

(No Model.)

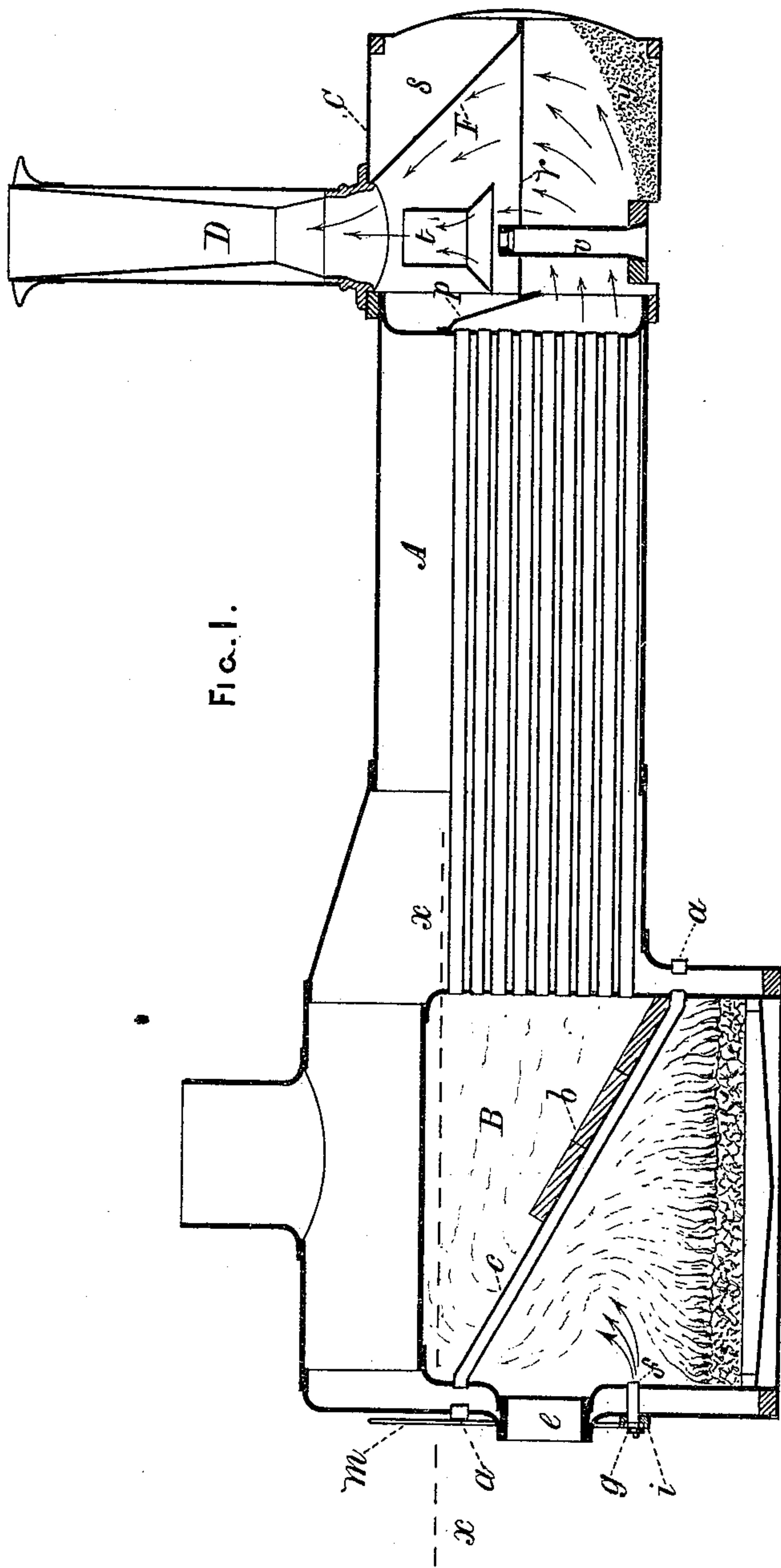
2 Sheets—Sheet 1.

J. B. BARNES.

## FURNACE FOR LOCOMOTIVES.

No. 354,007.

Patented Dec. 7, 1886.



WITNESSES.

R. Newton.

A. C. Beatty.

INVENTOR.

Joshua B. Barnes

By F. S. Davenport, Atty.

(No Model.)

