion of the air-chamber, and the other with the coolest portion, one or more hot-air ducts for conveying air from the hottest portion of the air-chamber to points remote from the heater, and one or more hot-air ducts for locally discharging air from the less heated portion of the air-chamber.

Another feature of my invention consists in a cold-air duct, having a downward and an upward section, and a curved perforated portion connecting the two sections, whereby cinders, &c., taken into the duct with the cold air are discharged through the perforations, and prevented from contact with radiating surfaces of the hot-air chamber, and also from entering the car.

It is obvious that, if locomotive cinders or other similar foreign matter should enter the apparatus, and be lodged upon the highly-heated surfaces in the air-chamber, and thereon burned, the heated air will be seriously vitiated, which is not possible with my heater. The incoming air, forced downward, is changed in its direction by the curved plate, which secures an easy passage of the air through both the downward and the upward sections.

Another feature of my invention consists in the construction of the outer walls or casing of the apparatus, the same being composed of rolled plates of metal provided with rectangular flanges, which serve as ties for strongly connecting the side walls with each other, and also afford seats for threaded bolts employed in uniting the walls. The exterior sectional outline of my apparatus is square or rectangular, and the cold and hot air ducts located therein outside of the square or rectangular fire-chamber being of a similar form the entire interior space is well utilized. The fire-chamber is practically surrounded by ducts and air-spaces, and is mounted upon the metallic floor of the air-chamber, so that in case of serious accident to the car it would be seldom, if ever, that the burning fuel would escape so as to endanger the wreck, because while the outside walls might be crushed inward, or the whole structure flattened, they would not be liable to separate, but would retain its entire contents.

Ventilating hoods or funnels of various forms have heretofore been employed in connection with car heaters and ventilators; but I know of none which have been designed with

special reference to a large opening for use with the arched roof of a car, and to being located closely-adjacent to the roof, so as to present no unnecessary surface for resistance to the air while the car is in motion.

One feature of my invention consists in the combination, with my car heating and ventilating apparatus, of a hood or funnel of novel form, the same having, in lateral section, the outline of an oblique-angled parallelogram. This hood is so mounted upon its pipe that its two sides are parallel with the pipe, and its top and bottom oblique thereto crosswise of the car, and its inner side is higher than the outer side, and rests upon the central arched roof of the car, and lies closely adjacent thereto.

Another feature of my invention consists in making the fire-chamber, the air-ducts, and the walls which inclose the fire-chamber in sections which are easily detachable, whereby the heater may be readily set up or taken down, and new parts or sections substituted for such as may become worn out, or otherwise injured.

To more particularly describe my invention I will refer to the accompanying drawings, of which there are three sheets.

Figure 1 represents my novel apparatus in front elevation. Fig. 2 represents the same in top view. Fig. 3 is a vertical central section on line *u v*, Fig. 1. Fig. 4 is a horizontal sectional view on line *t u*, Fig. 3. Fig. 5 is a vertical section on line *w w*, Fig. 1. Fig. 6 is a similar section on line *t t*, Fig. 1. Fig. 7 is a horizontal section on line *x y*, Figs. 3 and 6. Fig. 8 is a similar section on line *y z*, Fig. 6.

My apparatus is preferably mounted upon the floor of a car. No base is requisite, although a cast-iron base-molding may be employed as a means for securing the heater in position, and at the same time for affording a neat and desirable finish. The drawings illustrate at the top of the heater a projecting cornice, which is desirable only as a finishing feature.

In the construction of the heater I have given special attention to economy in labor, and the attainment of a maximum of radiating-surface within a minimum of space. The inclosing vertical walls M may be composed of four pieces of sheet-iron, or of thin cast-iron; but in either case each piece, at the edge, is provided with a rectangular bend or flange, as at *m*, (shown in Fig. 4,) and also in all the sectional views.

On referring to Fig. 7 it will be seen that the flanges are so arranged at each corner that, when bolted together, they operate like posts, which strengthen the sides at the corners, and that the front-plate flanges afford resistance to any outward tendency of the end plates, and that the rear flanges of the end plates operate in like manner with relation to the rear plate.

