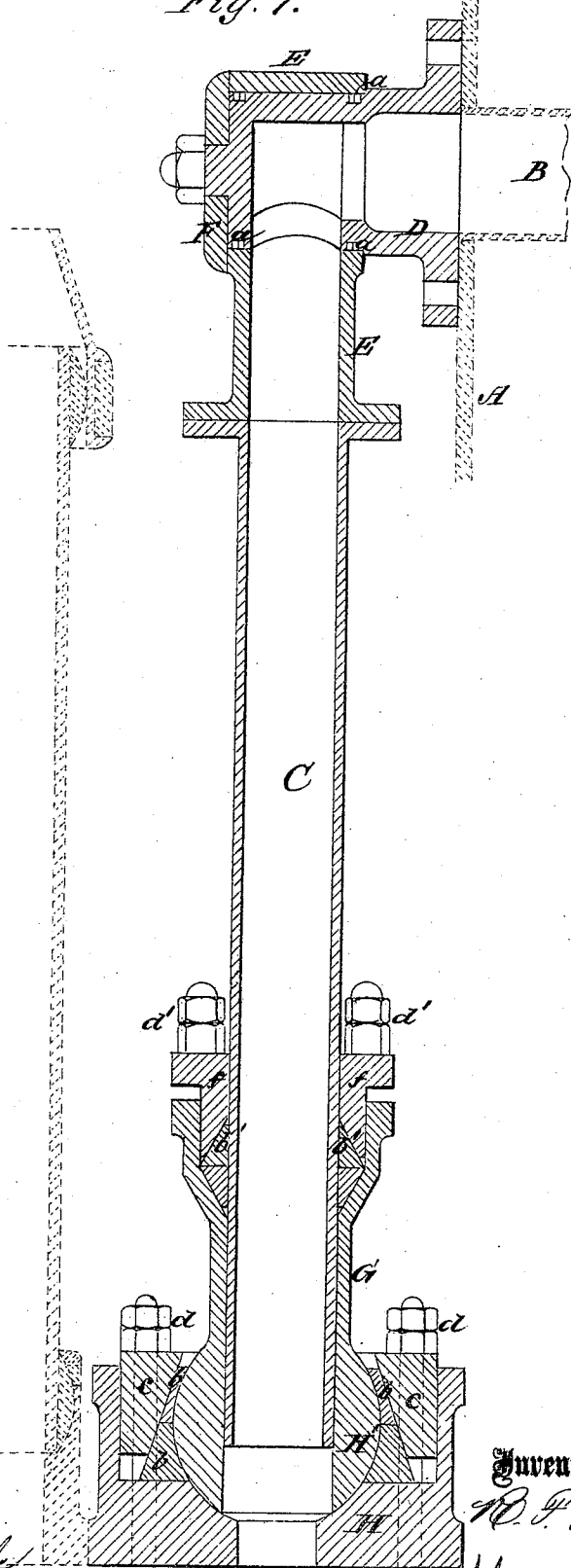


Patented Oct. 3, 1871.

Fig. 7.



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Fig. 2.