2 Sheets—Sheet 2.

J. B. BARNES.  
FURNACE FOR LOCOMOTIVES.

No. 354,007.

Patented Dec. 7, 1886.

FIG. 4.

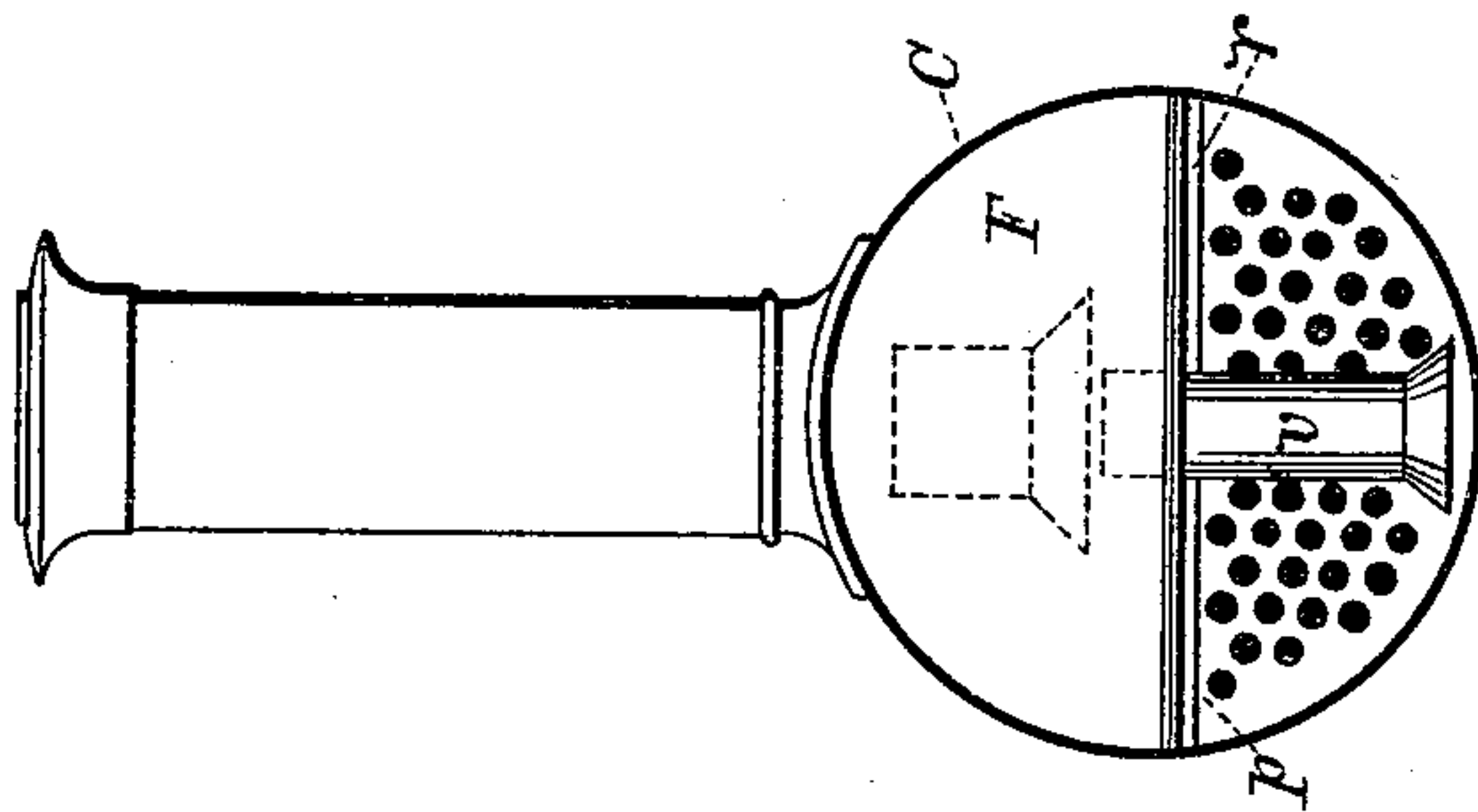


FIG. 2.