The two sides and the rear require no shaping, but the front may be rounded at the center, as shown, or it may be plain, provided there be sufficient air-space afforded between its inner surface and the front wall of the fire-chamber A, which is rectangular in form, and is provided with a rectangular grate, B, one portion of which is circular and movable, while the remainder is stationary. With a grate thus constructed, a fire can be maintained in a form best suited to the shape of the fire-chamber. The movable grate may be shaken as usual, while the ashes on the stationary portion of the grate may be displaced with a poker, if necessary. The center of the fire will always have the best draft, and the fuel at that point, being in a perfect and rapid state of ignition, will secure a perfect, but slower, burning of the outlying fuel at the corners and ends of the grate.

For the purpose of attaining an extensive radiating surface, I have constructed my fire-chamber with four rectangular walls and a flat top. The lower portion of the fire-chamber is lined, as is usual, with fire-pots. The upper portion of the chamber at L is of a width corresponding with the length of the grate, but it is slightly less in depth, and is partially occupied by heating-flues, as at *c*.

C denotes the smoke-flue, which is projected above the roof of a car, and is provided with a cap, heretofore invented by me, or with any other form suitable for inducing the requisite draft. The fire-chamber has two separate connections with the smoke-flue, which are clearly shown at *a* and *a'*, Fig. 6. The duct at *a* is the main duct, through which the unconsumed products of combustion are conveyed to the smoke-flue. It extends from the rear wall of the fire-chamber rearward, downward, and thence into the base of the smoke-flue. The upper duct *a'* is an auxiliary duct, located near the top of the fire-chamber. It has much less area of opening than the main duct, and directly enters the smoke-flue. It is not intended to materially affect the draft through the main duct, but, being always open, it will prevent any accumulation and pressure of offensive gases, and obviate the liability of their entering the air-chamber through the adjacent joints, or of their escaping into the car through the feeding-aperture at *e*. Beneath the grate is an ash-pit, accessible by way of door *f*. The fire-chamber is a complete structure in itself, is strongly made, and is sustained on four legs, as at *n*, which may be secured to the car-floor by bolts extending through the bottom plate of the heater. There is a door in the base of the smoke-flue C, which is accessible through the ash-pit, for the removal of soot and other solid matters which may be lodged therein.

The air-heating chamber embraces the entire unoccupied space inclosed by the exterior walls of the apparatus. One portion thereof, at D', is separated from the larger portion D by means of plates which surround the sides and top of the upper portion L of the fire-chamber, and it is provided with rectangular ducts, as at *c*, Fig. 7, which traverse the

upper portion of the fire-chamber, and are wholly exposed on all sides to the heat in the fire-chamber, thereby affording extensive radiating surfaces. The air in this portion of the heating-chamber is susceptible of being heated to a much higher degree than that in the remaining portion D, although this latter has radiation from the surfaces of the remaining portion of the fire-chamber, and of the smoke-flue C and its communicating ducts *a* and *a'*. The air-chamber is supplied with fresh air, under pressure, when the car is in motion, by means of the hood or funnel E on top of the car. The air is forced against a swinging valve, (as heretofore,) thence downward into two cold-air ducts, F and G, into the hot-air chamber. The larger duct F communicates at its base directly with the section D of the air-chamber, and the air, on circulating around the fire-chamber and smoke-flues beneath the ash-pit, and above the section D', is discharged locally direct from the heater through the hot-air ducts H H'. These ducts are vertical, and their discharge-apertures at their bases are curved and hooded, as at *o*, so as to deliver the heated air in downward currents, which, striking the floor, are well diffused with the air in the car. This feature of discharging the heated air is of marked value, as compared with discharging it upward or laterally through registers, as has been quite common. When heated air is discharged upward, it ascends with more or less velocity, according to its temperature, and therefore the upper portion of the car is first heated, leaving the lower portion to remain cold until after the entire upper portion has been heated. Similar results are experienced when the hot-air currents are discharged laterally into the car.

The cold-air duct G supplies the portion D' of the air-heating chamber. It is in this instance smaller than the duct F, being proportioned to the cubical capacity of the portion D' of the hot-air chamber which it supplies. Referring to Figs. 3 and 4, it will be seen that duct G extends downward to a point adjacent to the fire-pot, thence bends to the right hand, thence extends upward and enters the section D' of the air-chamber near its bottom. At its bend this duct is provided with a perforated bottom, (shown at *i*, Fig. 5,) for the purpose of allowing cinders, &c., which enter with the cold air to fall through into the chamber D, from the bottom of which they may be removed by way of the door K. Foreign matters entering the portion D of the hot-air chamber, and resting upon the floor thereof, are not liable to vitiate the heated air therein, because they do not come in contact with heated radiating-surfaces; but, on the other hand, if such matters were allowed to enter the highly-heated portion D' and to be in contact with its highly-heated surfaces, the hot air would be objectionably charged with smoke or gas. Each cold-air duct is provided with a valve or gate, as at *g* and *h*, for regulating the supply of air to the apparatus.

