UNITED STATES PATENT OFFICE.

ALFRED BERNEY, OF JERSEY CITY, NEW JERSEY.

IMPROVEMENT IN ARTIFICIAL FUEL AND METHODS OF BURNING THE SAME.

Specification forming part of Letters Patent No. **139,288**, dated May 27, 1873; application filed May 17, 1873.

To all whom it may concern:

Be it known that I, ALFRED BERNEY, of Jersey City, county of Hudson and State of New Jersey, have made a new and useful improvement in the combination of anthracite coal-dust, slack, or screenings, with bituminous coals and dust, other coals, and fuels, and new processes for burning the same, in railroad-locomotive furnaces and other furnaces.

To enable others skilled in the art to which it pertains to make and use the same, I do declare the following to be a full, clear, and exact description of the invention.

When ready to use my invention for the first time in a furnace to generate heat, a fire must be first started with wood and bituminous coal, or some other suitable fuel, and then adding the anthracite dust with care, separately, each day increasing or diminishing the quantity until the proper amount which the furnace will burn profitably and use fully, using at the same time some one of the more easily-burning fuels herein named. On locomotive tenders I keep the anthracite dust in one apartment of the tender, and coal or fuel in another. After fully arriving at the exact amount that a furnace can burn, I mix it in that proportion, keeping some other fuel ready in any emergency to aid the fire, if it gets too low, or more heat is required.

On locomotives, get steam up to about fifty pounds' pressure with other fuel, bituminous or anthracite coals, making a good bed of fire before using any of the anthracite dust. There are many reasons why, on railroad locomotives, too much dust must not be used rashly, and when mixed in large quantities, care must be taken to well mix it, and use less dust than could be burned.

Anthracite dust or screenings may be mixed with bituminous coals or dust, if of good quality, in proportions of one-half of each kind, in large or small quantities, and improves by the mixing. The very fat sulphurous or melting coal of the west is improved by the combination. The anthracite dust may be mixed with coke, as above, or it can be burned with anthracite coal, which forms a solid bed of fire for it.

To be able to economize in fuel, also burn more anthracite coal-dust, and to save the expensive fuels, I make the following improvements to any furnace, where possible: I insert water-flues, of two or more inches in diameter, a quarter of an inch thick, in rows of **W** shape, or straight along. At the bottoms of the **W** put a hollow wrought flue, same as above, with holes in it three inches apart, and along on a line. This tube is movable, to dump the fire when necessary, the end of the front to be slipped through a hollow stay-bolt with a trumpet attached to the bolt outside. The loose bar is to go through the iron or brickwork outside, in the rear, and there it can be moved at pleasure. Make the bars half an inch apart; place this water-grate from six to twelve inches above the old grates, at the forward end; incline them up to the door an inch or two to the foot, as is well known how to do, by screwing one end in the inside sheet of the fire-box and calking the other, and the old grates remain as usual, for the sparks and small fuel to drop upon. This, being above the ash-pan or pit, keeps it alive, then burns it all up. It enables one to have a hot-air chamber, and thus the air is heated to a high degree, which causes it to more freely mingle with the gases and smoke, and thus consume the fuel which would be otherwise wasted. The water-bars make steam very freely, and save fuel. A blow-off plug must be kept close to the bottom of the lower grates, so as to blow off as required, to keep the water-bars and boiler free from mud or sediment; two or three water-bars to a side in each **V** is enough to form one.

On locomotive-tenders, put in a partition of wood or iron lengthwise, and about the middle of the tender. It can be made of any style—loose boards or stationary. If of iron, put a stationary one-half way down, with two or more revolving ones to throw back on the pivots; this enables the fireman to get the fuels easier. In front of this partition place the usual bulkhead of boards; the compartments thus formed will do to hold the dust in one and the coals or coke or other fuel in the other.

I put on, where possible, a spark-arrester of this kind: Insert one or more large flues (generally two) in the boiler, and at the bottom have them from three inches to five or

six in diameter; put in as flues usually are. Inside of these put in a movable one, with a set-screw at each end to prevent its slipping; then put a T-shaped pipe forward; let one end be inserted in a flue and the other outside to get the air in. On the outside end put a trumpet ten inches (more or less) in diameter. The other part of the T turn upward, so that a pipe can be inserted from the stack to fit in it easily. Inside of the stack proper put an inside pipe of the height of the waist. Upon the top of this, inside, place a cast-iron cone, supported by three rods, carrying the cone on a plane with the largest diameter of the head of the stack. Surrounding the top of the inside pipe is an annular deflector, extending half to the outside pipe, and pitched downward. At an angle of forty-five degrees, near the bottom of this inside pipe or case, is a series of double-incline planes. The highest points make at the front and rear of the stack, and joining, while the lower ends at the sides are three inches apart, leaving an opening between. Immediately below these openings are others cast in the base or saddle of the stack, into the lower side of which are the pipes inserted from the T.

The object of this invention is to save and conduct back to the furnace all the sparks and dust, as well as steam, smoke, gas, and heated air. It will save fuel, and prevent the dust from flying out of the stack. Use Nos. 8 or 10 wire-mesh, put in the largest part of the stack, as it will prevent any back pressure.

