(No Model.)

C. T. SCHOEN.

GRATE FOR FURNACES.

No. 354,248. Patented Dec. 14, 1886.

FIG. 1.

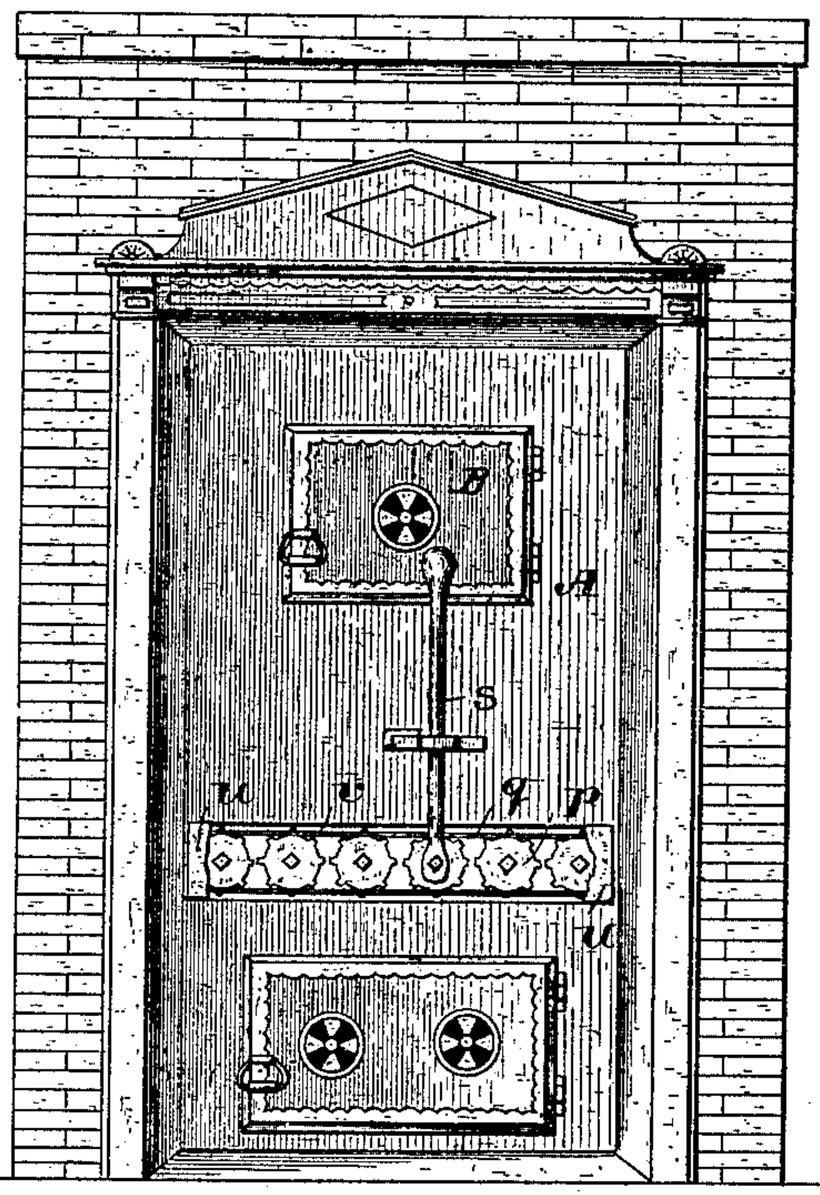


FIG. 7.

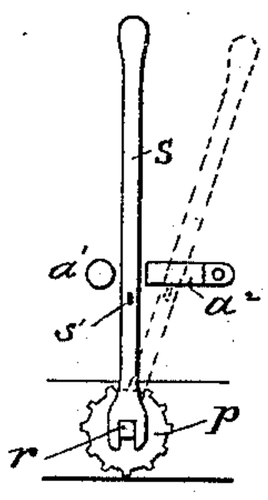


FIG. 8.

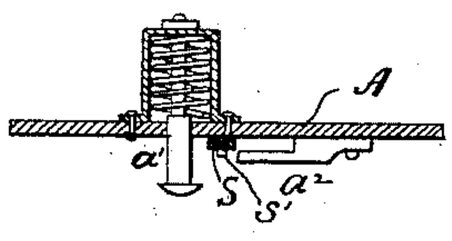


FIG. 4.

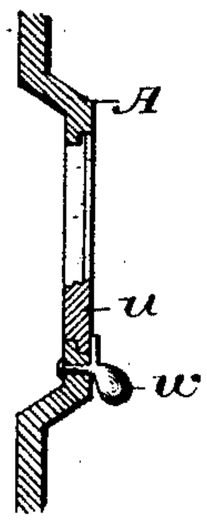


FIG. 2.

