3 Sheets—Sheet 1.

C. J. EAMES.

OIL BURNING LOCOMOTIVE.

No. 182,568. Patented Sept. 26, 1876.

Fig. 1.

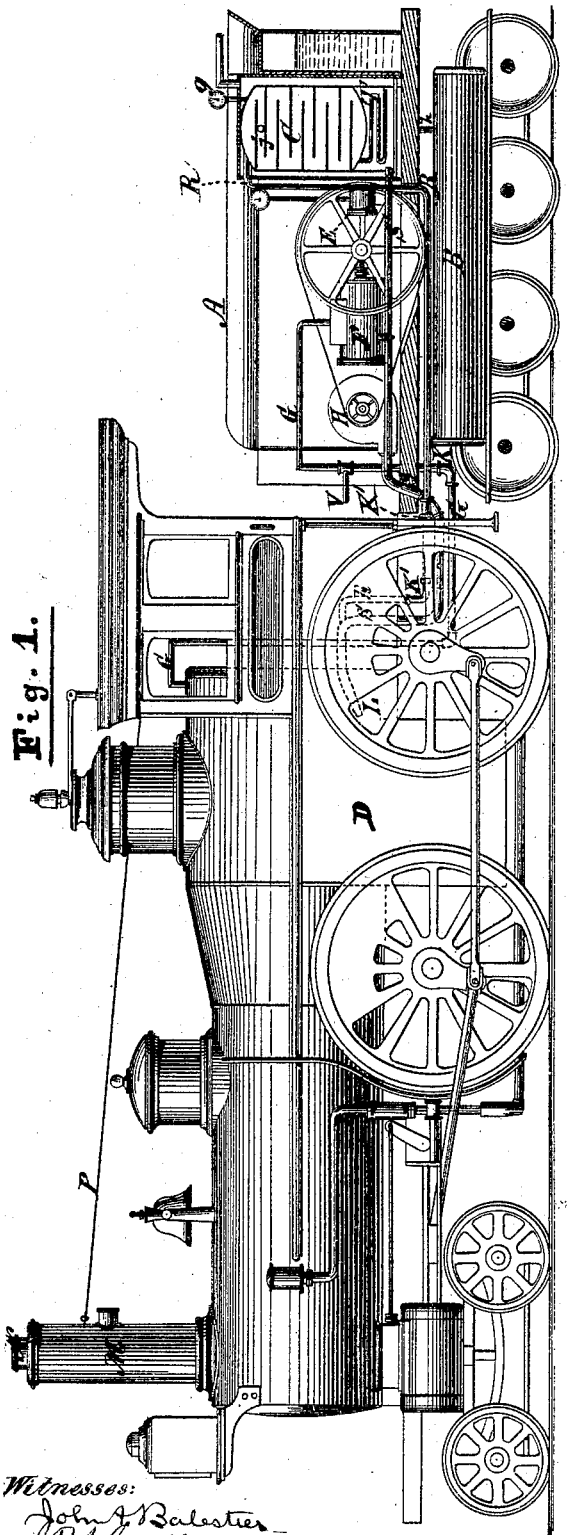
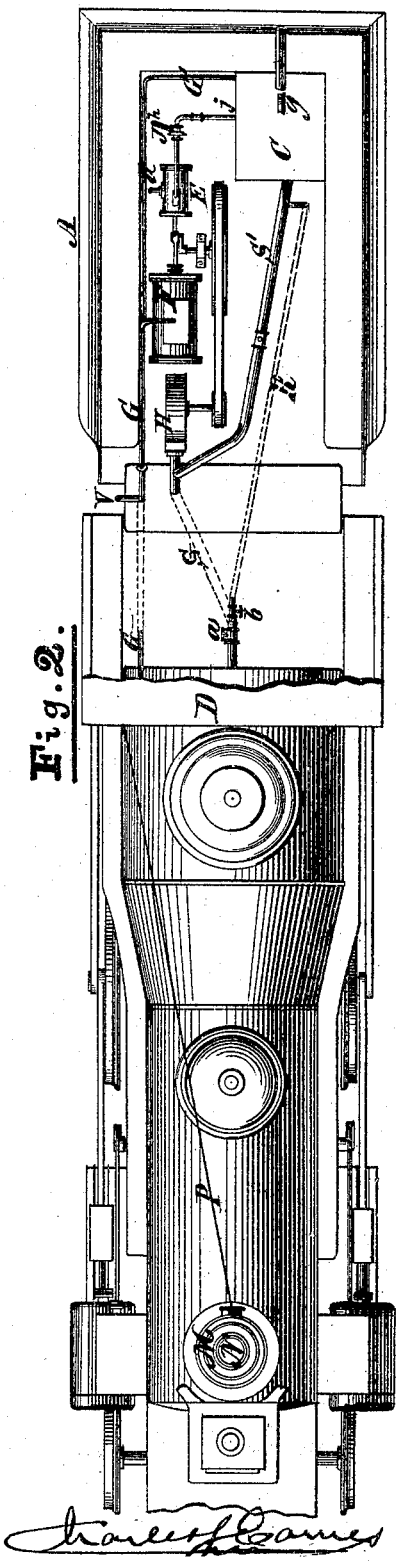


