

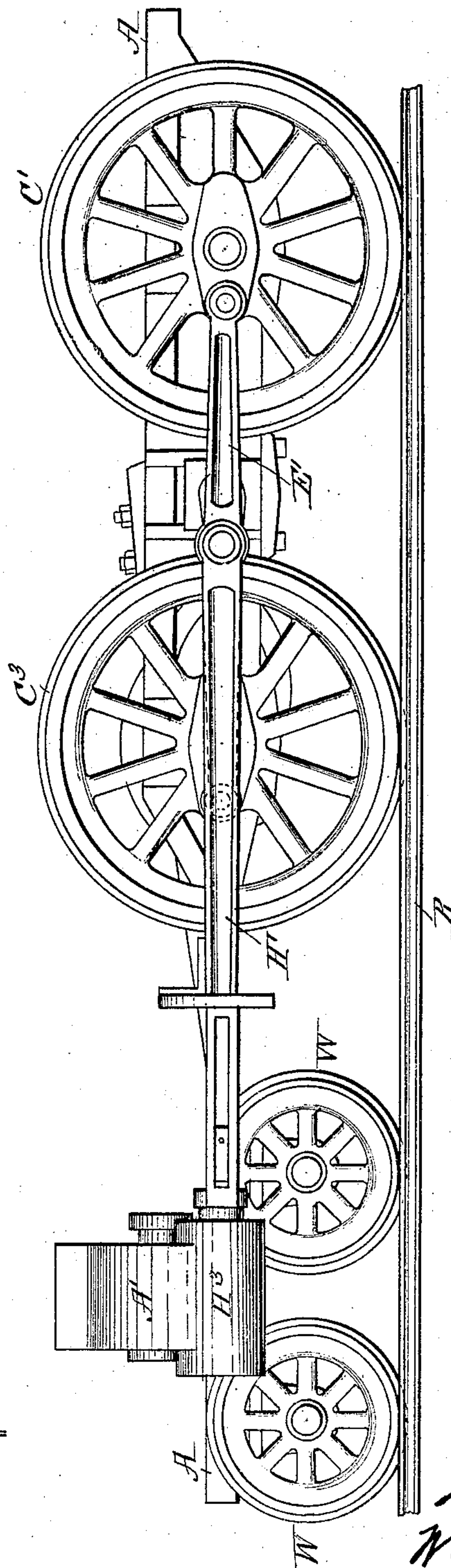
No. 848,572.

PATENTED MAR. 26, 1907.

H. F. SHAW.
BALANCING LOCOMOTIVE ENGINE.

APPLICATION FILED OCT. 23, 1906.

