(No Model.) 2 Sheets—Sheet 1.

# R. HELMHOLTZ.

## LOCOMOTIVE.

No. 516,436. Patented Mar. 13, 1894.

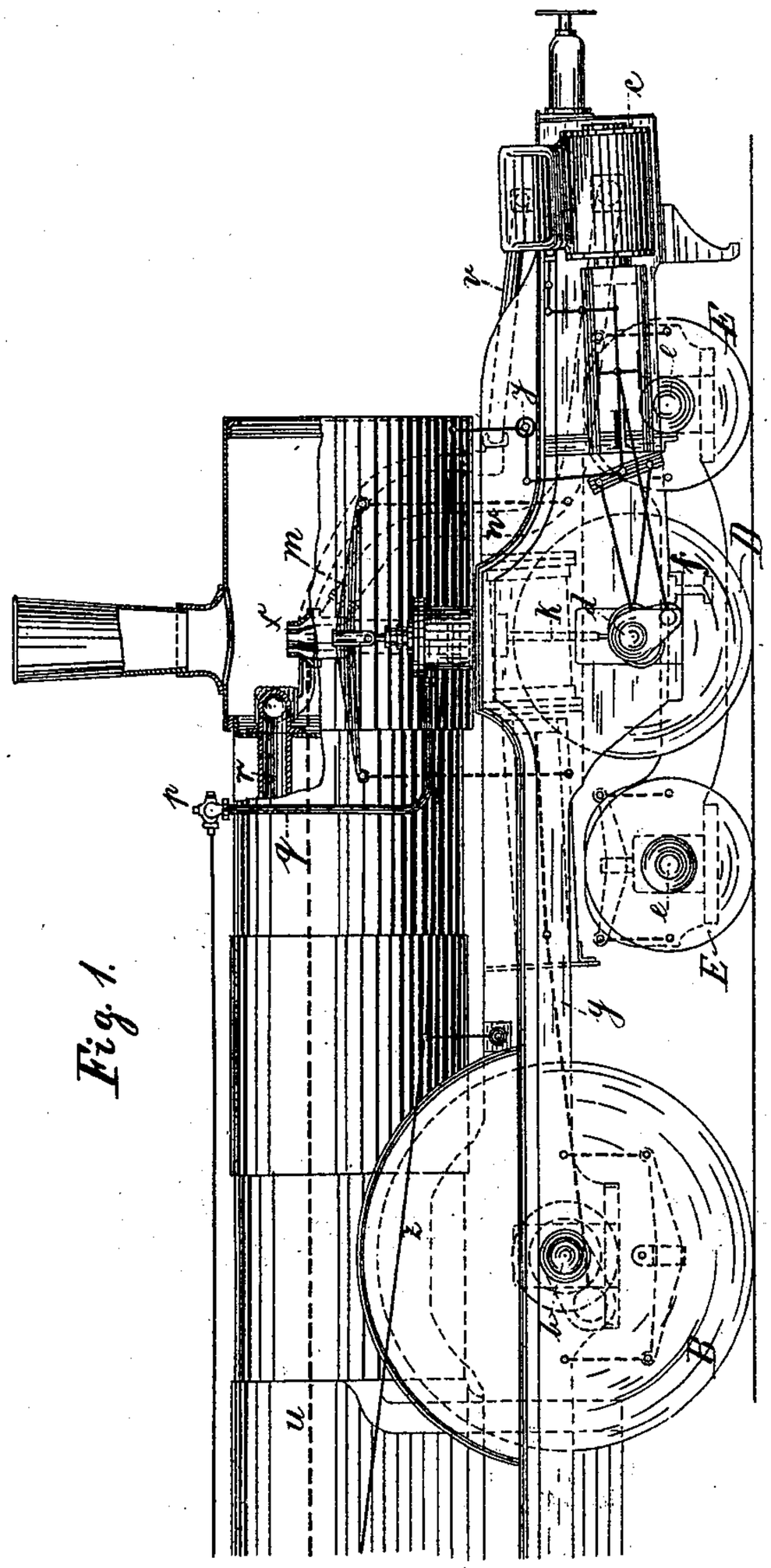

Fig. 1.

