(No Model.) 3 Sheets—Sheet 1.

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## LOCOMOTIVE.

No. 525,205. Patented Aug. 28, 1894.

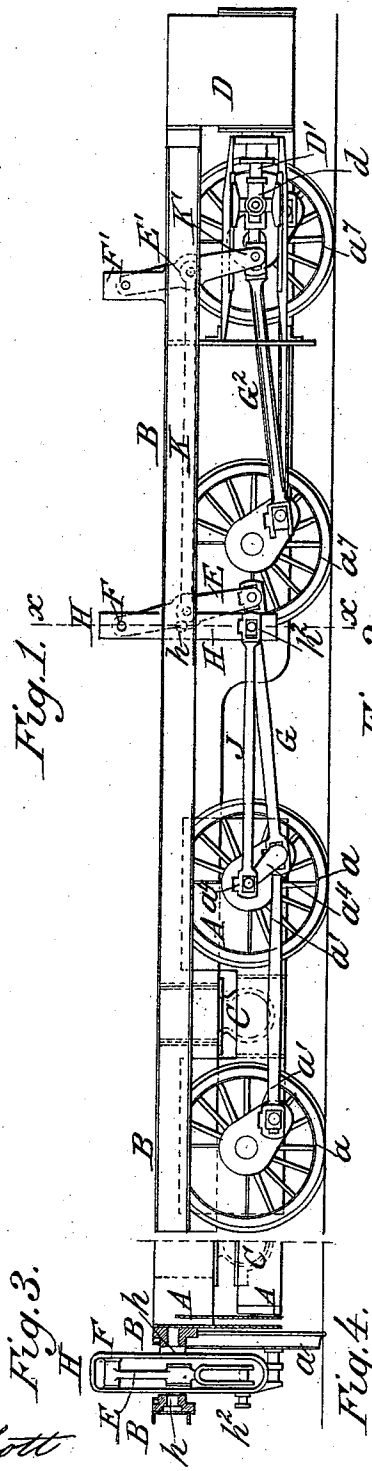


Fig. 1.

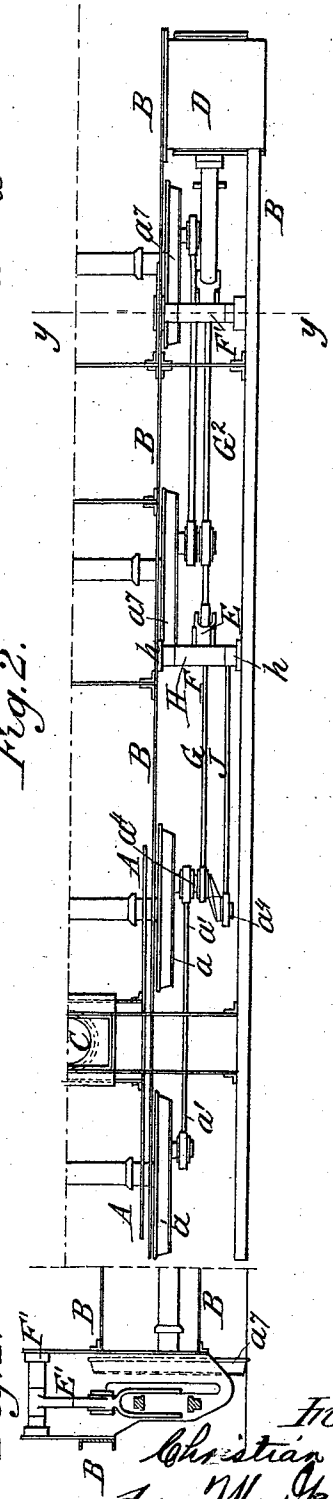


Fig. 2.



Fig. 3.



Fig. 4.

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Fig. 6.

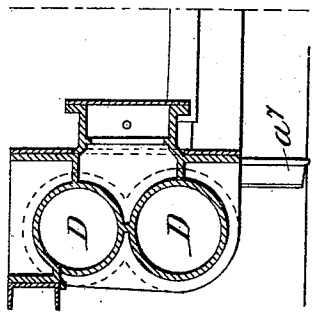



Fig. 8.

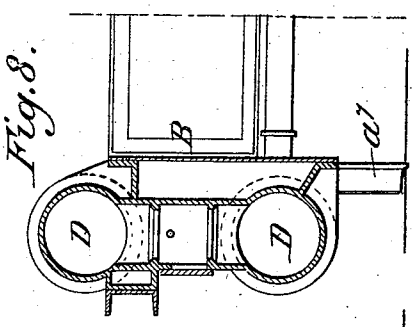



Fig. 5.