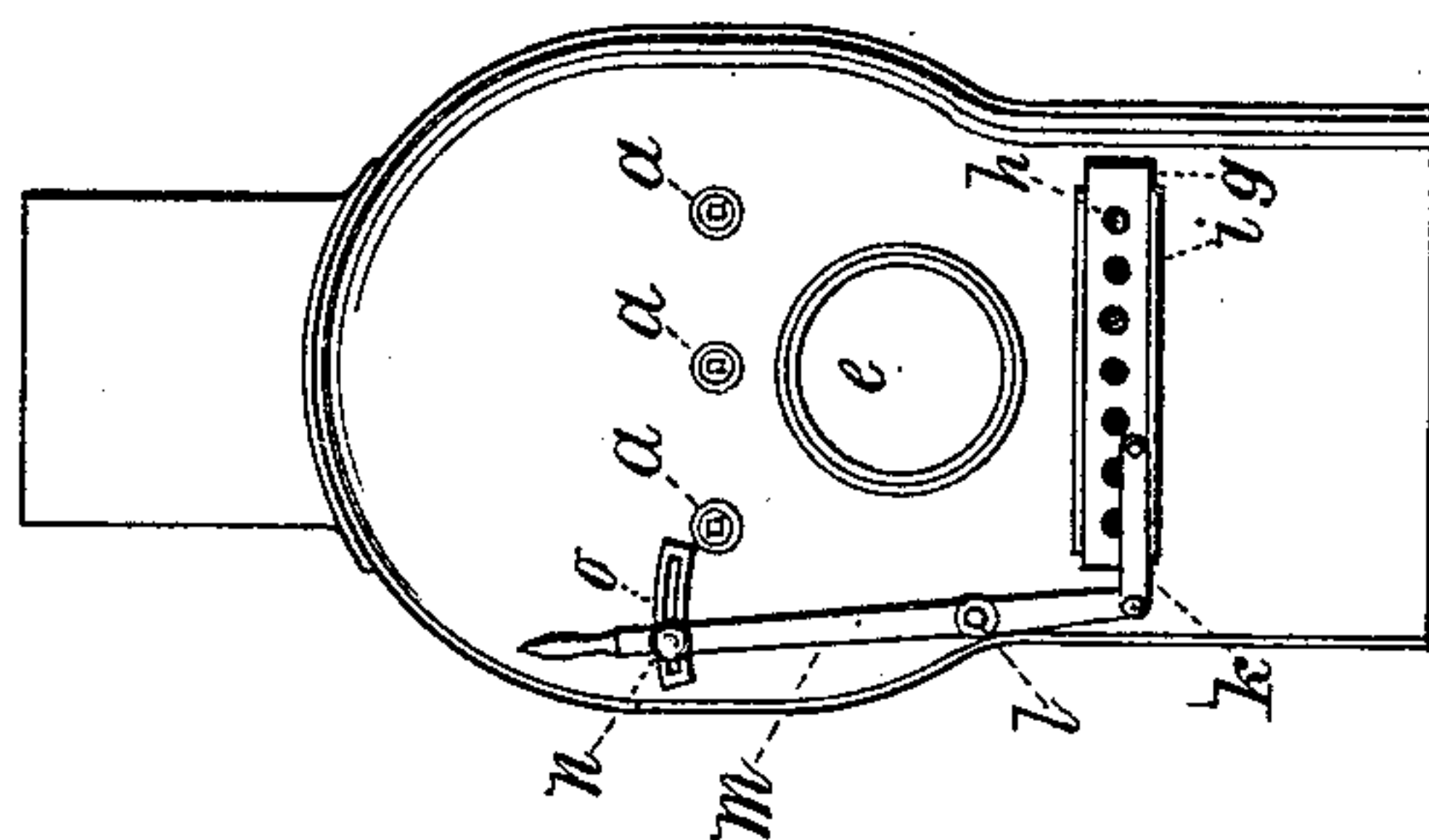