3 SHEETS—SHEET 1.



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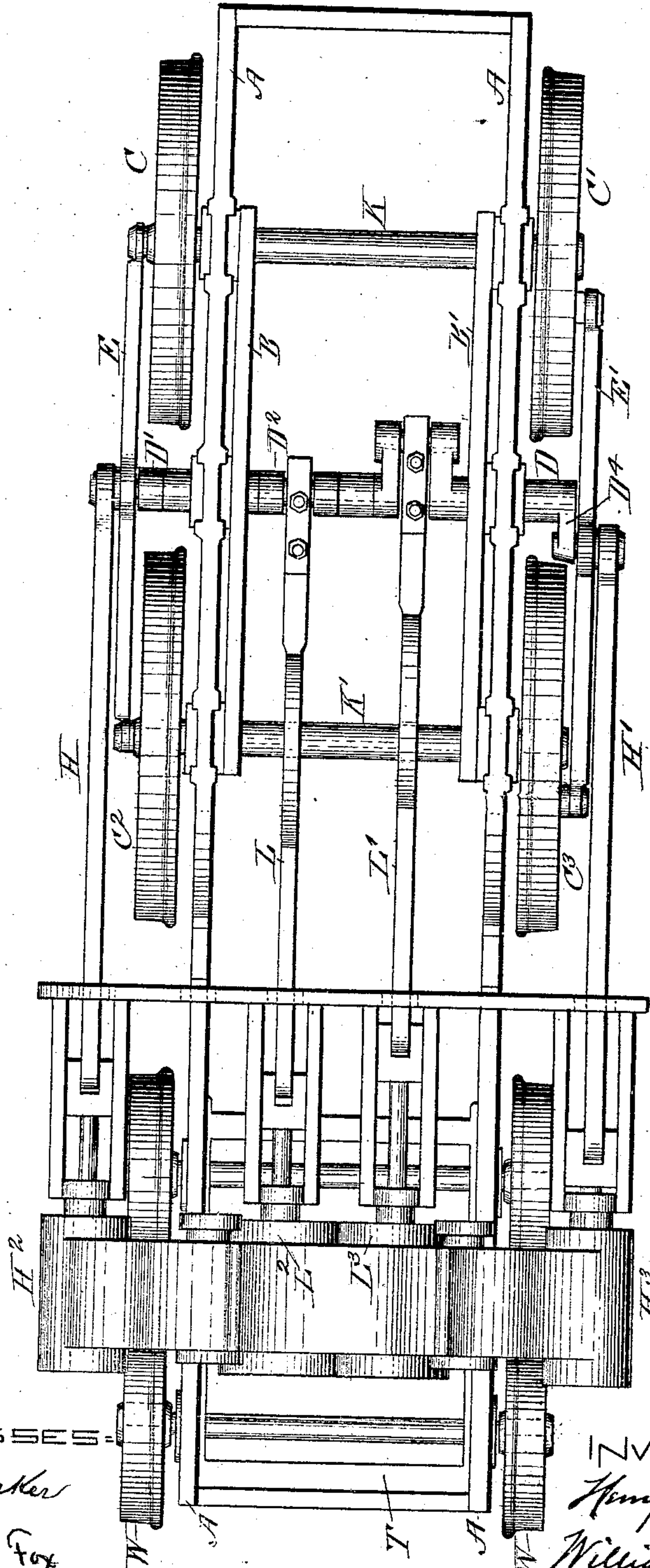


FIG. 2.

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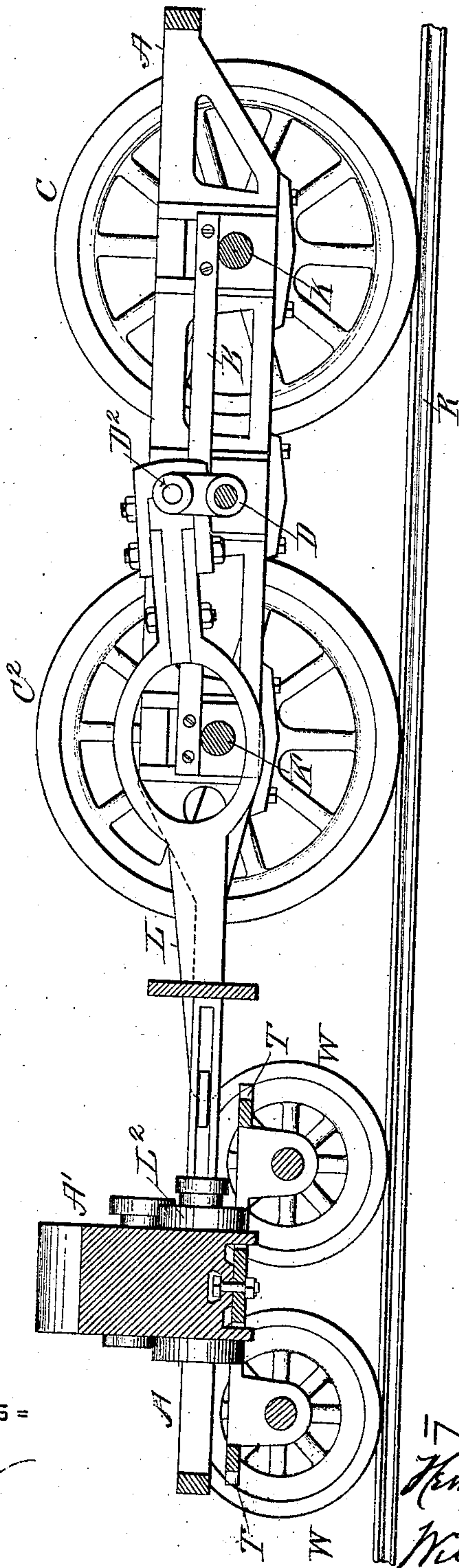