Fig. 2.



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Inventor:
Charles J. Eames

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C. J. EAMES.

OIL BURNING LOCOMOTIVE.

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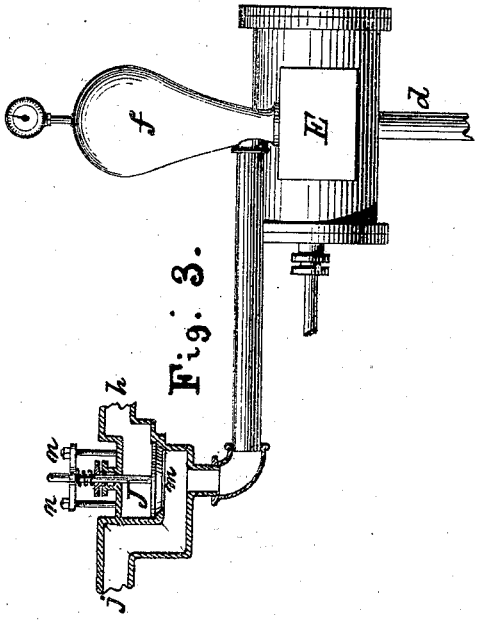

Fig. 3.

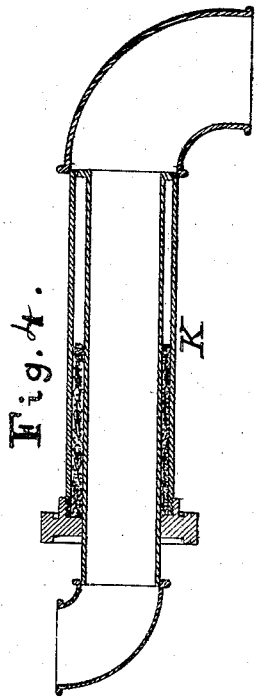

Fig. 4.

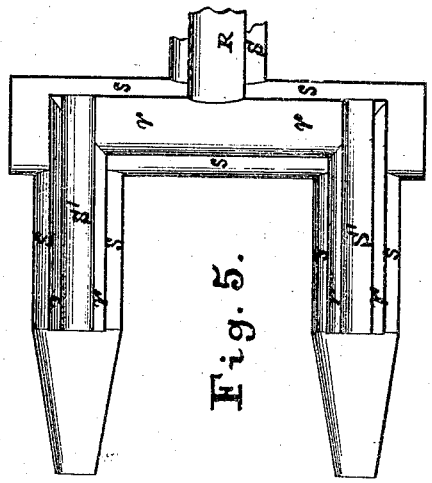

Fig. 5.

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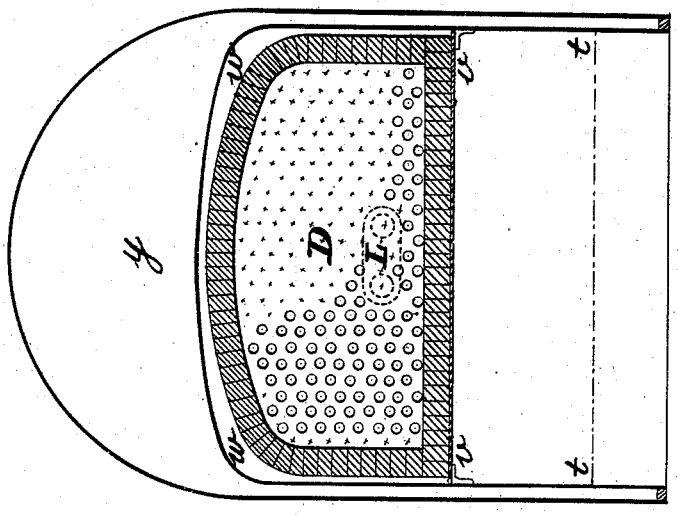

Fig. 6.