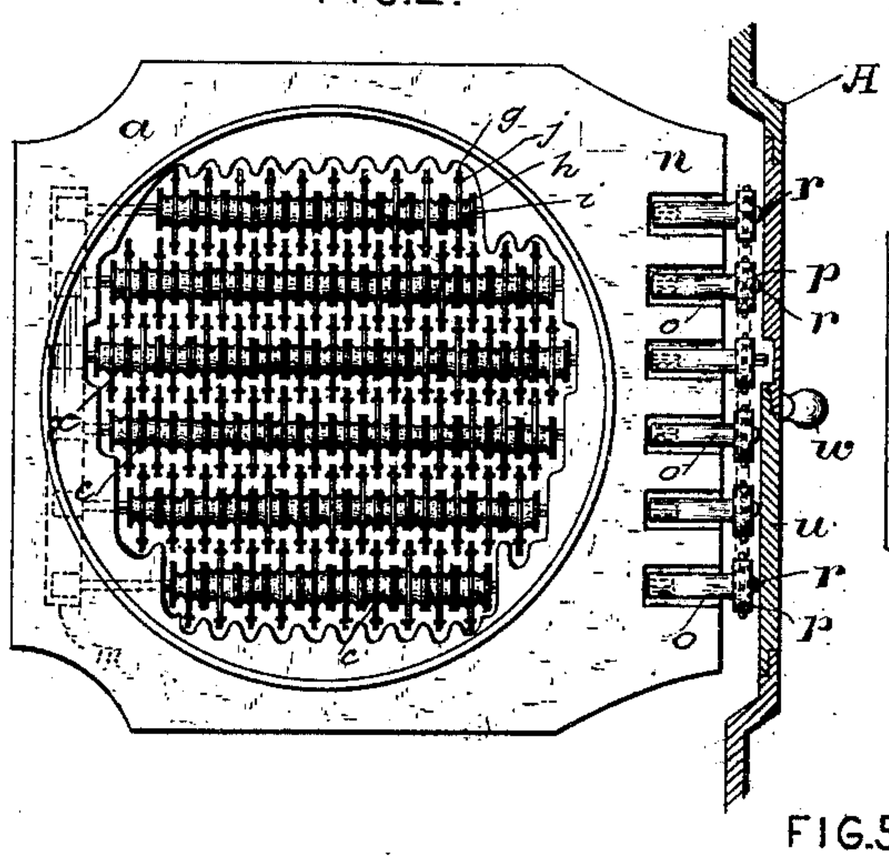


FIG. 3.

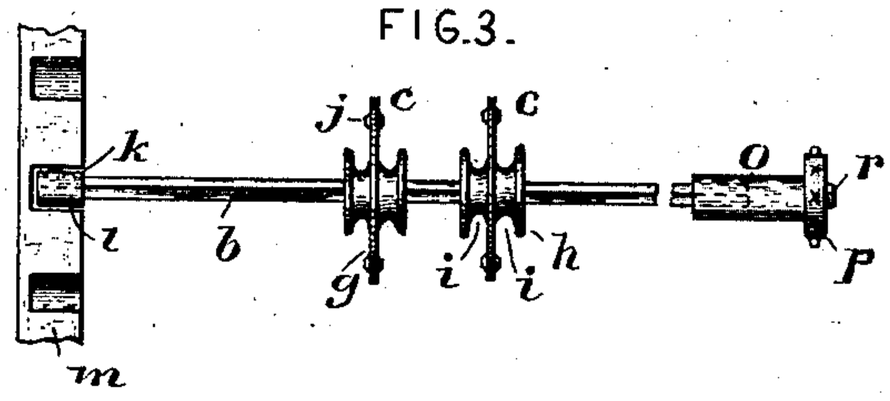


FIG. 6.

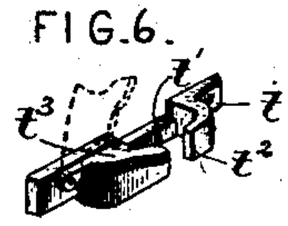
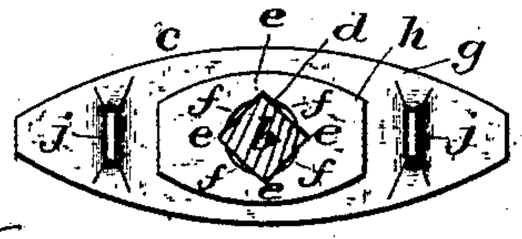


FIG. 5.



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UNITED STATES PATENT OFFICE.

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GRATE FOR FURNACES.

SPECIFICATION forming part of Letters Patent No. 354,218, dated December 14, 1886.

Application filed May 1, 1886. Serial No. 200,788. (No model.)

To all whom it may concern:

Be it known that I, CHARLES T. SCHOEN, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Grates for Furnaces, of which the following is a full, clear, and exact description.

