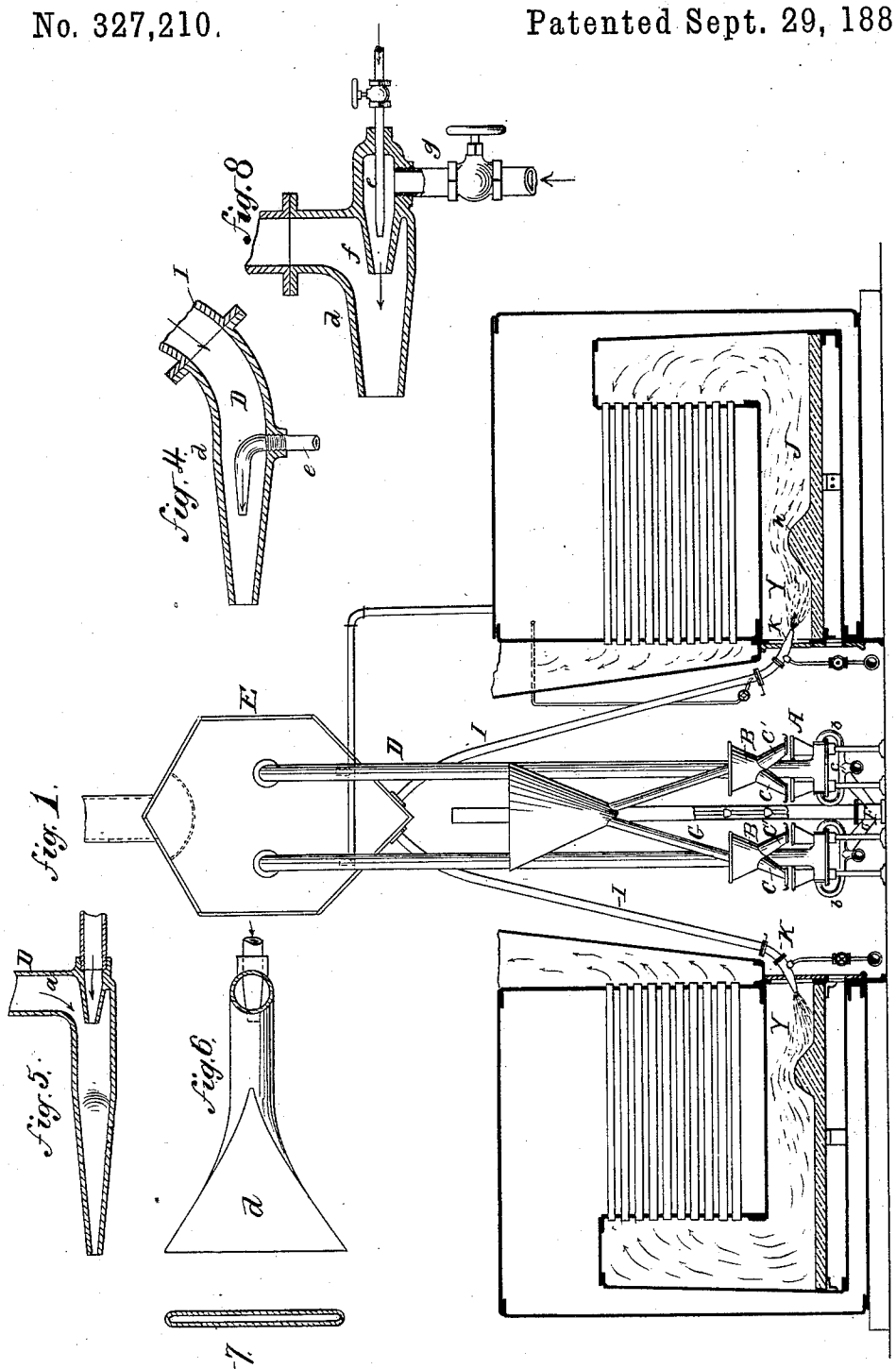
(No Model.) 2 Sheets—Sheet 1.

W. WESTLAKE.

FEEDING FINE FUEL.

No. 327,210. Patented Sept. 29, 1885.



Witnesses:
L. Sargeant.
Wm. F. Jayers.