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UNITED STATES PATENT OFFICE.

CHARLES J. EAMES, OF NEW YORK, N. Y.

IMPROVEMENT IN OIL-BURNING LOCOMOTIVES.

Specification forming part of Letters Patent No. **182,568**, dated September 26, 1876; application filed January 15, 1876.

To all whom it may concern:

Be it known that I, CHARLES J. EAMES, of New York, in the county of New York and State of New York, have invented certain Improvements in Oil-Burning Locomotives, of which the following is a specification:

In this present specification I confine myself to the devices and modifications needed to apply my inventions to the existing locomotives as constructed for burning coal.

The first part of my invention consists in furnishing the fire-box of the locomotive-boiler, through a pipe of special construction, described below, with a current of oil completely vaporized and heated to a high temperature.

The generator which I prefer is the one patented to myself, in connection with H. H. Eames, October 15, 1872, No. 132,266. With this vapor-generator are combined a pump for supplying oil to the generator, which pump is operated by a small engine, supplied with steam from the locomotive-boiler through a pipe of special construction, described below; also, a blower for supplying air to the fire-box of the locomotive, operated simultaneously with the pump by the same small engine.

The pump is an ordinary double-action one, with a piston of sufficient length to pack itself with oil, the oil itself serving also as the lubricating agent. The gearing which connects the blower and the pump is so adjusted, by means familiar to mechanics, as to cause the blower to throw just the volume of air required to burn the oil thrown by the pump, which is at least one thousand one hundred or one thousand two hundred cubic feet of air per gallon of oil fed to the fire-box by the pump and generator. This proportion varies somewhat in practice, according to the quality of the oil and the condition of the atmosphere.

The oil-pump is furnished with a relief-valve, so constructed and arranged, as described below, as to cause all excess of oil thrown by the pump over and above the rate of feed required for the generator and fire-box to pass into the oil-tank. The generator, engine, pump, and blower may occupy the same space upon the tender which is occupied ordinarily by the coal.

The second part of my invention applies to the case in which the above combination is carried upon the tender; and consists in a mode of connecting with the locomotive and and attaching to the fire-box and blower the pipes which conduct the oil-vapor from the generator and the steam from the locomotive-boiler to the small engine, the main object of which is to provide for and accommodate the motions arising from the vertical oscillations of the locomotive upon its springs and the other rapid fluctuations of position and of level which are incident to the case. This is accomplished by the use of a new kind of packed sleeve-joint, whose construction is more particularly described below, and which admits of two motions, one sliding and the other revolving. Two of these joints, one situated at a horizontal part of the vapor-pipe and the other at a vertical part, suffice to follow and adjust to every change of relative level and distance between the locomotive and the tender. The whole length of the vapor-pipe is also protected by any suitable means from loss of heat by radiation.

Some other points in which an ordinary locomotive is modified in arrangement to adapt it to my principles are as follows: The deep open ash-pan, of the ordinary form, is altogether dispensed with, which leads to great advantages in snowy weather, there being no injury to the fire in this case from penetration of snow.

The ordinary internal arrangements of the stack for forcing the draft by the exhaust steam, together with the spark-arrester, become useless, and are altogether abolished. The gases of combustion pass off through a vertical chimney, which incloses the exhaust-pipe concentrically. This exhaust-pipe is much larger in diameter than usual—about nine inches, instead of only three or four—and is made to rise three or four inches above the top of the exterior chimney provided for the gases of combustion, the object being entirely to prevent any urging of the draft by the exhaust during rapid running, such as is a matter of necessity when burning coal. The exhaust-pipe extends downward, as usual, through the chamber in front of the boiler, to connect with the valve-boxes. To control, if necessary, the action of the increase of draft that will arise from the rapid motion of

the locomotive through the air, I introduce into the chimney, which concentrically surrounds the exhaust-pipe, a damper, operated by a rod extending to the cab of the locomotive.