This invention relates to that class of furnaces in which is used a grate composed of a series of sectional grate-bars, so constructed and arranged as that each section may be removed and replaced at pleasure, so that if any portion of a grate-bar be defective or injured it may be readily replaced without the expense of an entire new grate or grate-bar.

The object of the invention is to produce an economical, durable, and efficient grate for furnaces and other heating apparatus burning coal or other like fuel.

The invention consists in certain novel features in the construction of the grate sections and bars, the means for operating them, and the means for applying them to and in a furnace, all and severally as I will now proceed to more particularly point out and claim.

In the accompanying drawings, Figure 1 is a front elevation of a furnace, partly broken out. Fig. 2 is a top plan and partly sectional view. Fig. 3 is a detail of one of the grate-bars. Fig. 4 is a vertical section of the door. Fig. 5 is a side elevation of one of the grate sections or teeth, with the bar or shaft in section; and Fig. 6 is a perspective view of the guide for the grate-shaking lever. Fig. 7 is an elevation, and Fig. 8 a horizontal section, illustrating another form of guide.

I have shown my invention applied to a bricked furnace. *a* is the bed-plate or grate-frame, suitably supported beneath the fire-chamber, and adapted to receive and sustain a series of grate-bars which are constructed in accordance with my invention, as follows, the description of one bar sufficing for all:

b is a bar or shaft, preferably square in cross-section, of merchant, mild, or low-carbon steel, and I prefer steel, because it requires several hundred degrees more of heat to melt than cast-iron, and, of course, a correspondingly higher temperature to injuriously affect it, cause it to warp, twist, or burn, and also because it is stronger and can sustain a heavier load than cast or wrought iron without bending. On this bar, and in immediate contact with one another, I place a series of cast or malleable iron grate sections or teeth, *c*, each of which has a central orifice, *d*, to receive the bar, said orifice, however, coming into contact with the bar only at its four corners, *e*, and being recessed at *f* between said corners, so as to leave air-spaces between the section and the bar to serve as non-conductors, and thus relieve the bar of the heat that would be thrown upon it by close contact throughout of the tooth and bar. (See Fig. 5.) The sections *c* are made with a central body, *g*, of the shape of an elongated truncated ellipse, and on either side of this body are wings *h*, of the general shape of the body, but of only about half its length, and separated from the body by channels *i*, the said wings having the orifice *d* for their common center along with the body. The outer vertical faces of these wings are plane or flat, so that the wings of adjacent sections strung on a bar may come together flush. Beyond the ends of the wings the body is provided on each side at each end with vertical ribs *j*, standing off from them. The wings may be edged to facilitate crushing clinkers. When a series of bars provided with such sections are arranged in the grate bed or frame, the body of the section of one bar will align with the wings of the sections of its two neighboring bars, the ribs of the two sections being parallel. From this arrangement it is obvious that the fuel has an almost continuous and unbroken bed, and yet the channels *i* and the interstices between the wings and bodies of adjacent sections give, in the aggregate, a largely-increased draft-space, composed, however, of a large number of small spaces. Furthermore, this arrangement of the grate-sections admits of their rotation to riddle the fire without losing an excess of fuel, it being understood, of course, that in the riddling of the fire the sections will receive barely a quarter of a revolution. The many sharp angles and projecting surfaces on my grate-sections and their relative proximity in a grate insure the breaking up, thoroughly and completely, of all clinkers, and hence insure a clean, bright fire.

The grate-bars are preferably secured in the grate-frame by means of thimbles *k*, slipped

on the bars at one end and borne in sockets *l* in a socket-plate, *m*, secured underneath the frame at one end. The bars are supported in sockets *n* at the other end of the frame, and have as bearings the socketed spindles *o* of wheels *p*, said socketed spindles being, like the thimbles *k*, slipped on the ends of the bars, and as easily applied and detached.

The wheels *p* are sprocket-wheels in this instance, and the several wheels of the series of bars entering into the composition of the grate are connected by a chain-belt, *q*, whereby the motion of one wheel is transmitted to all alike. These wheels have bosses *r* projecting from their outer faces, and one such boss is squared to receive a lever, *s*, whereby the wheels may be rotated to shake the grate. This lever stands upright normally, and is embraced by a guide, *t*, on the furnace-door A, said guide consisting of a casting bolted to the door, having a central opening, *t'*, for the vibration of the lever, and an opening, t^2, midway of its opening, so that the lever cannot be detached from the grate except when standing in the vertical, and said lever being adapted to be applied to and detached from the grate only when the grate-sections are in position to support the fire, it follows that the grate cannot be left in improper position with the lever detached. A check-piece, t^3, is hinged to swing across the guide to limit the movement of the lever to the shaking of the grate, said check-piece having to be swung aside from said guide, as indicated in dotted lines, in order to admit of sufficient throw of the lever to set the grate-sections at such angle as to dump the fire. The lever projects over the feed-door B, so that it cannot be opened without first removing the lever; hence there is no liability of fresh fuel being placed upon a dumping-grate. Instead of this form of guide for the lever, I may use that shown in Figs. 7 and 8, wherein a spring-button, *a'*, and bracket a^2 take the place of the guide first described, and the lever *s* is forked at one end and straddles the sprocket-wheel boss, said lever having a projecting lug, *s'*, to prevent it from being removed, except when between the button and bracket. The button is pushed into the door when it is desired to dump the grate.