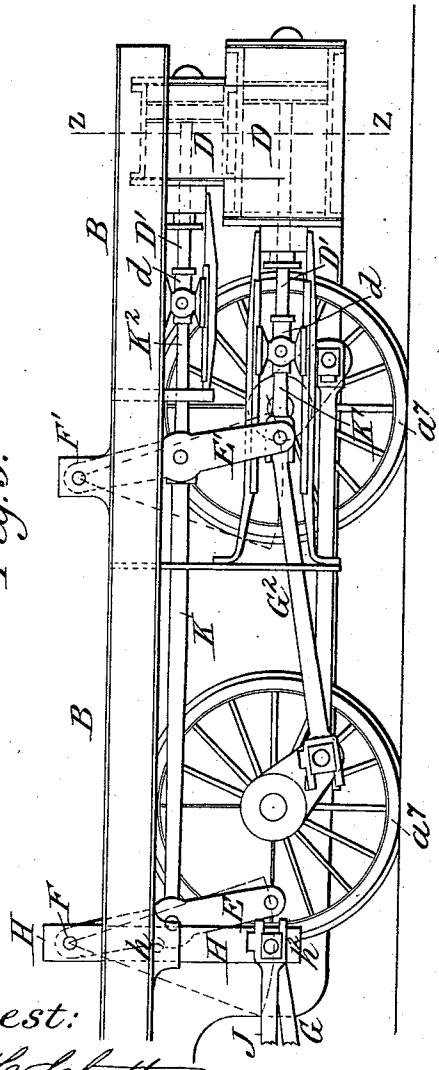
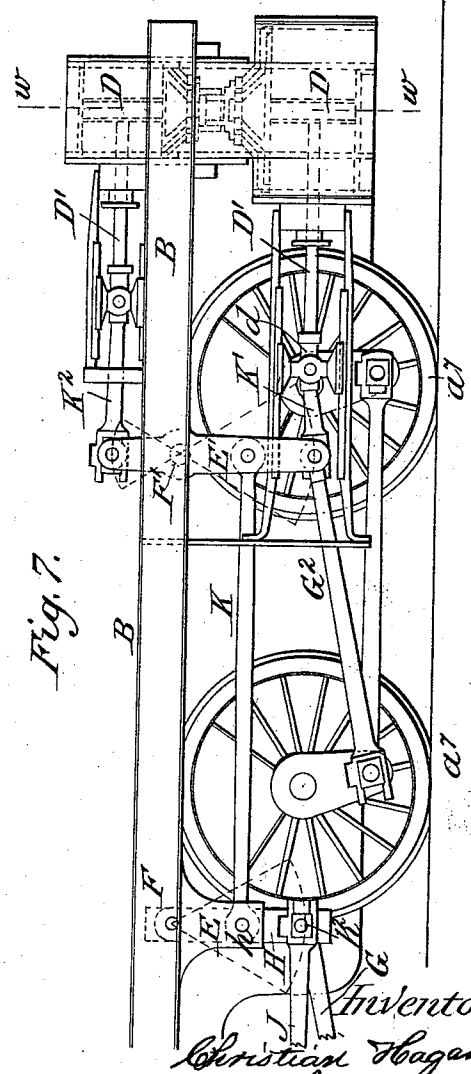



Fig. 7.




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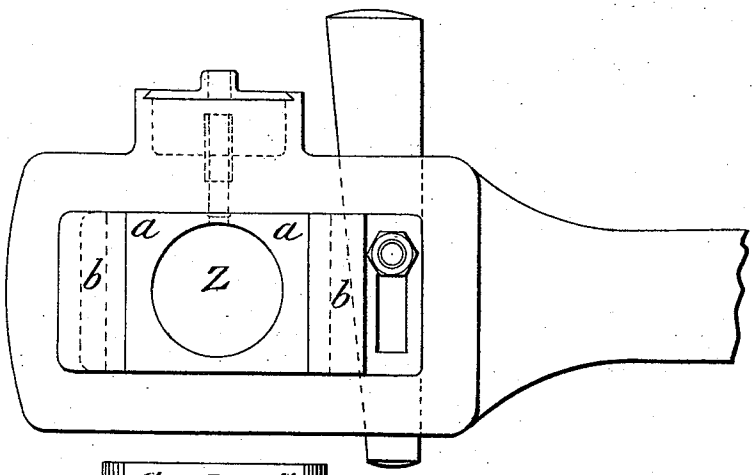
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*Fig. 9.*