Inventor
William Westlake.
By Foster & Freeman
Attys

N. PETERS, Photo-Lithographer, Washington, D. C.

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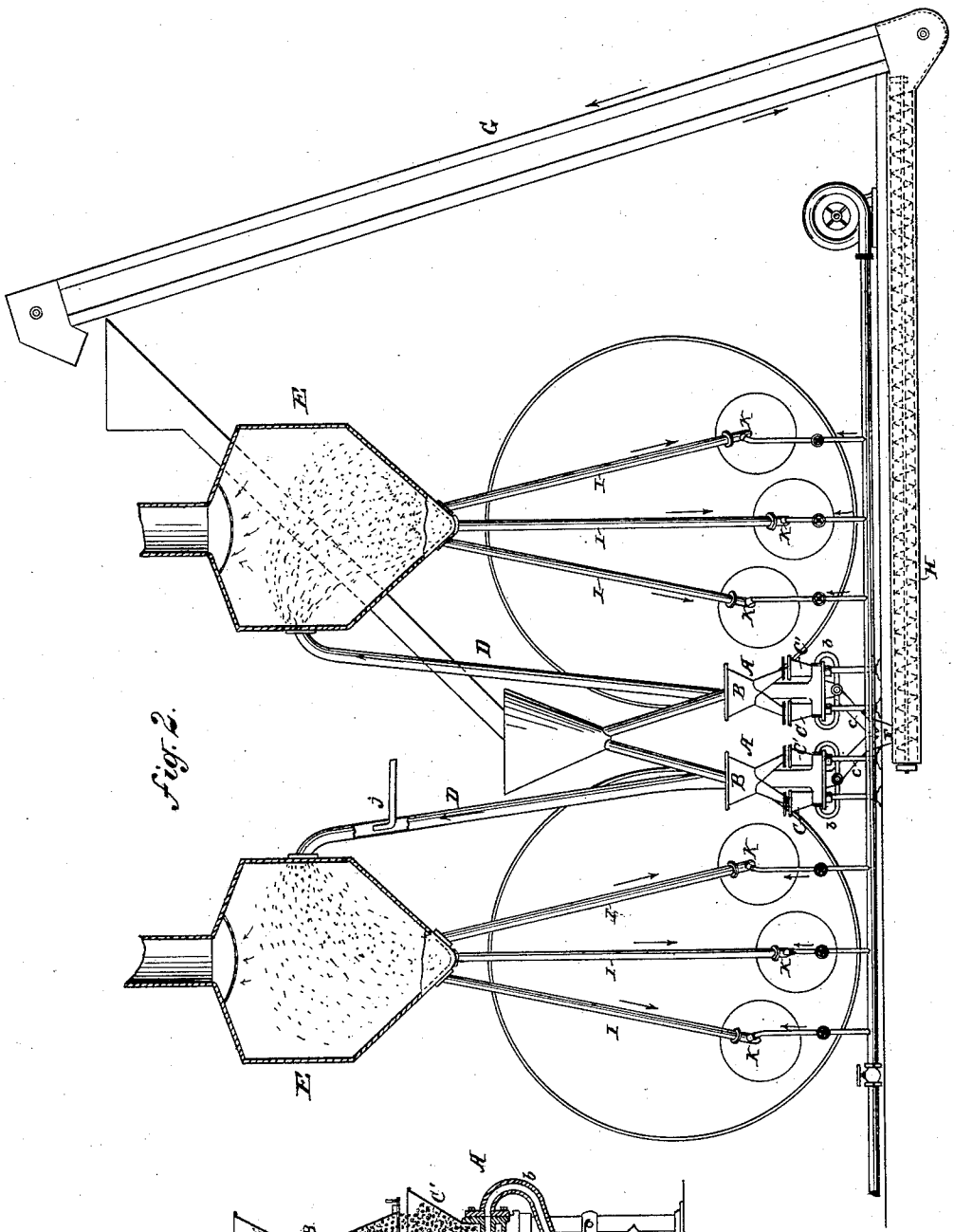


Fig. 2.

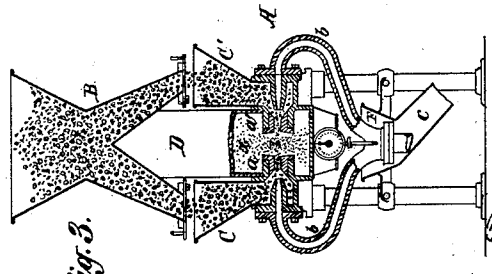


Fig. 3.

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UNITED STATES PATENT OFFICE.

WILLIAM WESTLAKE, OF BROOKLYN, NEW YORK, ASSIGNOR TO THE UNITED STATES COMBUSTION COMPANY, OF NEW YORK.