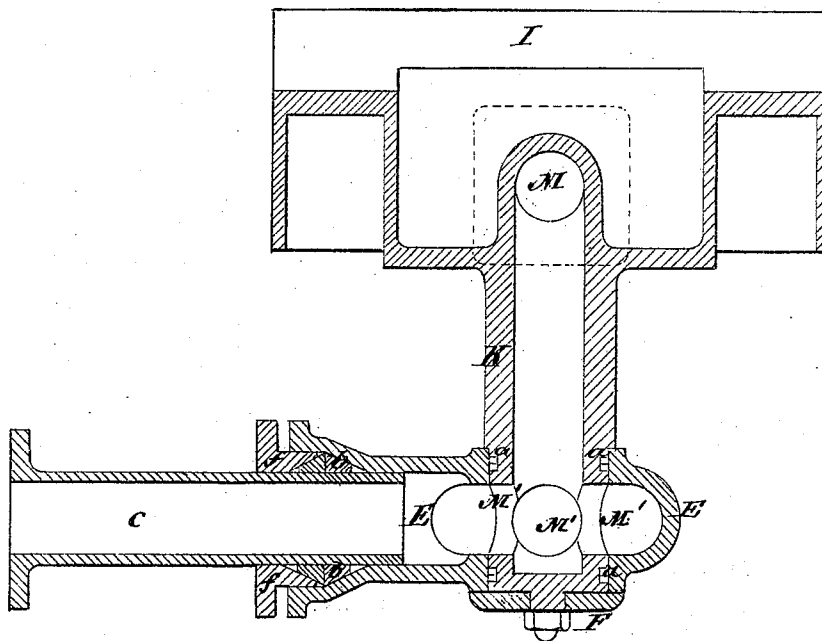
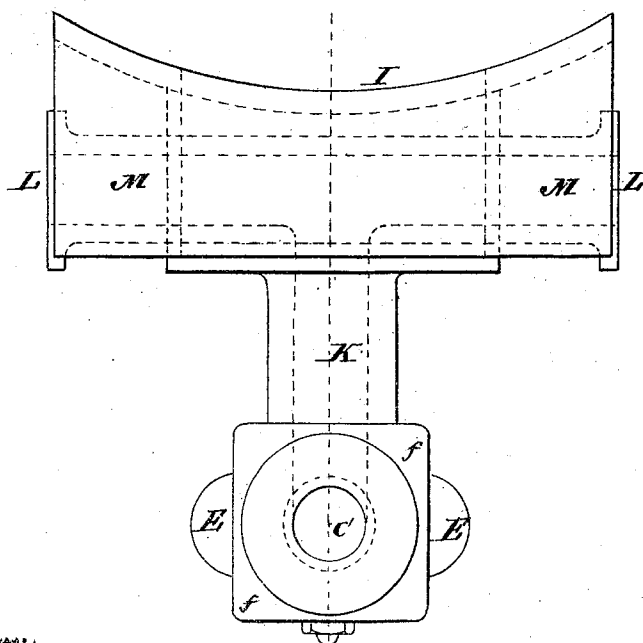


Fig. 3.



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No. 119,591.

4 Sheets.
Sheet III.

Fig. 4.

Patented Oct. 3, 1871.

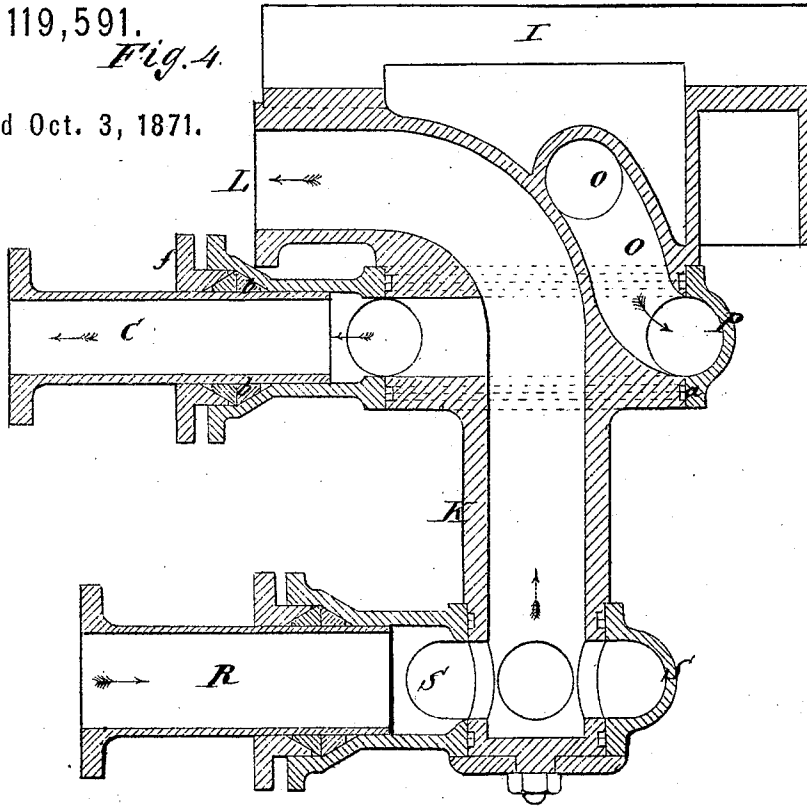
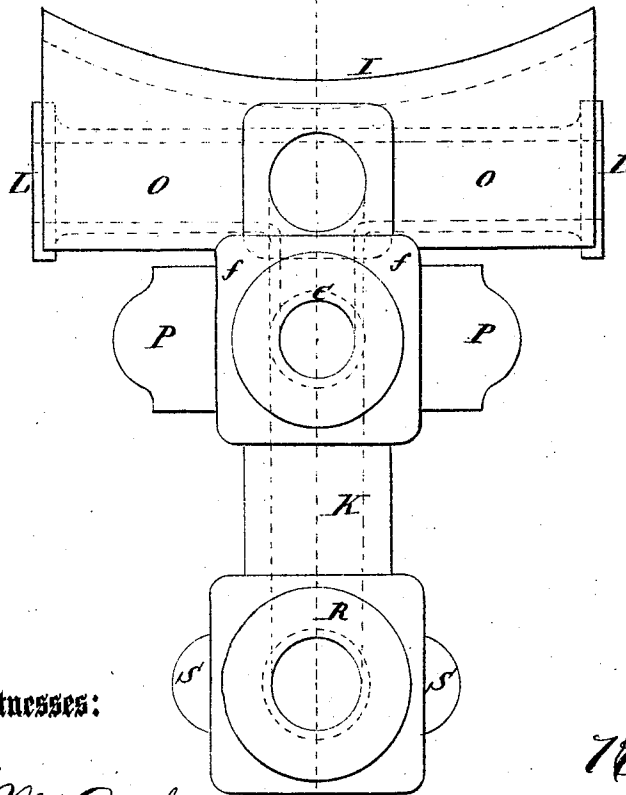