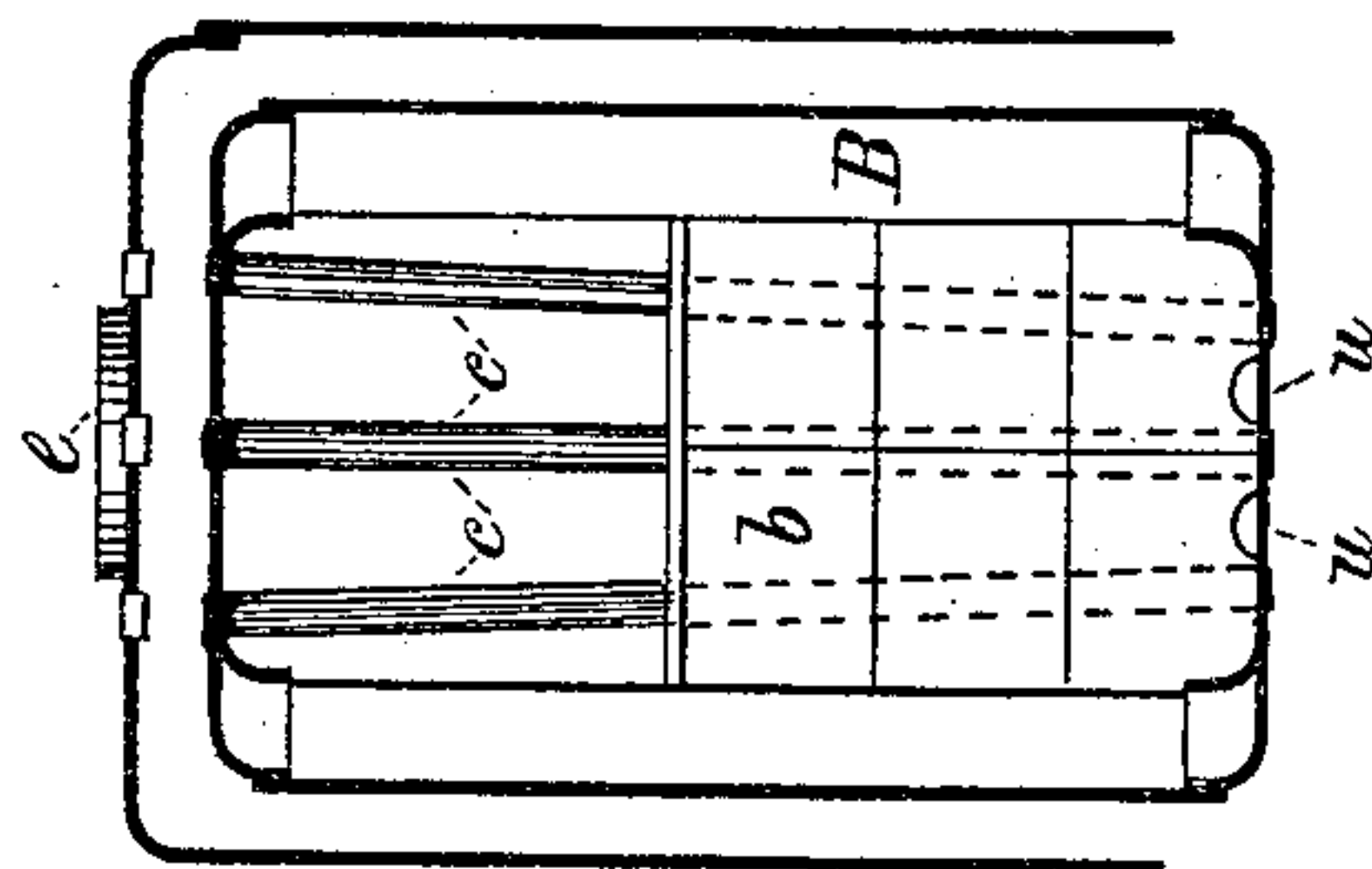