FEEDING FINE FUEL.

SPECIFICATION forming part of Letters Patent No. 327,210, dated September 29, 1885.

Application filed July 1, 1884. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM WESTLAKE, a citizen of the United States, and a resident of the city of Brooklyn, in the county of Kings and State of New York, have invented new and useful Improvements in Feeding Fine Fuel, of which the following is a specification.

My invention is an improvement in apparatus for burning solid fuel; and the same consists in reducing the said fuel to an impalpable powder and carrying it directly from the reducing apparatus to the fire-place and burning it in connection with jets of air or steam, or both, substantially as described hereinafter, so as to thoroughly consume every particle of the fuel without waste, and without the formation of cinders, and so as to secure an intense heat and rapid combustion.

In the drawings, Figure 1 is a sectional elevation showing an apparatus for carrying out my invention in connection with the furnaces of two steam-generators. Fig. 2 is an elevation in part section showing a modified form of apparatus. Fig. 3 is a sectional elevation illustrating one form of pulverizer. Figs. 4 to 8 are sectional views illustrating different forms of injectors.

Various apparatus have been devised from time to time with the view of burning fine fuel, as contradistinguished from the coarser fuel ordinarily burned upon beds or grates, and such fine fuels have been introduced into the fire-boxes by means of blasts; but in all such cases, as far as I am aware, the fuel, while much finer than that ordinarily used upon beds and grates, has been much coarser than I have found could be practically and economically employed. For instance, it has been, in whole or in part, in the form of fine grains or meal.

I have found that a much better and more economical effect can be produced by substituting for the meal fuel heretofore employed fuel in the shape of an impalpable powder or dust so fine that it will float readily in the air, but with little tendency to descend, in which condition it will burn with great fierceness and rapidity, giving off an intense heat, and the ash will be in such a fine condition that it will be carried with the blast.

Owing to the extreme fineness of the fuel which I use in carrying out my invention, it would be almost impracticable to reduce the coal to its powdered state and then transport the powder and make use of it at different points from that where it is manufactured, inasmuch as it will escape from the crevices of ordinary vessels, and in the process of transfer from one vessel to another, with such injurious effects as in many instances to debar its use.

To secure the advantages of employing the fuel in its finely-divided state and avoid those incident to its transportation and transfer, I combine with each furnace suitable means whereby a comparatively coarse fuel is pulverized, and the finer impalpable portions only carried from the pulverizer into the furnace.

In order to illustrate my invention, I have shown in the drawings pulverizing apparatus and furnaces and burners or injectors of certain forms; but I do not limit myself to these constructions.

The pulverizer may consist of one or more machines, A. As shown, each machine consists of a hopper, B, containing fine coal—as, for instance, pea-coal—and two receptacles, C C′, from which the coal flows through suitable channels in front of nozzles *a a′*, communicating with pipes *b*, through which superheated steam at a high pressure flows to the said nozzles. The nozzles *a a′* are arranged in line opposite each other within a chamber, X, and the steam-jets striking the particles of coal carry them from opposite sides and against each other with great force, so that they are thereby reduced to a fine impalpable powder.

The chamber X communicates with a tube, D, leading to a receiver, E, and also with a chute or spout, *c*, so that the blast resulting from the inflowing jets will carry the finest portion of the fuel up the tube D into the receiver, while any coarser portion which fails to be reduced will pass through the chute *c* to a case, F, communicating with an elevator, G, by means of which the particles will be carried above and deposited in the hopper B. When two machines A are used, one hopper and one elevator may be common to both, as shown in Fig. 1.

Where the elevator is necessarily at a dis-

tance from the casing F, a spiral conveyer revolving in a tube, H, may be used to carry the particles to the foot of the elevator, as shown in Fig. 2. In either case there is a constant circuit of the fuel until it is reduced to an impalpable state, and all impalpable particles are carried as soon as formed into the receiver E.

From the receiver a pipe, I, leads to an injector, K, within or extending into the fire-place Y, and suitably constructed to receive a jet of highly-compressed steam or air, or both, and also a stream of the fuel-dust, which is carried by the air-jet, and therewith, into the fire-place and burned, the air or steam supplying the carbon with sufficient oxygen to insure a thorough combustion.

