No. 715,494. Patented Dec. 9, 1902.

E. MASLIN & C. THERYC.

FURNACE AND AIR FEEDING APPARATUS THEREFOR.

(Application filed Feb. 5, 1902.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1

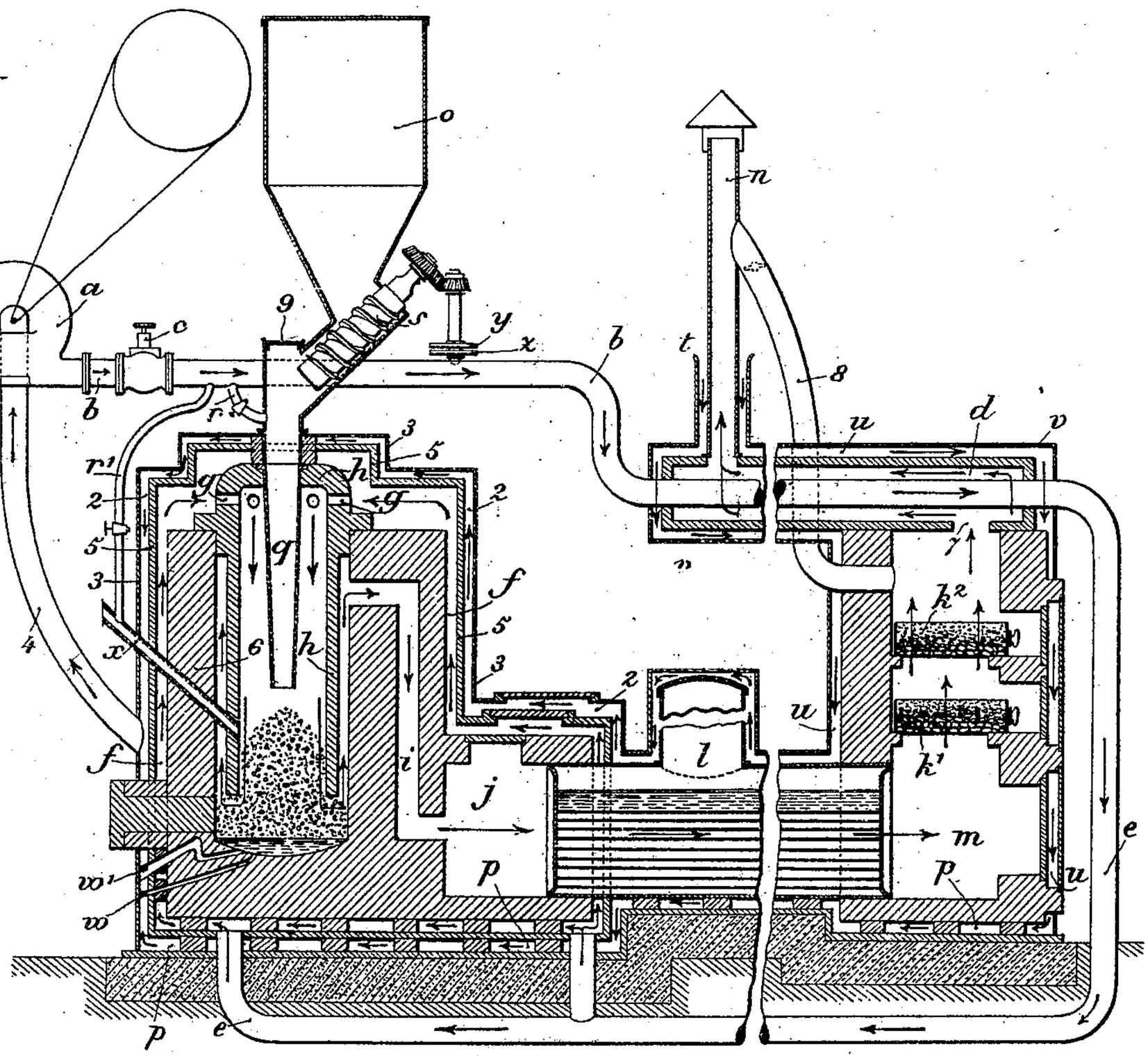

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Fig. 2

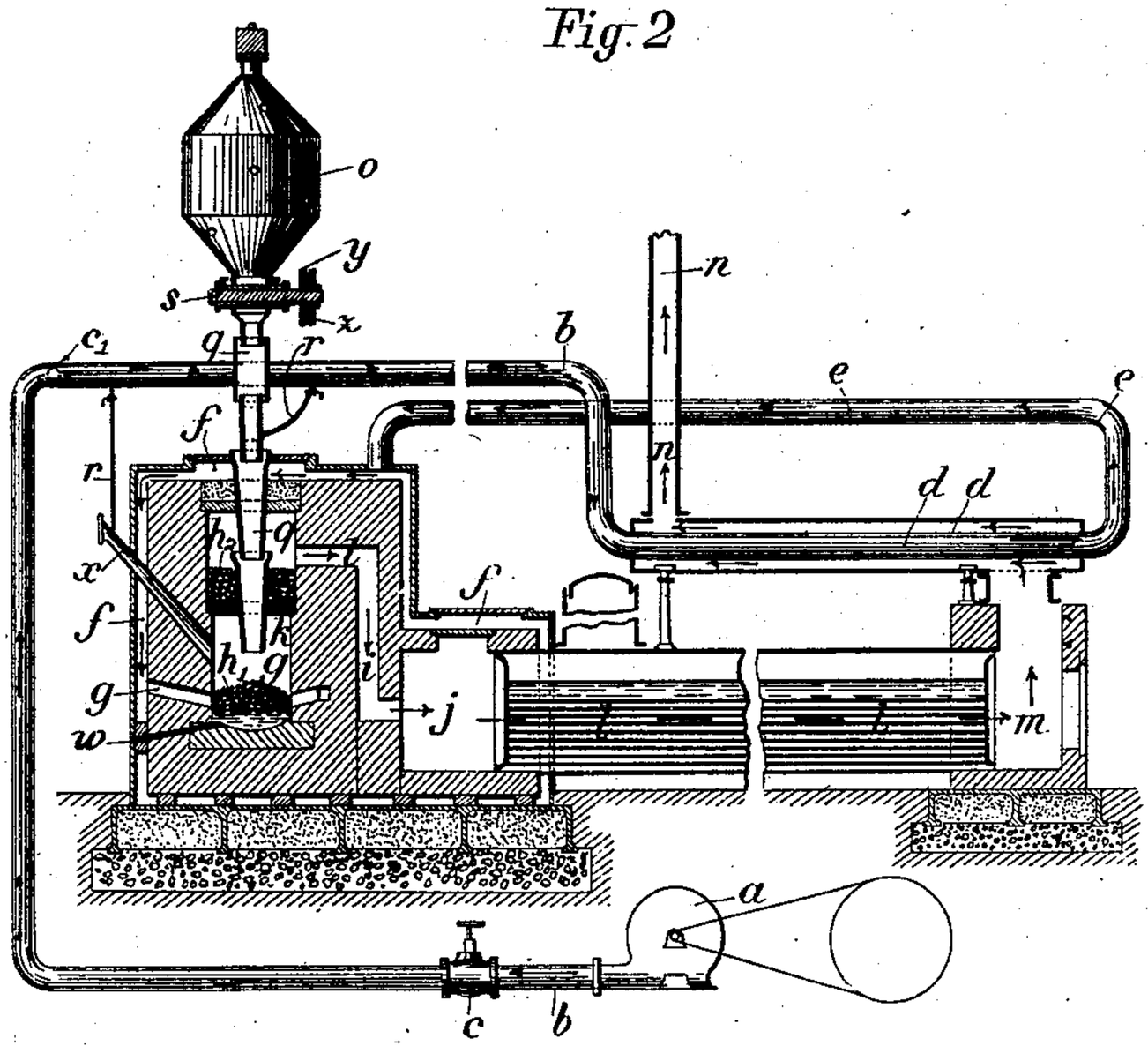


Fig. 3

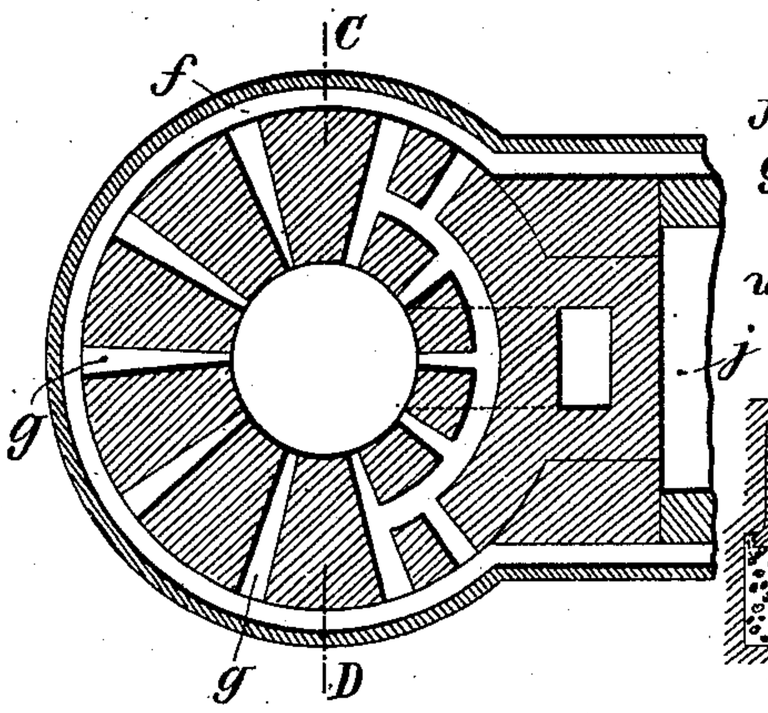
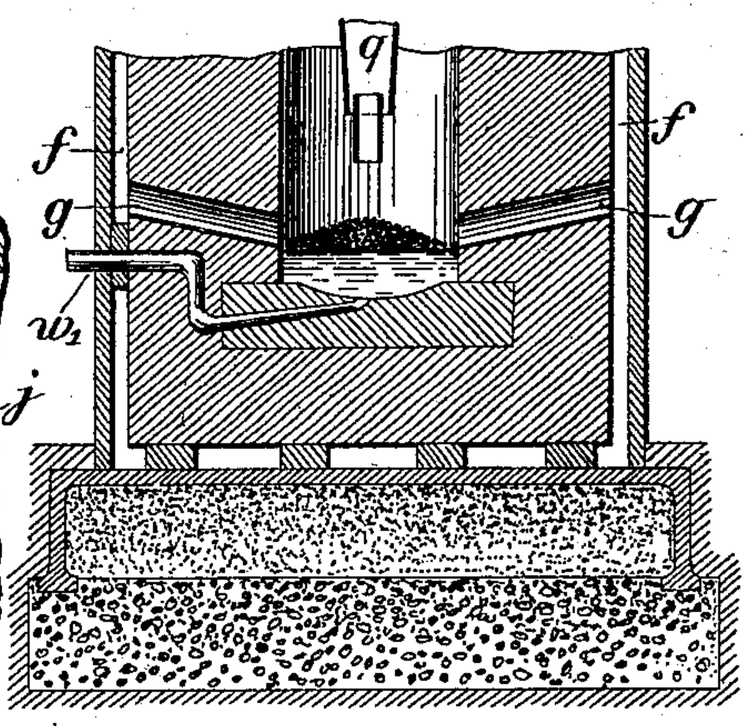


Fig. 4



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UNITED STATES PATENT OFFICE.

EMILE MASLIN AND CHARLES THERYC, OF MARSEILLES, FRANCE.

FURNACE AND AIR-FEEDING APPARATUS THEREFOR.

SPECIFICATION forming part of Letters Patent No. 715,494, dated December 9, 1902.

Application filed February 5, 1902. Serial No. 92,735. (No model.)

To all whom it may concern:

Be it known that we, EMILE MASLIN and CHARLES THERYC, engineers, citizens of the Republic of France, residing at Marseilles, France, have invented certain new and useful Improvements in Furnaces and Air-Feeding Apparatus Therefor, of which the following is a specification.

