S. D. TILLMAN.

Heating Drum.

No. 9,690. Patented April 26, 1853.

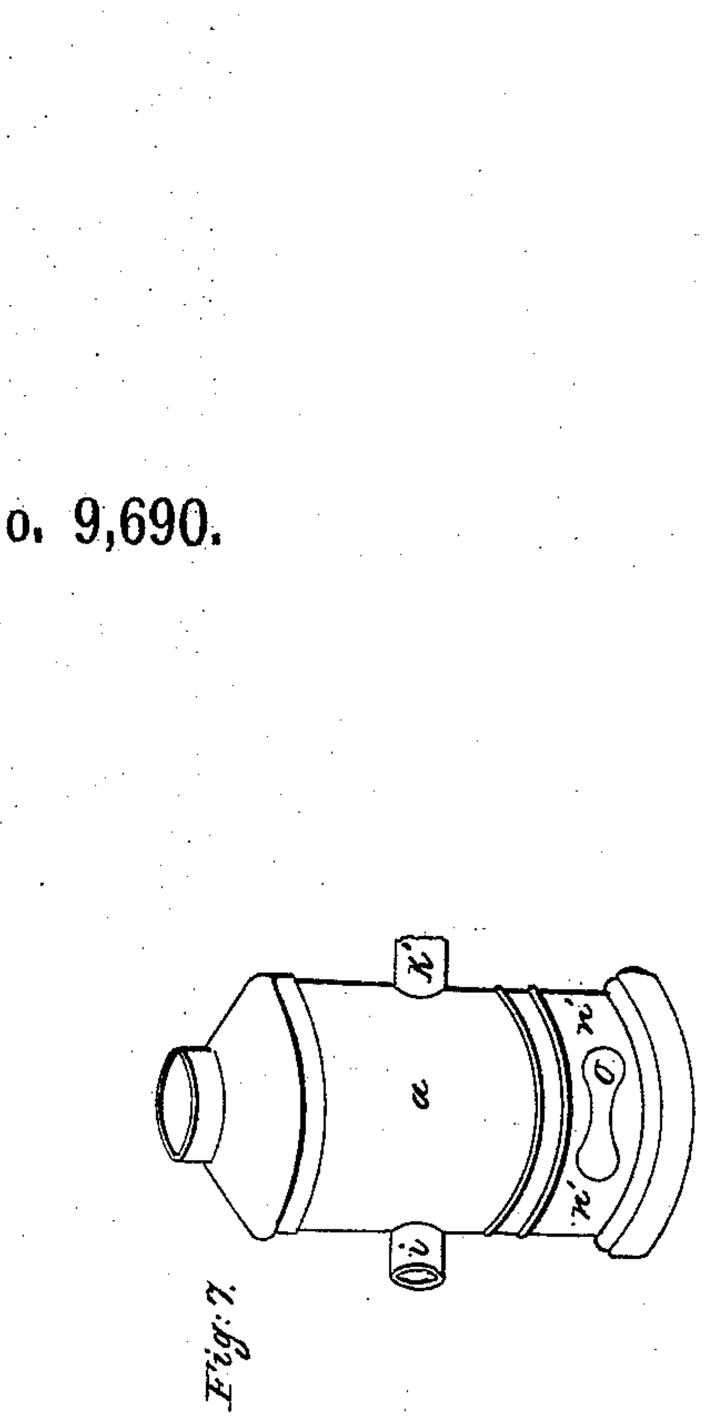

Fig: 1.

Fig: 7.

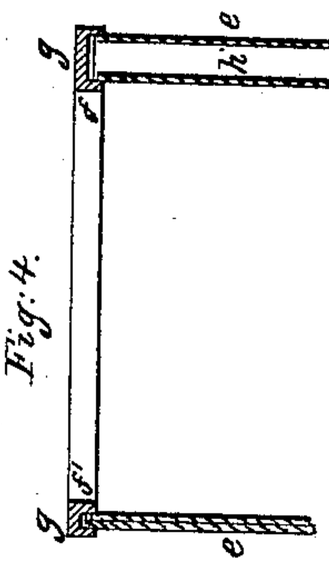

Fig: 4.