FIG. 3.



WITNESSES.

*R. Newton.*

*N. C. Beatty.*

INVENTOR.

*Joshua B. Barnes.*

*By J. S. Davenport, Atty.*



# UNITED STATES PATENT OFFICE.

JOSHUA B. BARNES, OF SPRINGFIELD, ILLINOIS.

## FURNACE FOR LOCOMOTIVES.

SPECIFICATION forming part of Letters Patent No. 354,007, dated December 7, 1886.

Application filed July 2, 1886. Serial No. 206,980. (No model.)

*To all whom it may concern:*

Be it known that I, JOSHUA B. BARNES, of Springfield, in the county of Sangamon and State of Illinois, have invented a new and Improved Furnace for Locomotives; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention relates to an improvement in smoke-consumers and spark-arresters, and is designed chiefly for railroad locomotive-engines.

The prime object of my device is to utilize more effectively than heretofore those products of combustion which have been allowed to escape into the air—as smoke, cinders, and sparks—or, at best, have been but very imperfectly consumed or made available as a heat-generating element.

The principle upon which my invention is based is that the hydrocarbons which are produced by the destructive distillation, or what is more commonly called “combustion,” of coal in the furnace of the boiler, when gradually mixed with common atmospheric air, and the temperature sufficiently reduced, assume the form of unflammable smoke; but immediately after leaving the bed of the fire, and before mixing with cold air, these same hydrocarbons are not only rich in carbon but are highly inflammable. Holding, then, in view this well-ascertained property of the products of combustion, my object is, first, to provide means for igniting the inflammable gases as soon as they leave the bed of the fire, and while they are yet intensely heated, by bringing in contact with them, at the proper time and place, a duly-proportioned quantity of air, distributed, as hereinafter described, so as to produce its maximum effect; second, to consume, and thereby utilize as a generator of heat, that carbonaceous matter scarcely yet reduced to the condition of coke, which, under ordinary circumstances, is ejected so abundantly from the smoke-stack of the locomotive-engine in the form of cinders or large sparks; third, to produce, by means of compounded currents of air, induced by a peculiar structure and combination of the internal parts of the smoke-box, such an increase in the power

of the draft as to admit of a considerable enlargement of the nozzle of the exhaust-pipe, and thereby decrease in an important amount the back-pressure or reaction of the exhaust-steam upon the pistons.

With these ends in view my invention consists in certain details of construction and combinations of parts, fully explained in the following specification, and illustrated in the accompanying drawings, in which—

Figure 1 is a side sectional view of the fire-box and smoke-box of a locomotive-boiler, taken in the line of the axis of the latter, and shown as provided with my device. Fig. 2 is an end elevational view of the fire-box. Fig. 3 is a sectional plan view of the fire-box, taken in the line *xx* in Fig. 1, and Fig. 4 is an end view of the smoke-box, having the door removed.

Referring to the drawings, A represents the body of the boiler, B the fire-box, C the smoke-box, and D the smoke-stack. In the interior of the fire-box is a deflector, *b*, of fire-brick, supported by three water-tubes, *c*, connecting the water-space of the front part of the fire-box with that of the rear, said tubes being in order to insure proper circulation and necessary facility for cleaning, not less than three inches in diameter, and inclined and located with reference to the bed of the fire and crown-sheet about as indicated in Fig. 1, access to the interior of said tubes being provided for by means of removable plugs *a* in the shell of the boiler.

Situated in a horizontal line a little below the door *e* of the fire-box are seven short tubes, *f*, affording openings from the outside of the boiler to the interior of the fire-box for the purpose of admitting to the fire, as hereinafter explained, an induced current of atmospheric air controlled as to quantity by a plate, *g*, provided with a series of holes, *h*, (see Fig. 2,) and adapted to slide horizontally in a guide-plate, *i*, which, like the plate *g*, is furnished with a series of openings coincident with the tubes *f* and the sliding plate *g*. Adapted to vibrate upon a stud, *l*, secured in the end of the boiler, is a hand-lever, *m*, for actuating the slide *g*, and connected therewith by a link, *k*, the upper part of said lever being provided with a thumb-screw, *n*, for clamping it to a



plate, *o*, having a curved slot, in which plays the nut of the thumb-screw, so as to retain the lever in any required angular position, and hence retain the plate *g* at either end of its stroke, or at any intermediate point thereof.

In the smoke-box is a baffling-plate, *p*, secured to the flue-plate and extending downward only a little below the center of the cylindrical part of the boiler, but wholly across the interior of the smoke-box, and at a distance from and inclination to the flue-plate about as shown in the drawings. To the lower part of said baffling-plate, and to the sides of the smoke-box, is secured horizontally and a little below the center of the boiler a spark-arrester, *r*, consisting of a thin perforated iron plate, the perforations being preferably of an oblong form about an inch in length and a quarter of an inch wide.

Sustained so that the lower extremity of its flared or funnel-shaped part shall be slightly above the top of the nozzle of the exhaust-pipe and the upper extremity of its cylindrical part, a few inches below the bottom of the smoke-stack, is an induction-pipe, or what is commonly called the "petticoat-pipe," (shown in the drawings at *t*,) the function of which is to improve the draft-creating power of the exhaust-steam in its passage from the blast-pipe *v* to the smoke-stack.