Fig. 5.



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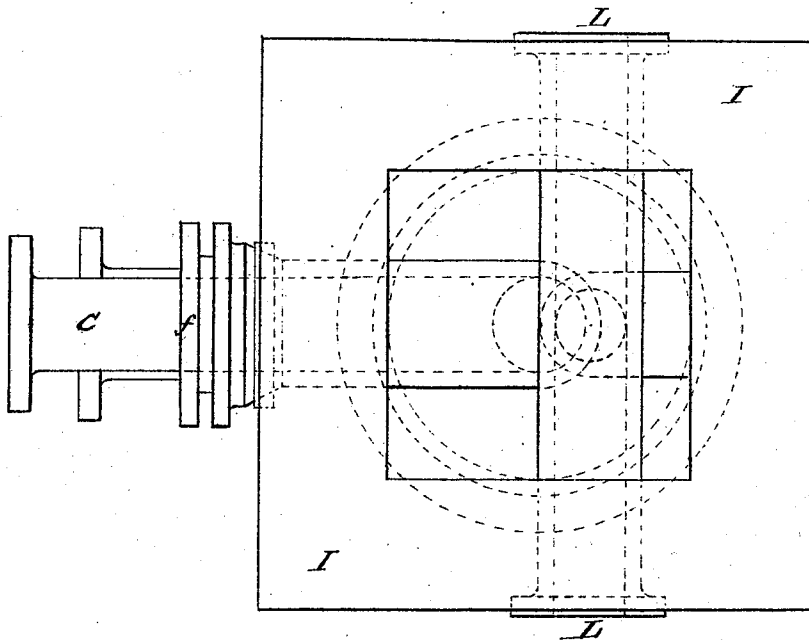
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Fig. 6.



Witnesses:

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UNITED STATES PATENT OFFICE.

ROBERT FRANCIS FAIRLIE, OF VICTORIA CHAMBERS, WESTMINSTER, ENGLAND.

IMPROVEMENT IN LOCOMOTIVE-ENGINES.

Specification forming part of Letters Patent No. 119,591, dated October 3, 1871.

To all whom it may concern:

Be it known that I, ROBERT FRANCIS FAIRLIE, of Victoria Chambers, Westminster, in the county of Middlesex, England, have invented new and useful Improvements in Locomotive-Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, which will enable others skilled in the art to make and use the same, reference being had to the accompanying drawing forming part of this specification.