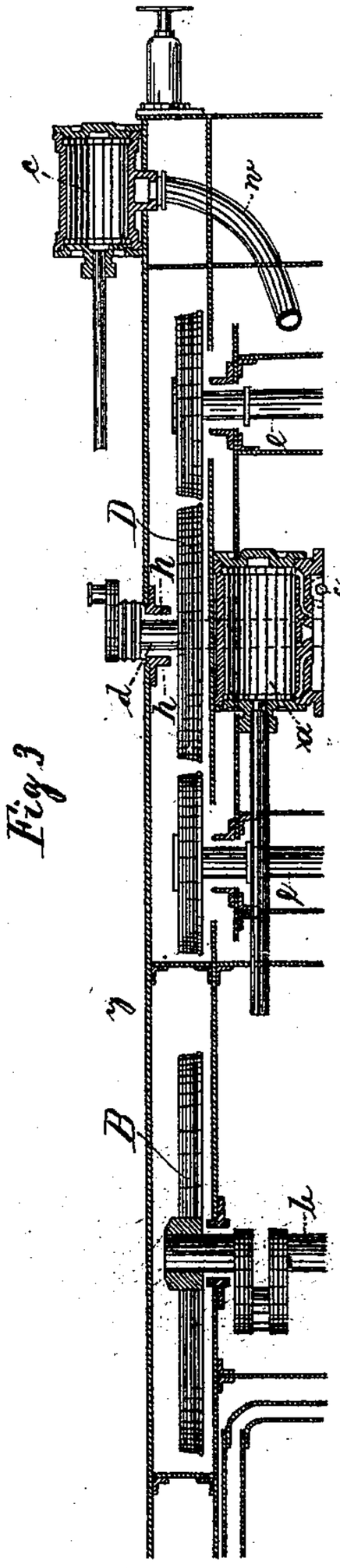

Fig 3

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Fig. 6.

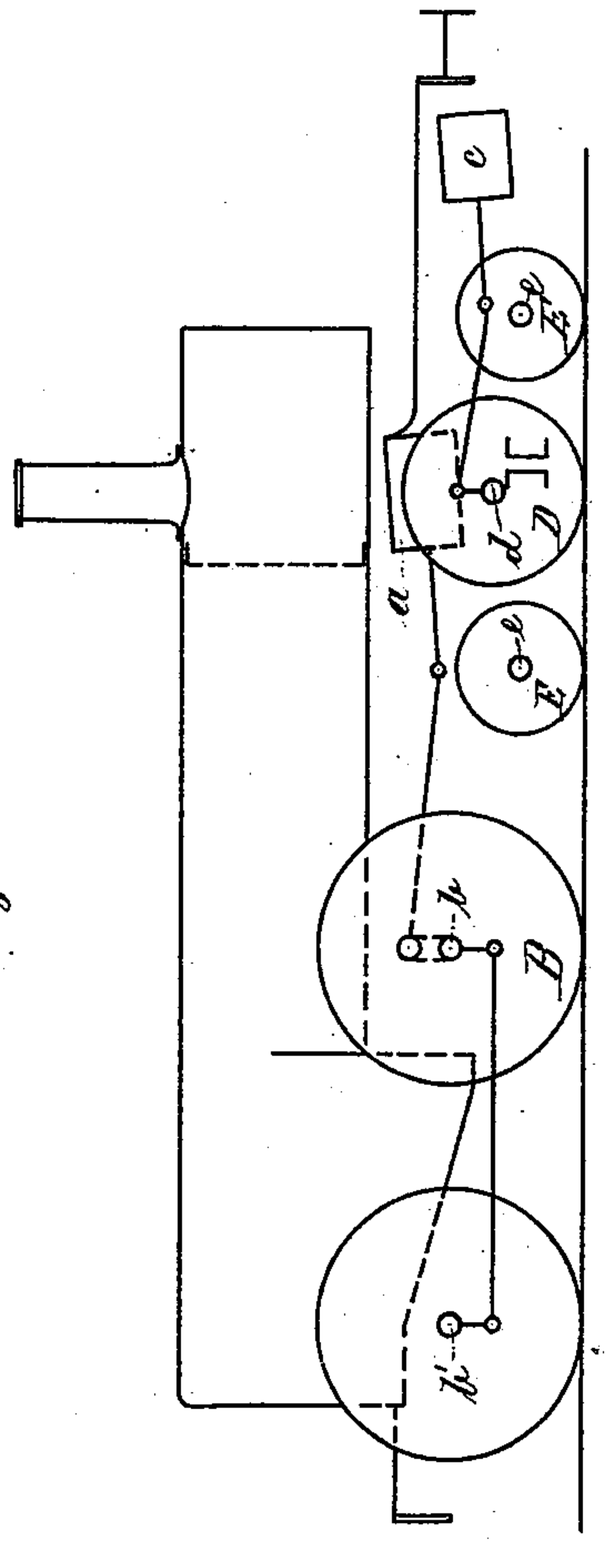



Fig. 4.