I use a superheater, made as follows: Take two sheets of iron, three-eighths to half an inch thick; cut out nearly as many two-inch holes as there are flues in the boiler; turn up the edges four to six inches around, so that one will fit over the other, (like the cover to a box,) so as to leave six to eight inches clear inside; rivet or screw it together same as boilers are made; put in iron flues the same as flues are inserted; fit the cast-iron connections from the steam-pipe and steam-chests, (as are usually made to the ordinary steam-pipes in the smoke-arch,) holes being cut in the superheater to pass the steam in and out. Another way to make it is to make one side turned up, cover-like, six to ten inches with a flange turned, so that a flat plate can be bolted on with red lead. The connections can be fitted onto the large part in before the flues are put in. The counter-case can be of cast iron, or all made of copper. The case will take no more room in an arch than the pipes do now. The case is heated by the waste fire, and dries or superheats the steam, which will save fuel by the expansion, as well as the nuisance of the exhaust steam going into the air.

I heat the feed-water by placing a coil of pipe, made so that one part is coiled up five coils, then crossed down five coils. This coil is to be made of two-inch copper pipe; the coil to be fifteen inches in diameter on the inside; to stand a water-pressure of two hundred pounds. Braze bands of copper where it crosses, so as to keep it steady. Place this coil in a double case, made of galvanized iron, three to four inches wide in the inside, so that the coil will fit in loosely. The end of the coil-case is open at the bottom to set over it; at the top it is inclined outwardly three inches. The case should be thirty inches high; the inside diameter fifteen inches across; the outside nineteen. Make a cast-iron saddle with flanges one inch high, so that the case will set inside of them, outside of this outer flange, and three inches from it cast another so as to hold the stack and leave an annular space three inches around, for sparks, &c., to fall in, as before described. Cast the holes for an inch drip-pipe in the rear of it, two two-inch-and-an-eighth holes on the right side, one two-inch hole in front—all these to be between the two inner flanges. Around these holes, except the drip-pipe *p*, cast a ring a little higher than the flanges, and in such a manner as to pack them with red lead, &c. Between the outer flanges on each side cast a three-inch hole for the sparks to fall through; fit the saddle on; put up through the smoke-arch an inch iron pipe; the bottom one an inch from the track. This is for the condensed water to fall through onto the ground. Fit into the front two-inch hole another iron pipe, run up into the case two inches; the other end into the single exhaust; or let in by branches into the double exhaust; connect the pump with a pipe to the coil, and another with the check-valve of the pump; let these pipes through the smoke-arch. The whole is then complete. Fit these pipes, and work all in a first-class manner; the result will be a great saving of fuel, and saving to a boiler, and aid in utilizing the anthracite dust.

Where new boilers and furnaces are made, or old ones to be altered over, a larger fire-box than is used for wood or bituminous coal ought to be made, so as to get more fire surface. About eight feet long for locomotives would be best, but seven feet will do. The dust requires more surface.

The exhaust should be made, if a single exhaust is put in, about three or three and a quarter inches wide. Double exhaust should be two and a half inches wide.

A volcano or crater fire is best to burn dust, taking care not to fill the holes up, or to leave the grates bare.

When grates of cast-iron are used, cast them on top on an angle, so that the dust will slide down easily into the openings between them. A slight shake will readily precipitate the dust down.

As no one, previous to my invention, ever successfully burned or utilized anthracite coal-dust or screenings in a railroad-locomotive furnace to generate heat to make steam, I do not confine myself to any proportions other than before patented, and herein specified. It can be used alone, after a fire is made, or in such portions with other fuels, such as bituminous coal, dust, coke, or other coals, or

artificial fuels, as use and desire may dictate. One-half dust can be mixed with half bituminous coal or dust, and used or burned successfully without any alterations by applying all of the combined improvements. All anthracite dust can be burned usefully, a lighter fire can be carried with about twenty per cent. of the anthracite dust, and then eighty per cent. bituminous coal or dust. Mixed proportions vary very much in each furnace.

What I claim as my invention and desire to secure by Letters Patent, is—

1. The improved processes, herein described, for combining, mixing, and using anthracite coal-dust, slack or screenings, with or without bituminous coal, dust, or other fuels, to generate heat in railroad-locomotive furnaces, substantially as described and for the purpose set forth.

2. The improved processes herein described for using anthracite coal-dust, slack, or screenings, alone or with anthracite coal, in railroad-locomotive furnaces as set forth, or in any other furnaces.

3. The processes herein described, alone or in combination, for the purpose of economizing fuel and burning anthracite coal-dust in railroad-locomotive furnaces, or other furnaces, substantially as described, and for the purposes set forth.

4. The combination of a hot-air chamber, with water-grates and other grates, a feed-water heater, a superheater, a spark, steam, smoke, heat, and oxygen conductor with a furnace so as to burn anthracite coal-dust or screenings, alone or with other coals or bituminous dust, to generate heat, as described, and for the purpose set forth.

ALFRED BERNEY.

Witnesses:
GEO. W. STOKES,
WM. G. HENDERSON.