My invention relates to a method or methods of supplying steam from the boiler of a locomotive to the cylinders which propel the wheels of swiveling or bogie-frames working on eccentric pivots under the boiler, the whole forming a locomotive-engine on the double-bogie principle; also of a method or methods of carrying the exhaust-steam to the chimney or chimneys for increasing the draught of the boiler-fire or fires.

In order that my said invention may be more fully understood, I now proceed more particularly to describe the same, and shall refer to the several figures on the annexed drawing, by which I have illustrated the various methods of carrying out my invention in practice, and in which the same letters of reference indicate similar parts in all the corresponding figures.

In carrying out my said invention I convey the steam to each pair of cylinders for propelling the engine or engines by means of a pendulous connecting-pipe, which is joined at its upper end to the end of the fixed steam-pipe, which usually passes through the steam-space in the boiler to the smoke-box tube-plate, and at its lower end by a universal ball-and-socket joint fixed direct onto a steam-chest between the cylinders, or to a branch pipe of which the ball-and-socket is the junction of the branches, which convey the steam to one or more steam-chests attached to each of the cylinders. Provision is made for the elongation or telescopic action of the pendulous pipe, as follows: the upper end of the ball-joint, at the bottom of steam-pipe, is made to form what is usually termed a stuffing-box, with a gland to be screwed in and out in the ordinary manner, with this difference, however, that metallic packing is employed instead of the ordinary kinds. Through this stuffing-box the end of the pendulum-pipe, which is turned true to one diameter on its plain part, is passed leading down to within three or four inches of the ball, so that there may be an

elongation or contraction of the length of this pipe to the extent already described. Thus, by the vibrating or pendulous movement of the steam at its connection with the interior steam-pipe, at its tube-plate, by the telescopic action of its length, and by its radial action, to any angle, by the ball-and-socket joint at the bottom, the bogie-frames can oscillate or revolve, or alter their position in relation to the boiler in any direction, and the steam-pipes are perfectly free to follow all the motions, and at the same time the joints will remain perfectly steam-tight. The exhaust-steam may be conveyed to the smoke-box by pipes also made with ball-and-socket joints at their lower ends, and provided at the upper ends with a ball or spherical enlargement sliding in the lower end of the blast-nozzle, which is made cylindrical to receive it. Thus, instead of using an expansion or telescopic joint in the exhaust-pipe, as is done in the steam-pipe, the enlarged spherical end of the pipe is made to fit the part of the fixed blast-nozzle so that, the spherical end fitting the cylinder like a piston, it is still free to move up and down in it, and thus compensate for any independent vertical movement of the bogie-frame toward the boiler. According to another method I convey the steam from the boiler to the cylinder of each bogie-engine through its bogie-pin to the steam-chests of each cylinder, the pipe radiating from and swiveling around the bogie-pin as the bogie itself does. I also reconvey the exhaust-steam back to an outer chamber round the bogie-pin or swiveling center and thence to the smoke-box by rigid pipes fixed between the smoke-box and bogie-pin. By another method I convey the steam from the boiler to chambers fitted on the bogie-pin or pivot which works in the center of each swiveling engine-frame. To these chambers, which are allowed to revolve or swivel on the pivots, pipes are jointed which convey the steam to the cylinders, and which are provided with metallic or other stuffing-boxes to allow for expansion or contraction caused by heat or any movement which may arise from undue play in the swiveling centers. The exhaust-steam is conveyed from the cylinders to the lower end of the bogie-pivots by pipes jointed thereto by chambers jointed in the same manner as those described above for conveying the steam to the cylinders. The exhaust steam is then conveyed through the center of the pivots to the upper

end, to which pipes are connected which convey the steam to the smoke-boxes or to the lower ends of the blast-pipes.