The bars are held in position and the sprocket-wheels retained on the bars by means of a movable gate or gates, *u*, in the furnace-door, against which the bosses of the wheels bear, and which preclude endwise play thereof. In the example of gate shown the top and bottom and sides of the opening *v* in the furnace-door are oppositely rabbeted, and the two parts of the gate correspondingly rabbeted to engage the same, they being held in place by a button, *w*. (See details, Figs. 2 and 4.) But the door may be hinged to fall down or to be swung sidewise. Suitable provision will be made for the passage through the door of the shaking-lever.

When a grate-bar is to be removed, the door or gate *u* is opened, the wheel of the desired bar pulled off, and the bar thus allowed to fall from its front socket into the ash-pit, whence it may be recovered, repaired, and replaced. By this construction and the peculiar construction of the grate-sections the most unskillful workman may set up and repair my grate.

A grate composed of a series of bars or shafts having arranged thereupon series of sections or teeth, the said bars with their teeth being revoluble in order to riddle the fire, and having the bars or shafts composed of mild or low-carbon steel and the teeth or sections made of cast or malleable cast-iron, possesses, in addition to the advantages already stated, the following points of excellence: By using the mild or low-carbon steel for the shafts or bars on which the teeth or sections are supported I am enabled to employ bars of much smaller dimensions and of less weight than were the bars of cast-iron or even wrought-iron of proportionate strength, for in order to get equal strength in a bar of wrought or cast iron the bar would have to be very much larger in dimensions and heavier than the steel bar, and consequently the air-space between the bars in a grate of given size would be much diminished. As it is of vital importance that the greatest amount of air-space possible with the proper support of the fuel should be present in a grate in order to secure the best results, it will be seen that by diminishing the dimensions of the bars without thereby sacrificing their strength and durability this air-space is largely increased. Furthermore, when a clinker or coal gets between the teeth in the act of shaking there is placed upon the bar a torsional or twisting strain, which tends to bend and distort the bar, and thus materially interfere with the proper operation of the grate both in supporting the fuel and in riddling. I have found that the steel bar more successfully resists this tendency than the materials heretofore employed, for under these conditions a steel bar of given dimensions will offer the same resistance as a cast-iron bar of about twice the size, and, as already remarked, this reduction in size of the bar not only gives an increased air-space, but diminishes the weight of the grate, and, in addition to these facts, a large bar, such as would be necessarily employed if cast-iron were used, largely increases the dead-surface on which the coal lies. The same objections exist against the use of wrought-iron bars, though possibly not to quite the same extent. The main point in making a grate is to have all the air-space possible, and at the same time have the intervening solid spaces, where the coal lies dead, as small as possible, and I have demonstrated that my construction of steel bars with cast teeth accomplishes this point more successfully than any other construction that has ever come under my notice. The material and construction of the teeth add not a little to this result. Constructing the teeth of cast or malleable cast-iron enables me

to make them quite light, and in the best possible shape for insuring plenty of air-space, and without special reference to their strength, for the reason that the steel bar carries the weight and takes the final strain.

I do not broadly claim a grate consisting of a series of bars, each composed of a shaft or bar, and a series of teeth arranged thereupon.

What I claim is—

1. A grate-bar for furnaces, composed of a bar or shaft, *b*, constructed of mild or low-carbon steel, combined with a series of grate sections or teeth, *c*, made of cast or malleable iron, and of substantially the construction shown, substantially as described.

2. A grate section or tooth comprising an elliptical body, lateral wings shorter than the body and parallel with it, with intervening channels and vertical ribs on said body, substantially as described.

3. The combination, with the grate-bars, and detachable sprocket-wheels thereon having bosses on their faces, of a cover or gate against which said bosses bear and are thereby held in position, and by means of which access is had to said wheels, substantially as described.

4. The combination, with the grate and its shaking-lever, of a guide for said lever, located vertically above said lever to limit its movement, and provided with a central slot to permit the removal of the lever only when the grate is in proper position to support the fuel, substantially as described.

In testimony whereof I have hereunto set my hand this 28th day of April, A. D. 1886.

CHARLES T. SCHOEN.

Witnesses:
THOMAS M. BELL,
THOS. F. BELL.