Figure 1 is a side view of the locomotive and tender A, showing the machinery upon the latter, with a sectional view of the generator and of the superheater under the same, the space occupied by the coal in ordinary cases being occupied here by the apparatus and machinery invented by me. The space occupied in A is largely exaggerated in this drawing, for the sake of convenience in representation, and that occupied by water largely diminished in proportion. Fig. 2 is a top view of the locomotive and tender, showing the interior of the latter from above.

B, Fig. 1, represents the oil-tank, in this case attached beneath the tender between its wheels. C is the generator, constructed and operating as described in the Patent No. 132,266, already referred to, so as to cause the oil entering at *j* to flow downward gradually from shelf to shelf, meeting the upward current of superheated steam from the superheating coil T, inside of which a fire is kept up. The gage *g* on the top of the generator serves to regulate the degree of pressure therein. E is the pump, which transmits the oil from the tank B to the generator operated by the engine F, *d* in Fig. 2 indicating the pipe which leads from the tank to the pump. J is the relief-valve, (also shown on a larger scale in Fig. 3,) the overflow from which passes back into the oil-tank through the pipe *h*.

The oil-vapor mixed with a little superheated steam passes through the pipe R, leading from the top of the generator down through the floor of the tender, and forward to the fire-box of the locomotive. In the course of this pipe R are introduced at the two points marked K′ two of the sleeve-joints, above referred to, for accommodating the relative changes of position of the locomotive and tender. One of these sleeve-joints is inserted in a horizontal straight portion of the pipe R, to provide for the longitudinal motions or changes of distance of the tender, and the other at one of the bends of the pipe R, the latter sliding up and down, and adjusting therefore to relative changes of level, while at the same time, by revolution on its vertical axis, it bends while passing around curves. Pipe R I sometimes lead up again through the floor of the cab before attaching to the burners, which, in this case, are inserted in the fire-box, as represented in this drawing at the point L, inclining downward at a small angle. At other times I introduce the burners into the lower part of the fire-box under the floor of the cab—an arrangement not shown in these drawings.

Pipe S conveys the air from the blower H operated by the engine F to the burners in the fire-box, also passing down through the floor of the tender, and having introduced in its course a section of flexible tubing, which will accommodate itself to all the motions. A branch pipe, S′, leads from blower H to the fire-space T of the superheating coil and generator. This is provided with a valve. In pipes R and S valves are provided, under the control of the driver, which are indicated in Fig. 2 at *a* and *b*.

The steam is conveyed to the small engine F from the boiler of the locomotive by means of the pipe G, which passes from the top of the boiler down through the floor of the cab, and up again through the floor of the tender, having introduced in its course, just as in the case of the vapor-pipe R, two of the sliding sleeve-joints, one sliding horizontally and the other vertically, as well as revolving on a vertical axis. The vertical joint is shown at K; but the horizontal joint in this steam-pipe G does not show in the drawing. To steam-pipe G there is also a lateral pipe attached at V, through which steam may be introduced from another locomotive-boiler, or from a stationary boiler to start the process. A branch from G, marked G′ in Fig. 2, passes onto the fire-space under the generator, and connects with the superheating steam-coil T, in order to supply steam to the latter.

M represents the stack for the escape of the gases of combustion; N, the exhaust-pipe for the steam from the cylinders, and P is a rod leading from the cab to a damper in the stack M. Fig. 3 represents the relief-valve J, with its mode of attachment to the pump E, which is through the base of an air-vessel, *f*, provided for the purpose of equalizing the pressure, and on the top of which a gage is attached for the regulation of said pressure.

When the oil thrown by the pump is in excess, the increased pressure causes the valve *m* to rise, and this excess flows through *h* back to the tank. The tension of the helical spring which holds down the valve *m* is graduated by the nuts *n n*.

Fig. 4 is an enlarged view of one of the sleeve-joints, marked K and K′ in Fig. 1. The sleeve-joint is constructed of any ordinary piping, the outer pipe leaving around the inner pipe a space of about half an inch, which space is packed to half its length, as figured with some suitable cement composition indestructible by the action of the heated oil-vapor, or by high-pressure steam. This leaves the joint free to slide in and out throughout the other half of its length.