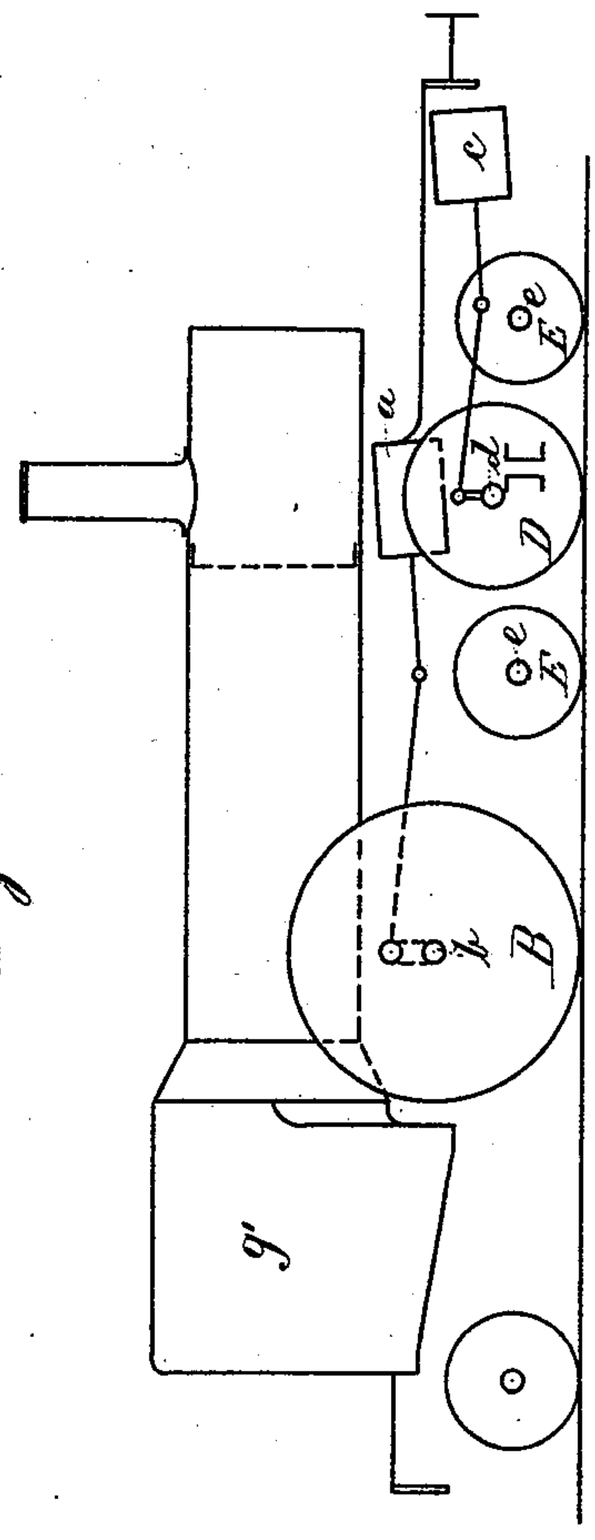



Fig. 2.