FIG. 3.

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HENRY F. SHAW, OF BOSTON, MASSACHUSETTS.

BALANCING LOCOMOTIVE-ENGINES.

No. 848,572.

Specification of Letters Patent.

Patented March 26, 1907.

Application filed October 23, 1906. Serial No. 340,225.

To all whom it may concern:

Be it known that I, HENRY F. SHAW, a citizen of the United States, of Boston, in the county of Suffolk and State of Massachusetts, have invented a new and useful Improvement in Balancing Locomotive-Engines, of which the following, taken in connection with the accompanying drawings, is a specification.

My invention relates to improvements in the heavier moving parts of a locomotive's running-gear and consists in so constructing and connecting the said parts that any energy that they may have imparted to them from the source of power that is not fully expended in useful work may be mutually counterbalanced by said parts, whereby there will be no shock, jar, or "hammer-blow" to injure the engine or rails or to tend to throw the engine from the track.

The mechanism by which I attain the desired results is illustrated in the accompanying drawings, in which—

Figure 1 is a view in side elevation showing the parts of a locomotive-engine that are embodied in my invention or are needed in explaining it. Fig. 2 is a plan of the same. Fig. 3 is a vertical longitudinal section taken through the center.

In the drawings no parts are shown unless they form a part of the invention or are necessary to the understanding of the mechanism in which my invention is involved.

The rails upon which the engine is supposed to stand are indicated by R and the framework of the engine by A A, the saddle to which the cylinders are attached by A', the truck-frame by T T, and the truck-wheels by W W. The engine has four steam-cylinders. Two, H^2 and H^3 , are for high pressure and two, L^2 and L^3 , are for low pressure. The axles of the driving-wheels are indicated by K and K' and the driving-wheels by C C' and C² C³. The above-described parts may be of any ordinary approved construction and need not be particularly described.

D is a counter crank-shaft attached to the framework A A by journal boxes and housings in the same manner that the journal boxes and housings of the axles K K' of the driving-wheels are attached or in any approved manner. The crank-pins of the driving-wheels C and C² and the crank D' of the counter crank-shaft D are connected in

line by a single straight parallel rod E. The crank-pins of the driving-wheels C' and C³ and the crank D⁴ of the counter-shaft D are connected in line by a single straight parallel rod E'.

The parallel rod E engages with crank-pins of the wheels C C² and the crank D' of the counter-shaft D, while the parallel rod E' engages with the crank-pins of the wheels C' and C³ and the crank D⁴ of the counter crank-shaft D, as shown—that is, the sets of crank connections of one side of the engine are at ninety degrees with those of the other side, so that the pistons of the high-pressure cylinders H^2 and H^3 work with the usual advantage of leverage.

The two main rods H and H' are connected, respectively, to the center of the parallel rods E and E' by the cranks D' and D⁴, so that the work of the two cylinders H^2 and H^3 is transmitted directly to the cranks of the counter crank-shaft D and through the said cranks to the parallel rods E and E' and through them to the driving-wheels. This method of transmitting the force of the cylinders directly to the cranks of a counter-shaft and thence by balanced parallel rods to the driving-wheels admits of a more nearly perfect balancing of the reciprocating parts of a locomotive-engine than is possible with the usual manner of connecting, as will be explained below.