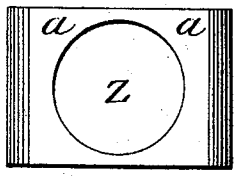




*Fig. 10.*

*Fig. 11.*

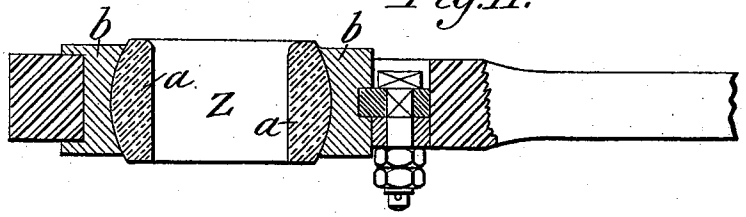
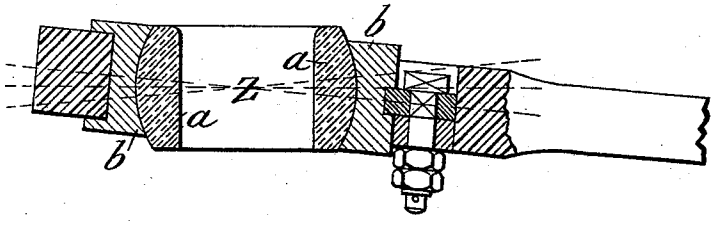



*Fig. 12.*




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# UNITED STATES PATENT OFFICE.

CHRISTIAN HAGANS, OF ERFURT, GERMANY.

## LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 525,205, dated August 28, 1894.

Application filed February 17, 1894. Serial No. 500,564. (No model.)

*To all whom it may concern:*

Be it known that I, CHRISTIAN HAGANS, a subject of the Emperor of Germany, residing at Erfurt, Germany, have invented certain new and useful Improvements in Locomotives; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to the propelling mechanism of locomotives, and its object is to so construct and connect the same with the driving wheels of the locomotive that it will be enabled to run on very sharp curves, or curves having a small radius.

The invention consists in providing the locomotive with a compensating gear interposed between the main frame and the swiveled truck on one or both sides of the locomotive, the said compensating gear being connected with a shifting part of the driving connections of the engine. And my invention particularly consists in a modification of the invention described and shown in Letters Patent No. 501,616, issued to me July 18, 1893, the essential difference being that in said patent, a weigh-lever is employed for moving the fulcrum of the two-armed levers, whereas, by this invention, I avoid the use of the weigh-lever and, in other respects, simplify the whole construction.

My invention consists, also, in such features, details and combinations of parts as will first be described in connection with the accompanying drawings and then pointed out in the claims.

In the drawings—Figure 1 is a side elevation of so much of a locomotive as is necessary to illustrate my invention. Fig. 2 is a half plan view of Fig. 1. Fig. 3 is a detail transverse section, partly in elevation, on the line *x—x*, Fig. 1. Fig. 4 is a similar view, on the line *y—y*, Fig. 2. Fig. 5 is a side elevation showing my invention as embodied in one form of compound engine. Fig. 6 is a transverse section on the line *z—z*, Fig. 5. Fig. 7 is a similar view, illustrating the embodiment of my invention in another form of compound engine. Fig. 8 is a transverse section on the line *w—w*, Fig. 6. Figs. 9, 10, 11 and 12 are detail views showing the construction of the connecting-rod ends or stub-ends and their bearings.

Referring to the drawings, A is a truck frame in which are mounted the truck wheels, $a'$, the truck being movably attached in the usual way to the main frame, B, by means of the ball and socket pintle, C.

Referring particularly to Figs. 1 to 4, inclusive, D is a cylinder, D′, a piston-rod, and $d$, a cross head, of the usual construction. To the cross head is pivoted a pitman-rod, K′, which is connected to the lower end of a lever, E′, fulcrumed to a projection, F′, attached to the main frame, B. The main connecting rod, $G^3$, is attached to the lower end of the lever, E′, at the same point with the pitman-rod, and serves to transmit motion to the main driving wheels, in the usual manner, the rear drivers receiving motion from the main drivers, by means of the parallel rods, $G^3$. The truck wheels, which, as before stated, are coupled by the parallel rod, $a'$, are driven from the engine by means of a connecting-rod, G, attached to the wrist-pin, $a^4$, and to the lower end of a lever, E, fulcrumed at F, in a swinging hanger, H, and connected by a rod, K, to the lever, E′. The hanger, H, is fulcrumed at $h$, on the main frame, and is connected by a controlling rod, J, to any suitable part of the truck, as, for instance, to the outer end of the compound crank, $a^4$.