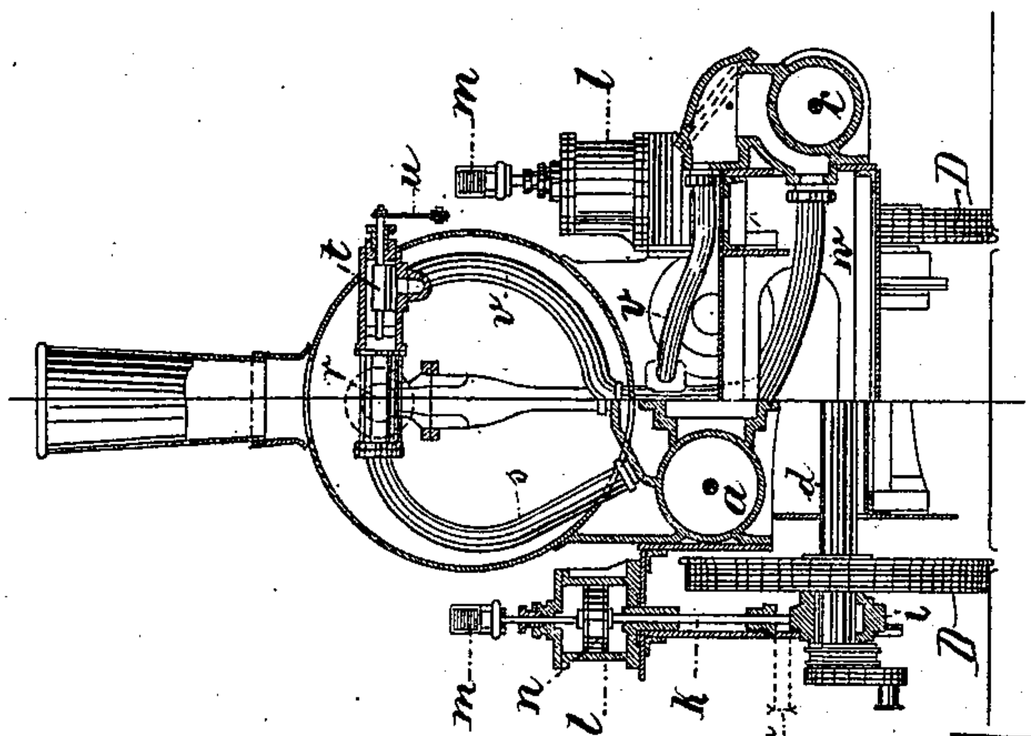
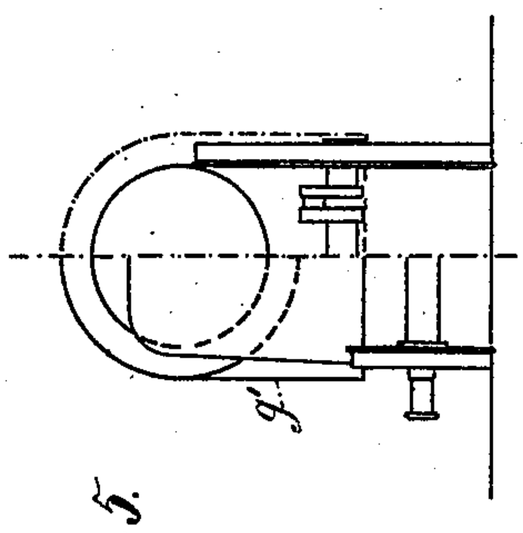



Fig. 5.

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# UNITED STATES PATENT OFFICE.

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## LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 516,436, dated March 13, 1894.

Application filed November 2, 1893. Serial No. 489,879. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD HELMHOLTZ, a subject of the Emperor of Germany, residing at Königsberg, East Prussia, Prussia, Germany, have invented certain Improvements in Locomotives, of which the following is a specification.

In locomotives of ordinary construction having two pairs of drivers driven from one pair of cylinders, the dimensions of such cylinders must be such as to produce the maximum hauling power, which corresponds, as is well known to the total weight resting upon the drivers. This construction has the objection that when a certain velocity is attained, the coupling of the drivers becomes superfluous, for the reason that the adhesion of one pair of drivers would be sufficient for the hauling power determined by the surface of evaporation of the boiler. Otherwise, smaller cylinders would, at these velocities, give better results than the dimensions calculated for the maximum hauling power. These two items, first, the heavier running of the drivers consequent on their being coupled, and second, the excessive dimensions of the steam cylinders, exert unfavorable influences on the working of the engine, and for this reason the best results at high velocity as well as the highest absolute velocities have been attained heretofore by uncoupled drivers or locomotives having but one pair of drivers. The use of such engines is, however, usually inconvenient by reason of the low hauling power of such engines.

The object of the present invention is to unite the advantages of the locomotive having uncoupled drivers whereby great velocity may be attained, with those of the locomotive having coupled drivers whereby great hauling power is imparted, and I will now proceed to describe the same with reference to the accompanying drawings, of which—

Figure 1 is a side elevation of a locomotive provided with my improvements and Fig. 2 is a transverse section of the same taken in two planes. Fig. 3 is a horizontal section of one half of the engine as seen in Fig. 1. Figs. 4, 5, and 6 are diagraphic views which will be hereinafter referred to.