Different forms of injectors are shown in Figs. 4 to 8, in which *d* is a nozzle or tube communicating with the tube I, and contracted either to form a circular end, as in Figs. 4 and 8, or a flat spreading end which will disperse the particles, as in Figs. 5, 6, and 7, and into the nozzle *d* projects the steam or air pipe *e*, arranged in such manner as to direct the jet to the mouth of the nozzle *d*.

When both steam and air are used, the steam-pipe *e* is inserted within a nozzle, *f*, extending into the nozzle *d* and communicating with the air-pipe *g*, as shown in Fig. 8. By this construction the fine dust is caused to flow into the nozzle *d* around the nozzle *f*, from which a combined jet of steam and air is directed against the dust and carries it through the nozzle *d* into the furnace. Suitable cocks are arranged in the pipes to regulate the flow of the steam and air.

One, two, or more injectors may be arranged so as to carry the dust-fuel into each fire-place, and the bed J of the latter is preferably provided with a transverse rib or projection, *h*, against the inclined side of which the inflowing jets are forced, so as to thoroughly mingle the powder and the gases and distribute them through the combustion-chamber, thereby affording an abundant supply of oxygen to each particle of carbon.

Where there are two or more boilers, the pipes I, for supplying each boiler or fire-place, all extend to a single receiver, E; but in some instances it may be preferable to use a separate receiver for each generator, as shown in Fig. 2.

It will be seen that by combining the pulverizer with the generator or furnace to be heated I am enabled to carry the finest particles of dust, which it would not be practicable to transport directly into the fire-place, and that I can operate repeatedly upon the fuel, gradually reducing it to an impalpable powder without loss, and without using any portion except the finest particles, which are in the best shape to be most effectively consumed and to result in the most intense combustion. The use of the finest particles of the fuel is essential to a perfect result, as the burning of coarse particles would result in imperfect combustion and cinders. To prevent the coarse particles from being carried into the receiver E, I reduce the upward blast in the pipe D in any suitable manner, so that the coarser particles will not be carried by the blast, but will fall back and be reconveyed to the hopper.

The force of the steam-jets from the nozzles *a a'* may suffice to carry up the fine fuel; but I prefer to use a moderate blast of air or steam at, say, about twenty pounds pressure issuing through a nozzle, *j*, in the pipe D, whereby only a slow current is created, so that only fine powder will be carried to the receiver and to the fire-place. In this respect my invention differs from other modes of burning fine fuel, and in which coarse and fine particles are mixed together and carried to the fire-place.

In some instances the receivers E may be dispensed with and the fine fuel may flow directly from the pulverizer to the fire-place.

It will of course be important in many cases to line the combustion-chamber with fire-brick or other refractory substance.

Although I have shown the invention in connection with steam-generators, it may be employed wherever it is necessary to secure a high heat by the combustion of fuel, and for portable as well as stationary generators.

I do not herein claim the method of making use of solid fuel herein described, but reserve it for a separate application under the office rules.

Without limiting myself to the precise construction and arrangement of parts shown, I claim—

1. The combination, with a fire-place, of a pulverizer constructed to reduce fuel to a finely-divided condition, and a pipe or conduit leading from the pulverizer to the fire-place, and means for directing a jet of steam or air, or both, with a stream of the divided fuel, into the fire-place, substantially as set forth.

2. The combination, with a fire-place, of a pulverizer constructed to reduce fuel to a finely-divided condition, a conduit leading from the pulverizer to the fire-place, means for forcing a jet of air or steam into said conduit, a hopper for supplying the pulverizer with the fuel to be divided, a receptacle into which the coarser particles of the divided fuel are received, and a conveyer between the said receptacle and the hopper, substantially as set forth.

3. The combination, with the fire-place, receiver for fine fuel communicating with the fire-place, and pulverizer, of means, substantially as described, for conveying the finest particles only of fuel from the pulverizer to the receiver, for the purpose set forth.

4. The combination, with a fire-place, of a pulverizer, a receiver with which the pulverizer communicates, means for forcing a jet of air or steam to carry only the finer particles of

the fuel into the receiver, and an injector communicating with the fire-place and with the receiver, substantially as set forth.

5. The combination, with a pipe or channel communicating with a device for pulverizing solid fuel, of a nozzle extending into the fire-place, and steam and air pipes communicating with said nozzle, substantially as set forth.

6. The combination, in a fire-place, of a nozzle or conduits for supplying it with impalpable fuel, and a jet of air or steam, or both, and a bed provided with a projection against which the inflowing stream is directed, substantially as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM WESTLAKE.

Witnesses:
DANIEL E. DELAVAN,
THOMAS KEECH.