The operation of the mechanism thus far described is as follows: When the locomotive is running on a straight track, the piston-rod drives the main connecting rod, $G^2$, lever, E′, parallel rod, $G^3$, and rod, K, through the medium of the pitman-rod, K′. The rod, K, in turn drives the lever, F, which moves the connecting rod, G, and actuates the crank, $a^4$, moving the truck wheels. On turning a curve, the truck wheels are swung on their central pivot, C, in the usual way, and, in so doing, move the hanger lever, H, through the medium of the controlling rod, J, either pushing the lower end of the hanger backward or pulling it forward, according to the direction in which the truck is moved. As the hanger lever, H, is fulcrumed at $h$, any movement of its lower end will correspondingly affect the position of the fulcrum point, F, of the lever, E, either moving it forward or backward, and, as the distance between the pivotal points of

connection of the rod, K, to levers, E and E′, is unalterable, the lower end of the lever, E, is also affected by any movement of its fulcrum, F, thereby altering the position of the arc through which the lower end moves. Thus, it will be seen, by properly proportioning all the parts, the increase or decrease of distance between the center of the rear truck wheel and the main driving wheel, due to the swinging of the truck, is properly compensated without throwing any undue strain on the connecting rod, G. However, the swinging of the truck gives rise to a lateral deflection of the connecting rod, G, which, with the ordinary methods of attachment, would either necessitate a large amount of lost motion at the stub-ends and wrist-pins, or would seriously strain the bearings. These disadvantages I avoid by an improved construction of stub-end, which will be hereinafter described.

In Figs. 5 and 6, I have shown the manner in which my invention is applied to one form of compound engine in which the two cylinders are close together, and have a common steam-chest, or slide-valve chest, on their inner sides. In this construction, the piston-rod of the upper cylinder is connected by a pitman-rod, $K^2$, to the lever, E, at the same pivotal point where the rod, K, is attached, thus enabling the upper pitman-rod to contribute its proportionate amount of work in driving the wheels. The remaining construction is essentially similar to that shown in Figs. 1 to 4.

In Figs. 7 and 8, I have shown the manner in which my invention may be applied to a compound engine having two cylinders with a common steam-chest between them, which necessitates the separation of the cylinders. In this construction, the lever, E′, is extended above its fulcrum point, and is connected to the upper cross-head by a pitman-rod, $K^2$, the direction of travel of one piston-rod being, obviously, opposite to that of the other.

In Figs. 9 to 12, I have shown a stub-end embodying some of the features of my invention and enabling me to overcome all the disadvantages which would arise were the connecting rods attached to the wrist pins in the usual way.

Referring to Figs. 9 to 12, *a*, is a bushing, which, instead of being flat on all its sides, as usual, has two opposite sides cylindrically curved, these curved surfaces forming part of one and the same cylinder whose axis is in the vertical central plane of the stub-end. This axis is also at right angles to the longitudinal axis of the wrist-pin, which passes through the cylindrical opening, Z, in the bushing, *a*. The bushing, *a*, is inserted between the two blocks, *b*, which each have a concave surface arranged to contact with the curved surfaces of the bushings, as will be apparent from the drawings. The blocks, *b*, are each grooved, one to receive the stub-end, and the other to receive the usual key for taking up the wear, the key being provided with a bolt and nuts, as in the ordinary construction. Oil is supplied to the wrist-pin and to the curved surfaces, by a common lubricator. It is plain from Fig. 12 that the curved or cylindrical surfaces of the bushing, *a*, permit the connecting rod to swing a considerable distance in each direction, without straining the wrist-pin, so that by providing the connecting rod, G, Figs. 1 and 2, at each end with the improvements shown in Figs. 9 to 12, the connecting rod may be deflected by the swinging of the truck, without straining its connections.

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

1. In a locomotive, the combination, with a hanger pivoted on the main frame, a movable truck-frame, and a controlling lever attached to the hanger and to the truck frame, of a one-armed lever fulcrumed on the hanger, a connecting rod connected to the lever and operating the truck wheels, and means for operating the lever.

2. In a locomotive, the combination, with a truck and a pair of levers, one of which has a movable fulcrum, of a coupling rod uniting the two levers, a connecting rod attached to the lever having the movable fulcrum and to the wheels journaled in the truck-frame, and a controlling lever movable with the truck-frame and arranged to shift the movable fulcrum of the lever, substantially as set forth.

3. In a locomotive, the combination, with the cylinder, piston-rod and cross-head, of a pitman-rod attached to the cross-head, a one-armed lever fulcrumed on the main frame and attached to the pitman-rod, a connecting rod attached to the lever, a main driving wheel operated by the connecting rod, a hanger pivoted on the main frame, a lever fulcrumed on the hanger, a rod connecting both levers, a truck-wheel, a connecting rod pivoted to the lever fulcrumed on the hanger and operating the truck-wheel, and a controlling rod attached to the hanger and to the truck-frame, substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

CHRISTIAN HAGANS.

Witnesses:
P. TEICHMANN,
C. LOHFELD.