In the drawings B represents the main drivers driven from the main cylinders *a* as seen in Fig. 3, and D represents the auxiliary drivers driven from the auxiliary cylinders *c*. The main engine, with its inner cylinders *a* and the driven axle *b* is provided with very large drivers, to be operated at all velocities, while the auxiliary engine comprising the external cylinders *c* and driving axle *d* is provided with drive wheels of small diameter, and is intended to increase the hauling capacity of the locomotive. For this purpose I have provided means whereby the auxiliary engine may be stopped when the speed reaches the limit and have also provided means whereby the forward drive wheels D and their axle *d* may in such cases be raised clear of the track in order to reduce the load on the main cylinders. The axle *d* is placed between two axles *e*, *e* bearing truck wheels E and is properly united therewith by means of a swinging or pivoted frame of well known construction (seen in Fig. 3) pivoted on a pin *f* to the main frame *g* of the engine, and sliding vertically in the ordinary manner between blocks *h*. The bearings *i*, (Fig. 2) of shaft or axle *d* are firmly connected with the spring actuated or elastic supports *k*. These spring supports *k* are in the nature of piston rods and bear pistons *n* arranged in the cylinders *l* through which they pass through stuffing boxes in the ends thereof and are connected to the leaf springs *m* (Figs. 1 and 2) such springs being supported from the frame in any convenient manner are tensioned upwardly in order to keep the drive wheels D normally lifted free from the track for a distance marked *o* in Fig. 2 of the drawings. By means of a three way cock *p* (Fig. 1) and the pipes *q* steam is admitted to the space above the pistons in cylinders *l* or said space is placed in communication with the atmosphere. The admission of steam thereinto has, as will be obvious, the effect of depressing the drivers D into contact with the rails. The admission of steam to the cylinders is effected through the inlet crosspipe *r*. The pipe *s* (Fig. 2) is branched off from the same and connects with the slide valve box, common to both main cylinders *a* and a check valve *t*, also connected

to said inlet pipe $r$ serves to open and close the passage to the pipes $v$ leading to the supplementary cylinders $c$. The valve $t$ is operated by means of a draw bar $u$ led back to the stand of the engineer. The exhaust steam of the supplementary cylinders is led through pipe $w$ and through an ejector or blast tube $x$ arranged concentrically around the blast tube of the main engine in the stack. The rod $y$ of the valve gear of the supplementary engine is connected by rod and lever $z$ with the operating bar of the main engine so that both may be manipulated simultaneously.

In order to operate the supplementary engine, the piston $n$ of cylinders $l$ is first pressed down by opening the cock $p$ so that the wheels D are pressed against the rails (whereby the two axles $e$ are relieved of one half the weight on axle $d$) and then valve $t$ is opened to admit steam to the cylinders $c$. To stop the supplementary engine valve $t$ is closed and steam allowed to escape from cylinders $l$ into the atmosphere whereby the wheels D are lifted clear of the rails by springs $m$. Both operations may be affected while the train is in motion. As far as the operation of the locomotive is affected, it does not matter whether both engines or only the main engine are in use, since they may be handled by the engineer simultaneously.

In locomotives provided with air brakes it is evident that cylinder $l$ may be replaced by an air cylinder and the wheels D depressed by compressed air instead of steam.

The device as illustrated and described possesses, over and above the advantages above enumerated, the following:—first, better production of steam and higher efficiency when the train is climbing steep grades for the reason that there is a greater number of revolutions of the supplementary axles and greater exhaust into the chimney; second, facilitation of the general arrangement of the locomotive by reason of there being only one pair of large drivers; third, a better position is afforded the engineer for whom the platform and fire box $q'$ (see Figs. 4 and 5) may be considerably enlarged between the wheels. Thus an increased grate surface may be employed by limiting the length of grate and the cylindrical portion of the boiler can be provided with more flues giving increased heating surface. It is evident that the supplementary axle $d$ may also be employed in locomotives having two coupled drivers as well as on locomotives having single drivers, and for this reason I do not desire to be understood as limiting myself to the exact construction and arrangement of my improvements as herein set forth.

Having thus described my invention, I claim—

1. In a locomotive, the combination with a main engine having two cylinders and drive wheels, of the supplementary drivers, means for raising and lowering said supplementary drivers and means substantially as described for actuating said supplementary drivers, substantially as set forth.

2. In a locomotive, the combination with the main engine having two cylinders and drive wheels, of the supplementary drivers vertically movable in the frame, spring supports for said supplementary drivers, cylinders arranged adjacent to said spring supports and pistons arranged in said cylinders and connected to said supports substantially as set forth.

3. In a locomotive, the combination with the main engine having two cylinders and drive wheels, of the supplementary engine also comprising two cylinders and drivers, trucks arranged on opposite sides of said supplementary drivers and means for elevating and depressing said supplementary drivers substantially as set forth.

In witness whereof I have hereunto signed my name in presence of two subscribing witnesses.

RICHARD HELMHOLTZ.

Witnesses:
EMIL HENZEL,
GY. MÄNDL.