The several cranks of the counter-shaft D all have the same throw, and each pair—that is, the pair D' and D², that take the work of the high-pressure cylinder H^2 and the low-pressure cylinder L^2 through their respective main rods H and L—are set in opposition and balance each other, and the other pair D³ and D⁴, that take the work of the cylinders L^3 and H^3 , are also set in opposition, so that the cranks of each also balance each other, and, furthermore, the force exerted by the cylinders H^2 and L^2 through the main rods H and L is also perfectly balanced. The same may be said of the cylinders L^3 H^3 .

It will be observed that the main rods L and L' of the low-pressure cylinders L^2 and L^3 are made heavier than the main rods H and H' of the high-pressure cylinders H^2 and H^3 . The object of this is to allow for the weight of the parallel rods E and E'—that is, the combined weight of the main rod H and its parallel rod E is just balanced by the weight of the main rod of the cylinder L^2 .

The same may be said of the main rod H' of the high-pressure cylinder H^3 and its parallel rod E in comparing their combined weight with the weight of the main rod L' of the low-pressure cylinder L^3 . Hence the weights of all the reciprocating elements of one side are balanced by each other. The main rod L and the crank D^2 just balances the main rod H , crank D' , and parallel rod E . The same is true of the similar elements of the other side. Thus each side is in perfect balance independent of the other so far as weight, momentum, and inertia are concerned.

The ordinary unbalanced locomotive-engine, especially when running fast, has an oscillating motion on a vertical axis. This motion is sometimes termed "nosing" and is caused by the momentum of the mass of the piston, its rod, and connected parts when the same is unbalanced. To correct this oscillation, I make the mass of the combined piston, rod, and connected parts of the high-pressure cylinder H^2 equal to the mass of the same parts of the low-pressure cylinder L^2 , and the same is true of the similar parts relating to the cylinders H^3 and L^3 . Thus there is no unbalanced force acting upon either side of the locomotive to cause it to oscillate on a vertical axis—that is, all nosing of the locomotive is prevented.

Turning to the working forces developed by the steam-pressure in the cylinders, the areas of the pistons in the high-pressure cylinders bear the same ratio to the areas of the pistons in the low-pressure cylinders that the steam-pressure in said cylinders bears to each other, so that the steam force exerted upon the crank D' is just balanced by the force exerted on the crank D^2 , and the same can be said of the cranks D^3 and D^4 .

The sustaining-bars B B' are firmly connected at their ends to the axle-boxes of the driving-wheels and at their centers to the axle-boxes of the counter crank-shaft D . These bars B and B' serve to sustain the wheels in line horizontally—that is, to keep either of them from dropping in case there

should be an abrupt depression in either of the rails.

In the drawings and specification I have shown and described a crank-shaft having two pairs of cranks and have shown two pairs of balanced steam-pistons and their moving parts in connection with the said crank-shaft; but I do not claim these parts, as they are shown and described in Patent No. 221,426, issued to me November 11, 1879, for locomotive-engines.

I claim—

1. In a locomotive-engine, a counter crank-shaft having cranks operated by the main rods of the steam-cylinders, parallel rods centrally connected to cranks upon said counter crank-shaft and connected at their ends to the crank-pins of the driving-wheels, substantially as and for the purpose set forth.

2. In a locomotive-engine, a counter crank-shaft having four cranks arranged in pairs, one pair at each side of the center of the engine, the cranks of each pair being set in opposition to each other one of each pair being connected to the center of a parallel rod and also to the main rod of a high-pressure steam-cylinder, while the other crank of the pair is connected to the main rod of the low-pressure steam-cylinder.

3. In a locomotive-engine a counter crank-shaft and means for connecting said shaft to the frame of the engine, the power-transmitting mechanism and the driving-wheels: sustaining-bars constructed to connect the boxes of the axles of the driving-wheel and the said counter crank-shaft and to sustain them in line substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, on this 18th day of October, A. D. 1906.

HENRY F. SHAW.

Witnesses:

HARRY C. LUCE,
J. INEZ L. FOX.