Figure 1 represents a sectional elevation of the arrangement of pendulous steam-pipe hereinbefore referred to. A is the smoke-box end of the boiler; B, the fixed or internal steam-pipe; and C, the pendulous connecting-pipe, which is connected or jointed to the fixed steam-pipe by the intervention of the hollow stud D bolted to the tube-plate, in continuation of the internal steam-pipe. This stud is turned cylindrical on its outer surface, on which is accurately fitted a metal ring or socket, E, with a circular outlet and flange for the better convenience of bolting the pipe C thereto. The socket E revolves on the stud D, into which two or more sets of double or treble packing-rings, *a a*, are fitted into suitable grooves for the purpose of making a steam-tight joint. F is a metal disk which is screwed onto the end of the hollow stud D and bears against the outer edges of the socket-piece E, which is thus kept in its position on the hollow stud. The pipe C is fixed to the flange or branch of the outlet-pipe of socket E, the lower end of such pipe being free to slide telescopically inside the socket piece G of the ball-and-socket joint H' formed on the steam-chest H. This ball-and-socket joint is made steam-tight by flexible split rings *b b* of brass or other metal, bored to fit the ball on their inner side and turned conical on their outer circumference, such rings being tightened up by forcing down an outer conical ring, *c c*, by means of screws *d d*. A stuffing-box and gland at *f* serve to keep the sliding joint of the branch-pipe C steam-tight, the said stuffing-box being fitted with similar metallic packing-rings, *b'*, which may be tightened when required by forcing down the gland *f* by means of the screws *d'*, as before. It will thus be obvious that the branch-pipe C will be free to oscillate and accommodate itself to all the movements of the cylinders on the bogie.

Figs. 2 and 3 represent a sectional elevation and end view of the saddle and bogie-pivot, through which the steam is conveyed from the boiler to the cylinders, as before stated. I represents the saddle, and K the center or pivot on which the bogie swivels. The steam is taken from the dome on top of the boiler by pipes connected at L L to the upper part of the bogie-pivot K, which is provided with passages M, through which the steam is conveyed to the lower end. This end is turned parallel or cylindrical on its outer surface, and is fitted with packing-rings *a a*, similar to those described with reference to Figs. 1 and 2. E is a socket piece or chambered ring which revolves steam-tight on the end of the pivot K. It is secured by a plate, F, bolted to the end of the bogie-pivot. *b b* are the metallic packing-rings, and *f* the gland of a

stuffing-box similar to that previously described, by which the rigid pipe C is connected to the branch pipe cast on the chambered ring E, for conveying the steam to the cylinders. M' are openings for the passage of the steam.

Figs. 4 and 5 represent a sectional elevation and an end view, and Fig. 6 a plan of the other arrangement of saddle and bogie-pivot, showing the chambered ring which revolves on the pivot and conveys the steam from the boiler to the cylinders, and also the passages through which the exhaust-steam is returned from the cylinders to the smoke-box. I is the saddle, and K the bogie-pivot. Fixed pipes connected at L to the upper part of the bogie-pivot convey the steam from the dome; and O are steam-passages leading to a chambered ring, P, fitted to revolve steam-tight on the bogie-pivot by means of packing-rings *a a*. The steam-pipe C leading to the cylinders is connected to the chambered ring P by means of a stuffing-box fitted with the gland *f* and metallic packing-rings *b b*, constructed as before described in reference to the first arrangement. The object of the stuffing-box is to permit of the elongation or telescopic action of the steam-pipe C, if necessary, to compensate for the oscillations of the bogie-frames or for expansion by heat. R is the exhaust-pipe, similarly connected to the chambered ring S, fitted to revolve on the lower end of the bogie-pivot, and communicating with the central passage thereof in a precisely similar manner to the chambered ring E described and shown in Figs. 2 and 3. The exhaust-steam is conveyed from the cylinders, by pipe R, through the central passage of the bogie-pivot, to a pipe connected at the upper end of the pivot, by which it is conveyed to the smoke-box.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The pendent, vibratory, and longitudinally-sliding pipe C, attached to the tube-sheet of a locomotive-boiler by a flexible elbow-joint, *a D E F*, and to steam-chests H of the cylinders that drive the wheels by a ball-and-socket joint, G H', combined with a swiveling or bogie-frame working on center pivots under the boiler, as and for the purpose specified.

2. The hollow swivel-pin K, the steam-supply pipes L, the hollow and swiveled ring E having branch pipe projecting therefrom, and rigid pipe C, combined and arranged in a bogie-engine, as and for the purpose specified.

The above specification of my invention signed by me this 30th day of May, 1871.

ROBERT FRANCIS FAIRLIE.

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M. WYNN, 24 Royal Exchange, London.

(72)