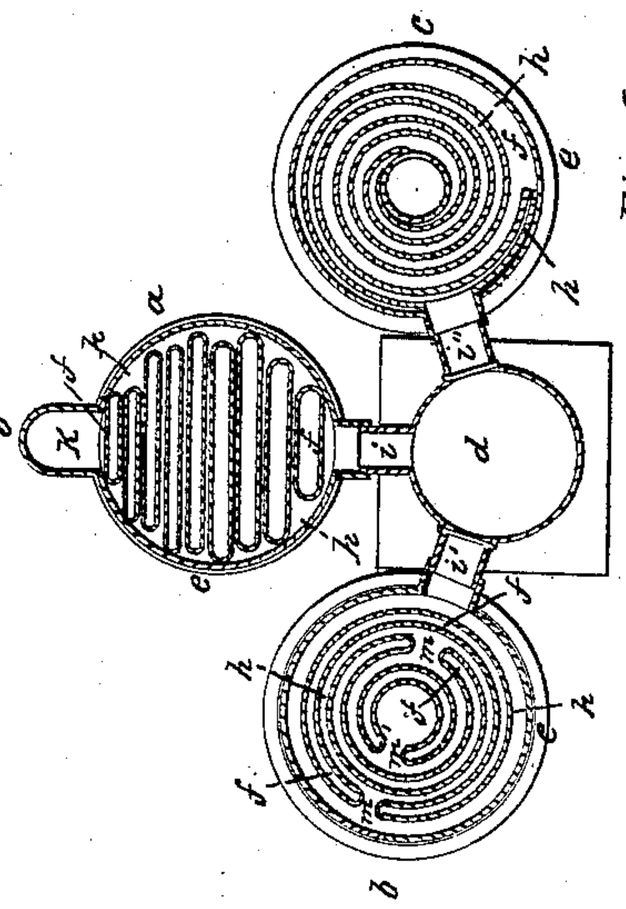

Fig: 3.

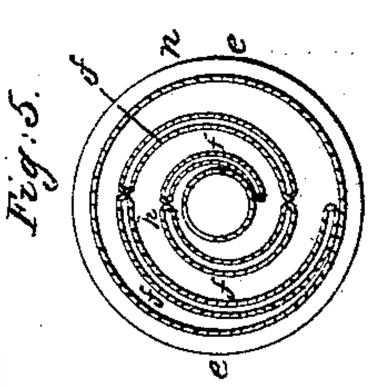

Fig: 5.

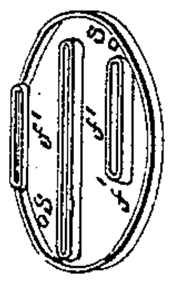

Fig: 6.

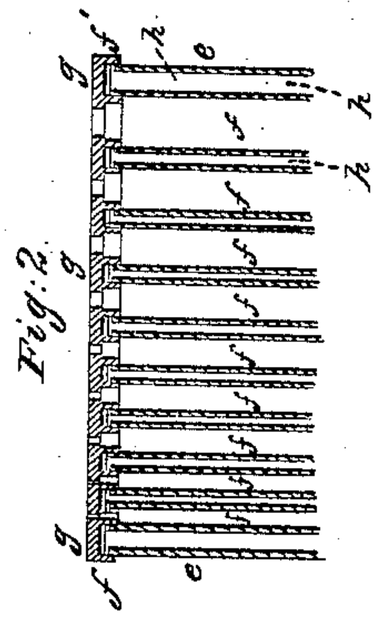

Fig: 2.

UNITED STATES PATENT OFFICE.

SAMUEL D. TILLMAN, OF SENECA FALLS, NEW YORK.

RADIATOR FOR STOVES.

Specification of Letters Patent No. 9,690, dated April 26, 1853.

To all whom it may concern:

Be it known that I, SAMUEL D. TILLMAN, of Seneca Falls, Seneca county, New York, have invented certain Improvements in Radiators, of which the following is a full description, reference being had to the accompanying drawings.

My improvement consists in certain modes of conducting and managing the draft of stoves through radiators, and of certain arrangements and construction of the radiating and air heating surfaces of the same, whether the source of heat is derived from stoves or furnaces, or from steam or hot water apparatus; and these improvements of the radiating and air heating surfaces, are also applicable to cases where heat is to be abstracted, as in the case of condensers or coolers.