Attached to the front end of the screen *r*, and extending rearward and upward at such an inclination as to meet the smoke-stack at its junction with the smoke-box, and fit the sides and circular part of the latter, so as to cut off the upper portion, *s*, of the smoke box, is a deflector, *F*, which, with the sides and arched upper part of the smoke-box, the baffling-plate *p*, and upper portion of the flue-plate or end of the boiler, forms, essentially, a conical chamber adapted to fill the office of a secondary induction-pipe for co-operation, as hereinafter explained, with the induction-pipe *t*.

The several parts described, both in the fire-box and the smoke-box, being arranged with reference to each other, as represented, and the fire kindled, the gases of quick evolution from the green coal, which is purposely thrown to the front end of the fire-box in passing over the bed of glowing fire and beneath the deflector *b*, which is soon raised to incandescence, become highly heated, and on meeting the inflowing stream of air from the induction-tubes *f*, instantly flash into flame, igniting and consuming the greater part of the fragments of heated coal that are usually ejected from the smoke-stack in the form of slightly-burned cinders. The heavier portions of the sparks not totally consumed in their first passage over the body of the fire strike in their ascent the crown-sheet of the fire-box, from whence they are thrown upon the back of the deflector, down which they roll and fall through the openings *u* (see Fig. 3) again into the fire; and this process is repeated until

there is nothing left of them that is inflammable.

The efficacy of the influx of air to the fire-box is mainly due to the deflector *F* in the smoke-box, which not only serves to cut off that part *s*, in which, without the deflector, an eddy would be formed, and consequently a counter-current set up, but forms a chamber in which the pipe *t* produces an effect similar to that produced by the exhaust-pipe in the pipe *t*—namely, an induced draft. This latter, by its co-operative action with the former, urges the process of combustion to such an extent as to admit of an important enlargement of the nozzle of the exhaust-pipe, the effect of which is to reduce considerably the back-pressure or reaction of the exhaust-steam upon the pistons.

On the escape from the flues of the unflammable portions of the sparks, those that are too large to pass through the slits in the arrester *r* fall into the lower front part of the smoke-box, as shown at *y*, from which they are from time to time removed by the ordinary means.

The results of my invention, ascertained by careful comparison extending over several months of regular daily service upon one of the principal lines of railway in the United States, as to the consumption of coal by those locomotives equipped with my device, and those not so equipped but performing like duties, demonstrate unequivocally that however much my device may in some of its details, either separately or collectively considered, resemble other inventions designed for the same purpose, the peculiar combination, proportional relations, and positional adjustment of its several essential and co-operative parts, render it as a fuel-economizer and spark-arrester much more than the mere equivalent of any of the devices which up to the present time have been put forth for the accomplishment of the same end.

Even without the deflector *b*, baffling-plate *p*, and spark-arrester *r*, by the simple co-operative action of the deflector *F* in the smoke-box with the controllable induced current of fresh air admitted, as described, into the fire-box, an important economy in fuel is effected.

I am aware that deflectors employed either in the fire-box or smoke-box are not new. I am also aware that the admission to the interior of the fire-box of induced currents of air is not new, and therefore I do not broadly claim such.

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

1. In a locomotive-engine, the combination, in the smoke-box, of a baffling-plate, a horizontal screen or spark-arrester, an induction-pipe, *t*, in connection with the exhaust-nozzle, and a deflector adapted to cut off the upper forward part of the smoke-box, so as to form by their union with the upper arched half thereof and the flue-plate or end of the boiler



a chamber adapted to fill, essentially, the office of a secondary induction-pipe and co-operate with the primary induction-pipe, substantially as set forth.

5 2. In a locomotive-engine, the combination of the fire-box having a series of induction-tubes and an inclined deflector, as herein described, with a smoke-box having a baffling-plate, a spark-arrester, and a deflector, all of  
10 said parts constructed and located with reference to each other for co-operative action, as and for the purpose set forth.

3. In a locomotive-engine, the combination

of the fire-box having a series of induction-tubes arranged and controlled as herein de- 15 scribed, and the smoke-box provided with a deflector located in the upper front part thereof, and inclined, as set forth.

In testimony that I claim the foregoing I have hereunto set my hand this 16th day of 20 June, 1886.

JOSHUA B. BARNES.

Witnesses:

R. P. SHACKELFORD,  
F. C. SPRAGUE.