The present application for patent has for its object a process and certain combined arrangements designed to obviate the principal causes of loss of heat which are found in existing heat-generating apparatus and chiefly in the furnaces of steam-boilers which have a yield or duty much inferior to that which they ought to have. It is well known, in fact, that the most perfect existing methods of firing do not utilize in practice more than about sixty per cent. of the heat contained in the coal, there being therefore a loss of about forty per cent. on an average. The chief causes of these losses are as follows: First, the combustion is incomplete, there being formed soot and smoke and carbonic oxid and other combustible gases which escape being burned; second, the cleaning of the grate cools the furnace and leads to the fall and loss of unburned cinders through the grate-bars; third, radiation.

The present invention comprises apparatus arranged and combined to effect the suppression of the causes above indicated.

The fundamental idea of the apparatus is that of recovering the whole of the heat at present lost in the chimney, the products of combustion discharged by the chimney being thus quite cold and not intended to set up a natural draft. As a consequence it is necessary to employ artificial draft. Thus the improved apparatus comprises as its principal parts a blower, which draws in atmospheric air, and a regenerator or heat-exchanging apparatus, which heats this air to the temperature which the escaping products of combustion have as they leave the furnace; but this raises another point, as the grates of ordinary furnaces must, in order to keep them firm, be kept constantly cooled by the flow of the cold-air supply which enters below them. They would not be able to support themselves in a very hot-air blast having the high temperature developed in the furnace. Hence it is necessary to do away with the grates and, since the draft is artificial, to carry on the combustion in a closed chamber or stove. The necessary complement of the two first-mentioned parts of the apparatus is then a furnace consisting of a closed stove or chamber without any grating. These three parts are essential to one another, and to do away with any one of them would neutralize all the economy due to the present invention.