An important feature and object of my improvement is the attainment of the largest possible radiating and air heating surface in the smallest possible space, without obstruction to the draft or passage of the smoke, steam or water through the radiators; that is to say, without such obstructions as are generally incident to radiators and air-heaters in consequence of return or diving flues. In my air heaters, the increase of the heating surface is not attended, as in most other cases, with a contraction of the smoke passages, or a prolongation of the draft between the stove and the exit or chimney pipe; but on the contrary the enlargement of the air heating surfaces causes an increase of the smoke or draft passages, and as it is an indispensable feature of my air heater, that it should be vertical and the course of the draft through the smoke passages horizontal, it is evident that having once determined the lateral extension of the radiator or the room that it is to occupy horizontally, an extension of the air heating and smoke passages vertically will increase the capacity of both together; a lateral extension or increase of these passages in any direction would of necessity prolong the draft.

Another feature of improvement in my radiator consists in varying the air passages or spaces so as to contract them in some proportion to their distance from the source of heat. The air spaces may be diminished in width by diminishing their width in the cross section.

Another feature of my improvement consists in the arrangement of the flattened tubes so as to touch the sides of the casing alternately in a single vertical line for the purpose of exposing as much as possible of surface to the heating influence. This effect by having the edges of the tubes rounded and arranged as will be clearly seen by reference hereafter to the drawings.

Another improvement consists in the mode of constructing the radiator, with a view not only to the facility of construction but with special reference to the form and disposition of the tubes and spaces of my radiator. The tubes must be made of sheet iron, and the heads of cast iron so furnished with flanges that however numerous and narrow or thin, the tubes may be, they may be made securely tight, which I have found by experiment cannot be effected in the usual way of constructing radiators for stoves. I am aware that cast iron tops and bottoms have been made for sheet iron stoves, and that flanges have been cast on these tops and bottoms, but I consider my improvement as limited to the use of this device of heads and flanges of cast iron, in its application or combination with my arrangement of the flattened tubes to be hereafter described.

Figure 1, represents a front elevation of the heating apparatus in which three modifications are given of the radiators in connection with a stove. Fig. 2, is a vertical transverse section of radiator, *a*. Fig. 3, is a horizontal middle section of the stove and radiators *a*, *b*, and *c*. Fig. 4, is a vertical longitudinal section through the middle of one of the tubes of radiator *a*.

Like letters refer to like parts in the different figures.

In radiator *a*, *f f* represent a series of flattened pipes or tubes arranged within a case *e* which may be of sheet or cast iron, of cylindrical, square or other form. These pipes must be made of sheet iron or other metal and extend from the bottom to the upper head of the radiator, and have their edges rounded for the two-fold purpose of allowing an unobstructed passage to the smoke draft around one edge, while the other edge presents but a single line of contact with the case *e* giving the largest surface for exposure to the heating influence. It will be seen by reference to the Figs. 2

and 3, that the air spaces become contracted as they recede from the smoke pipe of the stove, the narrowest being nearest the exit pipe, where the heat is least, while the smoke pipe retains throughout, a uniform thickness or width in the cross section. This peculiar feature of my radiator is also found in the modification *c* Fig. 3 where a flattened tube is formed into a continuous spiral, where *f* represents the air passages and *h* the smoke passages. In radiator *a* the entrance and exit pipe for the smoke, are upon the same level or nearly so, and at or about the middle horizontal line of the casing *e*, so that the smoke draft is horizontal and unimpeded in its general direction. As soon however as the smoke draft enters the radiator through the pipe *i* a diffusion, upward and downward takes place, and finally at the exit pipe *k* there is a concentration of this draft. As the greater diffusion is upward, the pipe *k* may be dropped slightly, but not so as to give any considerable obliquity to the draft or impede its course. The power of this radiator is so great that the utmost facility should be afforded to the smoke draft, for when it arrives at *k*, its heat is so far abstracted that it must have free course to the chimney.

The passages for air *f f* are open at top and bottom, and as there is a considerable condensation of pyroligneous acid in the smoke passages, I make the lower head of the radiator of galvanized cast iron to save corrosion. It will be readily seen that the air heating surface may be increased by increasing the height of the casing *e* and tubes *f* without diminishing, obstructing or prolonging the draft, whereas if the draft were ascending and descending, one or both, the draft would be obstructed or prolonged. Under my arrangement the increase vertically of the tubes and casing, and the air heating surface therewith, causes an increase in the capacity of the smoke flue.