It is well known, when a heavy wind is blowing in mid-winter in a direction opposite to that in which a train is moving, that it would be practically impossible to heat the air which would be forced through a fully-open duct into the heater and through it. It is desirable also, that when but little heat is required that a light fire be employed, and that a quantity of cold air should be supplied in proportion thereto. The partial closing of the hot-air eduction-apertures would not serve the same purpose, because the apparatus and the hot-air ducts would be filled with highly-heated air under pressure, which, being but slowly discharged, would unduly radiate heat from the walls of the apparatus and the ducts at the very times when but little heat was required.

The highly-heated air is discharged from the portion D' of the air-chamber through its top at *d*, Fig. 6, into the duct I, which is elevated sufficiently to extend across the aisle near the roof, thence downward and along the floor to the opposite end of the car, and also through opening *d'*, Fig. 6, thence to the rear into duct I', which extends downward near the adjacent side of the car, and thence along the floor. At their delivering ends these ducts are provided with deflecting-surfaces *o*, which, as in the ducts H H', cause the hot air to be discharged downward upon the floor, as already described.

K' denotes a perforated plate, guarded by a sliding door, whereby a direct discharge of air from the less-heated portion of the hot-air chamber D may be discharged, instead of through the ducts H H'. When the car is not in motion, and no fresh air can be supplied under pressure, the door K is opened, which permits cold air from near the floor of the car to enter chamber D, and under these circumstances my apparatus operates like any ordinary hot-air car-heater. This capacity in a combined car-heater and ventilator has a peculiar value, and the combination therewith of the local cold-air passage at K and the local hot-air discharge at K' constitutes a novel and valuable feature, in that, while the car is not in motion and the supply of cold air under pressure ceases, the local supply of cold air, as described, results in preventing the apparatus from being unduly heated and the exposed parts from being injured by burning.

The hood or funnel E is of peculiar and novel form, and has increased value by reason thereof. It is obvious that a large area of opening is desirable, and at the same time it is obviously of consequence that it be located as closely adjacent to the roof of the car as possible. A round hood of a certain capacity would be of much greater height than a rectangular or square one of the same sectional area, and for this reason my improved hood or funnel is oblong in section, with a top and

bottom which, although parallel with each other, are inclined laterally, as shown, and therefore, while an extensive area of opening is secured, the hood can be located closely adjacent to the arched roof of a car, with the lowest side of the hood nearest the side of the car. In section my hood is an oblique-angled parallelogram, and in that respect is novel and possesses a special value, as stated, especially when mounted angularly upon its pipe, as shown.

It will be seen that the air-ducts are not secured to the walls of the apparatus. The lengths and connections are all made with slip-joints well fitted, and the fire-chamber can be removed intact from the remaining portion of the apparatus. It is, therefore, possible, by unbolting and removing the side walls and top, to readily detach and remove any portion of the apparatus for repairs, or for any other purpose.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a car heating and ventilating apparatus, the combination, with a fire-chamber and an air-heating chamber, one portion of which is more highly heated than the remainder, of cold-air ducts for separately supplying the differently-heated portions of the air-chamber, and hot-air ducts for separately conveying air from the differently-heated portions of the chamber, substantially as described, whereby hot air may be discharged both locally and remotely from the heater at a practically uniform temperature, as set forth.

2. In a car-heating apparatus, a cold-air duct, having downward and upward sections, and a curved section uniting the two, provided with perforations or holes, substantially as described, whereby the downward current of incoming air is reversed in direction, and cinders, &c., contained in the air are discharged through the holes in the duct and prevented from entering the air-chamber, as set forth.

3. A car-heater casing, composed of flat plates provided with rectangular flanges and secured by bolts, substantially as described.

4. The combination, with a car heating and ventilating apparatus, substantially as described, of a hood which is in transverse vertical section an oblique-angled parallelogram, and is angularly set upon its pipe, substantially as described, for the purposes specified.

5. A car-heating apparatus having a fire-chamber which is a complete structure in itself, and its air-ducts and inclosing-walls constructed in detachable sections, substantially as described.

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