A cement which I have found efficient and prefer for use in these joints contains the following ingredients intimately mixed in one hundred parts: Powdered asbestus, seventy-five parts; black oxide of manganese, ten parts; litharge, five parts; red lead, five parts; white lead, three parts; boiled linseed-oil, two parts.

The construction of this sleeve-joint will be obvious from the drawing to any mechanic skilled in making such connections.

Fig. 5 represents the construction of burner which I ordinarily use on a locomotive. It

is constructed on the same principles as that shown and specified in the Patents Nos. 148,042 and 152,942.

Upon a locomotive I have used a burner of two tuyeres, like that shown in Fig. 5. The internal induction-tube R proceeds from the oil-vapor generator, as represented in Fig. 1, and conveys the oil-vapor through the passages and concentric tubes marked *r r r r*, while the external larger induction-tube S conveys the air-blast through the passages and concentric tubes marked S′ S′ *ssss*, the two internal tubes S′ S′ being open at both ends. The result is that we have, within each tuyere, a blow-pipe system of a cylindrical jet of oil-vapor with an inner air-jet, and an outer cylindrical air-jet, the result of which is the perfect and intimate mixture of the two as they issue together from the tuyeres.

Sometimes, however, I use either in the fire-box or attached thereto a kind of burner or combustion-chamber on the principle of the one patented to me March 25, 1873, No. 137,132, consisting of fire-bricks so disposed as to present cellular interstices, within which the mixture of oil-vapor and air takes place, and in which the combustion begins, to be finished after issue therefrom into the body of the fire-box.

In all cases I have found it necessary to contract largely the dimensions of the fire-box and to line the whole of the fire-space so contracted with fire-brick, so that no metallic surfaces are presented directly to the flame, the rapidity of combustion being thus greatly increased.

The mode of accomplishing this is represented in Fig. 6, which is a transverse vertical section of the fire-box and boiler. *t t* indicate the former position of the grate-bars, which are here removed. *v v* is a plate of iron placed across the fire-box as a support for the fire-brick lining. This plate being paved with fire-bricks, the sides are also walled up, and an arch is carried over the top close to the crown-sheet. L represents the position of the jet-burner where it is used. D is the flue-sheet, only part of the flue-pipes being shown; and *y* is the water and steam space of the boiler over the fire-box.

Mode of Operation: In operating this locomotive a fire is first started under the generator C in the fire-space surrounded by the steam-coil T. Steam is then turned on at V by connecting with another boiler, and the blast from the blower H turned on through the pipe S′, and the fire urged under the generator until it is sufficiently heated to vaporize the oil, as has been fully set forth in the Patent No. 132,266, before referred to. The oil is then caused to flow into the generator, the steam-pump being started for that purpose, in sufficient quantities to maintain a uniform pressure in the generator, and the vapor thus formed controlled by means of the valve *b*, is allowed to pass through pipe R into the burner at L and ignited, the air-blast from H being also turned on through S. The ignition is effected through a small sliding door, which occupies a portion of the space of the fire-door of an ordinary locomotive.

When sufficient steam has been raised in the boiler of the locomotive operated with, the lateral steam attachment at V is cut off, and the steam from the locomotiye-boiler itself turned on through pipe G′, to supply both the small engine and the superheating steam-coil under the generator.

In this first operation of getting up the heat of the fire-box and raising steam in the boiler I sometimes find it desirable to assist the action of the blower H by introducing an upward jet of steam in the stack M, to create a draft therein.

I claim—

1. The method of generating steam in a locomotive-boiler by burning, within a fire-box lined with a refractory material, a highly heated hydrocarbon vapor, generated by the action of incandescent steam on a flowing current of oil, substantially as described.

2. In connection with a locomotive fire-box, the combination of an oil-vapor generator with an oil-pump and air-blower, operated by the same motor, which latter device adjusts the relative proportions of the oil fed to the vapor-generator and the air fed to the fire-box, substantially as described.

3. The combination, with the oil-feed pipe of an oil-vapor-burning locomotive, of a relief-valve and return-pipe to return the excess of oil to the reservoir.

4. In an oil-vapor locomotive, a sliding and revolving sleeve-joint, constructed and provided with a refractory cement-packing, as shown, and adapted to connect the pipes which convey the steam and vapor between the tender and the locomotive.

New York, December 24, 1875.

CHARLES J. EAMES.

Witnesses:

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