In the radiator *b* which is a modification involving the feature of the diminishing air passages, and also the tubes with rounded edges, and also the applicability of the sheet iron tubes with the cast iron heads and flanges, and also the feature of horizontal draft to some extent with the diffusion upward and downward of the same, and also the horizontal winding back and forth of the smoke flue, there is a difference in the general arrangement of these flues and air spaces or tubes. These tubes are here arranged concentrical, each leaving a vertical space or opening *m* from top to bottom as will be readily seen from the drawing Fig. 3.

In radiator *c* there is a spiral smoke flue *h* and a diminishing air space *f* as in *a* and *b*, and by adopting the modification represented by *n* in Fig. 5, of separate tubes with rounded edges, but still preserving the spiral smoke flue and diminishing air spaces the cast iron head and flanges become applicable to the spiral smoke flue.

In modifications *b*, *c*, *n*, the feature of general horizontality and upward and downward diffusion of the draft, and also the feature of increasing the air heating surface with an accompanying incresae of the capacity of the smoke-flue without prolonging the draft, are the same as in radiator *a*. Arising out of these last named features, there is one principal and important feature common to all the modifications *a*, *b*, *c*, and *n*, viz., that within a given circumscribed horizontal limit, I can increase to the greatest possible extent the number of air heating tubes or spaces without diminishing the capacity of the smoke flue. The effect of increasing thus, the number of air tubes will be to contract the smoke flues in the width of their cross section, and extend them vertically preserving their required capacity.

Fig. 2, exhibits a section of the cast iron head *g* for the radiator *a*, and of the tubes driven on to the flanges *f' f'*.

Fig. 6 shows one of the heads with three of its flanges *f'* in perspective. It is an essential feature in my application of these heads and flanges when connected with a stove that tubes embrace the flanges; for I have found that the matters of condensation from the smoke will soon destroy the tubes at their junction with the flanges when the flanges embrace the tubes. And further, these flanges being elevated, form receptacles for the acid matters of condensation, from which they may be drawn off at pleasure.

Fig. 7, is a perspective view of the radiator *a* in which is seen at the bottom a chamber *n' n'* which is below the lower head of the radiator and designed for a cold air chamber, in case it should be desired to ventilate and heat another apartment or at the same time to ventilate and heat both, in which cases the chamber should be closed with the exception of an aperture *o* of sufficient size to admit the pipe introducing the cold air, and the hot air pipe applied to the top of the radiator in the usual manner. The radiators are provided with caps or hot air receivers at the top to which pipes may be attached. These may be expended down over the outside of the radiators when I wish to convey in addition the heated air from the outside of the radiators.

In making the radiator *a* one head may be made smaller than the other, so that the outside casing may be easily removed for the purpose of cleaning out the smoke passages, without disturbing the tubes and heads which are held together with screw bolts S, S, Fig. 6.

When the tubes are made of thin metal or are very wide, they may be corrugated,

which will make them stiff and expose a larger surface. When steam is used the pipes are soldered to the heads, and those pipes farthest from the source of heat should be most corrugated horizontally, so that the increased amount of surface in a vertical direction will vary with the decrease of heat, and the connection of the heads will thereby remain undisturbed by the unequal expansion of the metal in the different tubes.

Having thus fully set forth the character and advantages of my improvements in radiators and air heaters, or coolers, what I claim therein as new and original is,

1. Having the entrance and exit passages on the same horizontal line of the radiator—or nearly so—and at or about the position of the line of the middle horizontal section of the radiator, when such arrangement of these passages is combined with a series of flattened tubes or air passages and horizontally winding smoke passages substantially in the manner and for the purposes herein above set forth.

2. And I also claim in combination with the vertical air spaces and smoke passages formed by the flattened tubes, the successive contraction of the air spaces in the manner set forth; that is to say, the air spaces varying in thickness, or the width of their cross section, as they recede from the source of heat, each tube being of uniform width or thickness throughout, but narrower or thinner than that which precedes it.

SAMUEL D. TILLMAN.

Witnesses:

R. I. GATLING,

O. CAMPBELL.