To obtain a satisfactory regeneration or recovery of the waste heat, it is necessary that the transmitting-surfaces should be kept in a proper state of cleanliness, since if they are incrusted they cease to transmit the heat. To avoid this inconvenience, it is necessary that only true gases (as distinguished from fumes, smoke, &c.,) shall be discharged into the recuperator. With this object and also for the more general purpose of preventing smoke and insuring complete combustion while using small coal or coal-dust we arrange a fuel-feeding device which can be regulated to introduce the fuel into the furnace in very small charges—for example, one hundred grams per second in a case where three hundred and sixty kilograms of coal are to be burned per hour. A regular combustion is thus obtained which can easily be rendered complete by supplying air in excess, thus insuring the consumption of smoke by destroying all fumes and soot. Furthermore, we filter or strain the products of combustion in order to clear them of any solid particles with which they may be loaded. Finally, to counteract the losses by radiation and to reduce them to a minimum we arrange a double casing around the furnace.

The parts of the apparatus are combined together in the manner we will now describe with reference to the annexed drawings, in which—

Figure 1 shows a vertical section of the arrangement of an installation in which the flames are forced backward—that is, in which the air-supply takes place from the top of the furnace. Fig. 2 shows a vertical section of the arrangement of an installation in which the feeding of the air takes place at the bottom of the furnace by means of twyers disposed in a ring. Fig. 3 is a horizontal section of Fig. 2 through the twyers. Fig. 4 is a section on the line C D, Fig. 3.

The air-supply is drawn in from the atmosphere by a blower *a*, actuated by a motor which takes its steam from the boiler *l*. This air enters the apparatus by a passage *t* which surrounds the lower part of the chimney *n*; it circulates in the space *u* formed between the regenerator *d* and an isolating-casing *v*, and flows thence partly by the passage *p* formed between the apparatus and the foundation, and partly by the space 2 which is formed between the outer part of the apparatus and an isolating-casing 3. From this conduit the air-blast reaches the tube 4, which conducts the same to the blower *a*. In this first passage the air receives and absorbs the heat radiated by the recuperator *d*, the chamber *m*, the boiler *l* and the first casing 5 which directly surrounds the furnace *h*. This air is then driven back by the ventilator *a* along the passage *b*, which passes through a regenerator *d* of any well-known system. In this journey the air absorbs the heat of the waste gases which escape by the upcast tube *n*. The air thus heated is discharged by the tube *e* into the passage *f*, arranged between the walls of the furnace *h* and a primary casing or jacket 5. In this last part of its course it absorbs the heat radiated by the furnace and is then discharged by the openings *g* into the top of this furnace.

The furnace is composed of a chamber 6, of refractory material, in which is arranged axially a sleeve or liner *h*, also of refractory material, which incloses the leading-in pipe *q* for the coal. The sleeve or liner *h* is shown in Fig. 1 as resting by means of a collar on the upper part of the furnace.

The coal is contained in the hopper *o*. Any suitable distributer *s* is arranged in the pipe *q* for supplying the small charges at regular intervals. This distributer is driven by the motor by means of fast and loose pulleys *y* and *z*.

The air is fed to the interior of the upper part of the liner *h* through the openings *g*. The quantity of air delivered by the ventilator is sufficiently in excess to insure the complete combustion of the coal. The action is regulated by the working of the screw *s*. The products of combustion ascend through the annular space around the sleeve or liner *h* and flow through the flue *i* into the chamber *j*. Then they traverse the fire-tubes of the boiler *l* and arrive at the chamber *m*, where they are filtered by two layers k' and k^2, of incombustible material, in gradually-decreasing fragments. They then pass into and traverse the regenerator *d* before escaping in a theoretically cold state to the chimney *n*.

It is impossible for any of the coal-dust not to be burned, since in the furnace *h* this dust is caught by the air, which is forced downward under pressure and drives it into the layer of burning fuel, where it is consumed. As regards the powder which happens to be carried away by the products of combustion the same is caught by the filters *k* k', where it is burned, owing to the high temperature which prevails in the chamber *m*, without any loss or disadvantage, since the regenerator *d* takes up and returns to the furnace all the heat contained in the waste gases whatever may be their temperature.

The filters k' and k^2 are made removable in order to be taken out and cleaned.

The ashes are liquefied by reason of the high temperature of the furnace, a flux being added, if necessary. They collect in the basin formed at the lower part of the furnace 6, and they are discharged naturally by the outlet *w* or by the siphon-passage w'.

x is an observation-tube to permit of observing the combustion.

r and r' are two branches, which permit of cool air being caused to enter the feed-pipe *q* and the observation-pipe *x*.

The lighting of the furnace and the getting up of steam in the boiler are effected by natural draft. To this end the recuperator *d* is shut off from the chamber *m* by closing the opening 7 and discharging the products of combustion directly into the atmosphere by the tube which leads from the upper part of the chamber *m*, such tube being closed by a damper during the ordinary working. The air is allowed to enter the furnace at the upper part of the pipe *q* by raising the cover 9, and in the same way the coal for lighting the fire is introduced. As soon as the pressure in the boiler is sufficient the motor for actuating the distributer *s* and the blower *a* is started, the cover-plate 9 and also the damper of the tube 8 are closed, and by means of the opening 7 the regenerator is put in circuit. Figs. 2 to 4 of the annexed drawings show a modification of this arrangement, in which the air-supply enters at the lower part of the furnace, there being a special filter *k* placed in the upper part of the furnace. h' and h^2 are respectively the fuel and filtering material. The air-supply is drawn directly from the atmosphere, and there is only a single outer isolating-casing. The same characters of reference designate the same parts, so that this apparatus does not need to be more fully described.

The advantages attained by the present invention are considerable: it permits of utilizing approximately the whole of the heat contained in the fuel, (which may be liquid or gaseous,) and it permits of regulating the temperature easily and with great nicety. One can, as desired, moderate or increase the combustion and suspend or restart it instantly, it being sufficient for this purpose to act on or control the motor which drives the ventilator and the distributer. It permits of increasing the power of a boiler or for a given power of reducing the heating-surface without decreasing the temperature usually attained in the furnace. The apparatus is smoke-consuming, it produces neither soot nor fumes, and the chimney need only be one of the simplest kind.

What we claim, and desire to secure by Letters Patent of the United States, is—

1. In an apparatus of the character described, a furnace provided with a fuel-chamber without a grate, a regenerator communicating with the said fuel-chamber, a jacket extending partly around the furnace and forming an air-passage, a casing surrounding said jacket and the remaining portion of the furnace and forming an air-passage, and means communicating with the jacket and with the casing for circulating air around the furnace through the regenerator and then feeding the same to the fuel-chamber to form an artificial draft.

2. In a furnace of the character described, a fuel-chamber, flues therefor, a jacket surrounding the fuel-chamber and the flues for the regeneration of the heat and forming an air-passage, a primary casing surrounding the jacket and the remaining portion of the furnace and forming an air-passage, and a regenerator mounted within the primary casing and in communication with the fuel-chamber.

3. In an apparatus of the character described, a furnace provided with a fuel-chamber, flues therefor, a jacket surrounding the furnace for the regeneration of the heat and forming an air-passage, a primary casing surrounding the furnace and the flues therefor and forming an air-passage, a regenerator mounted within the primary casing and in communication with the fuel-chamber, and a filtering means interposed between the regenerator and the fuel-chamber.

4. In an apparatus of the character described, a furnace, flues therefor, a jacket surrounding the furnace for the regeneration of the heat and forming an air-passage, a primary casing surrounding the furnace and the flues therefor and forming an air-passage, a regenerator mounted within the primary casing and in communication with the furnace, a filter arranged below said regenerator, and a boiler interposed between said filter and said furnace.

5. In an apparatus of the character described, a furnace provided with a closed fuel-chamber, a jacket inclosing said furnace and forming an air-passage communicating with said chamber, a casing surrounding said jacket and forming an air-passage, means communicating with each of the said air-passages for forming an artificial draft, a boiler communicating with the said chamber and surrounded by said casing, a regenerator arranged in the said casing, and a filtering means interposed between said boiler and said regenerator.

6. In an apparatus of the character described, a furnace provided with a fuel-chamber, a jacket surrounding said furnace and forming an air-passage communicating with said chamber, a casing surrounding said jacket and forming an air-passage communicating with the atmosphere, means communicating with the said air-passage for forming an artificial draft for the fuel-chamber, and a regenerator mounted in said casing and in suitable communication with said chamber.

In testimony whereof we have hereunto set our hands, in presence of two subscribing witnesses, this 22d day of January, 1902.

EMILE MASLIN.
CHARLES THERYC.

Witnesses:
THOMAS MEIFFREN,
ALPHONSE PUGET.