

No. 617,470.

Patented Jan. 10, 1899.

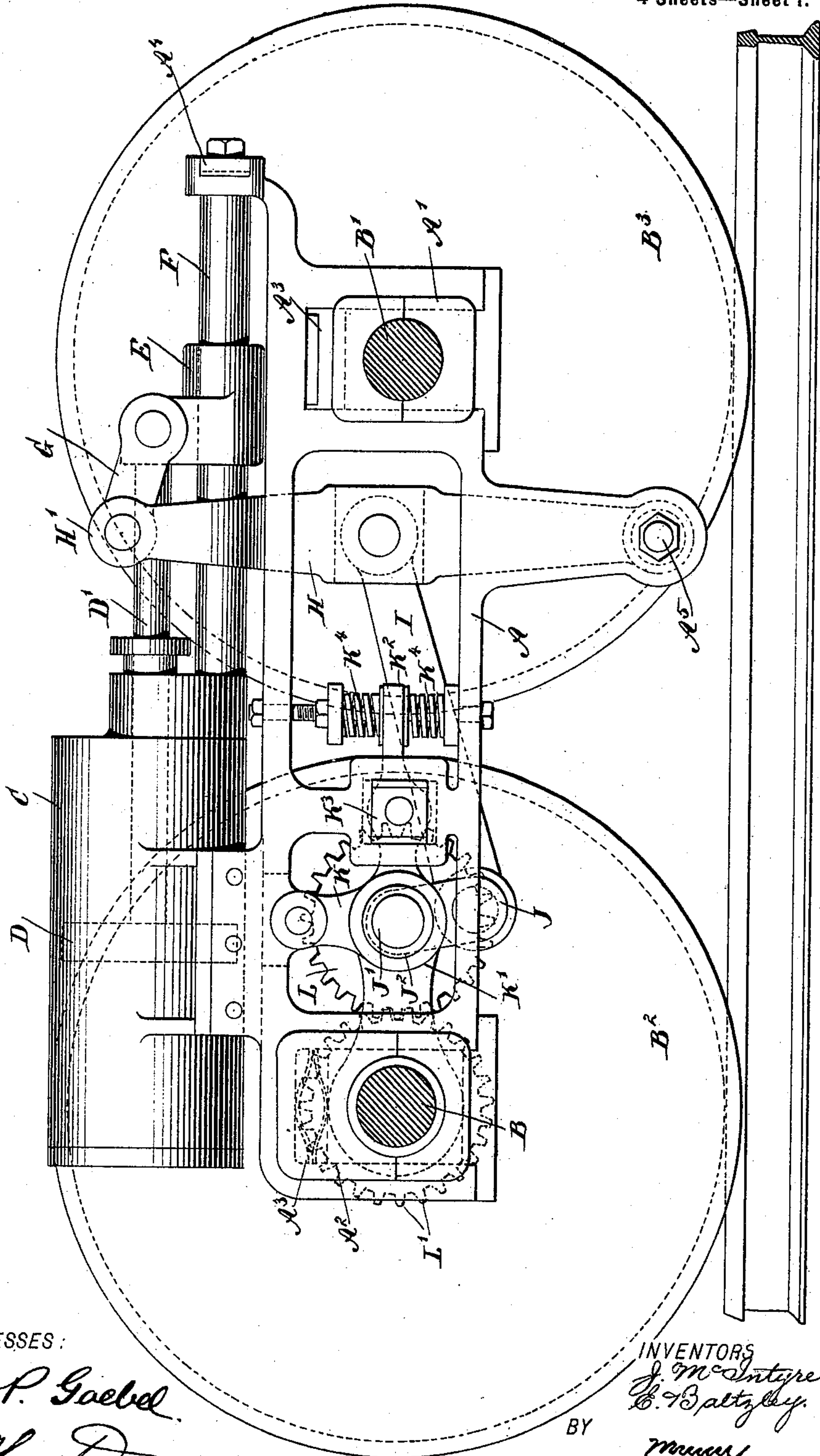
J. MCINTYRE & E. BALTZLEY.  
RECIPROCATING CAR ENGINE.

(Application filed Jan. 28, 1898.)

(No Model.)

4 Sheets—Sheet 1.

Fig. 1.



WITNESSES:

William P. Goebel  
Rev. J. H. H. H.

INVENTORS  
J. McIntyre  
E. Baltzley.

BY

Attorneys.

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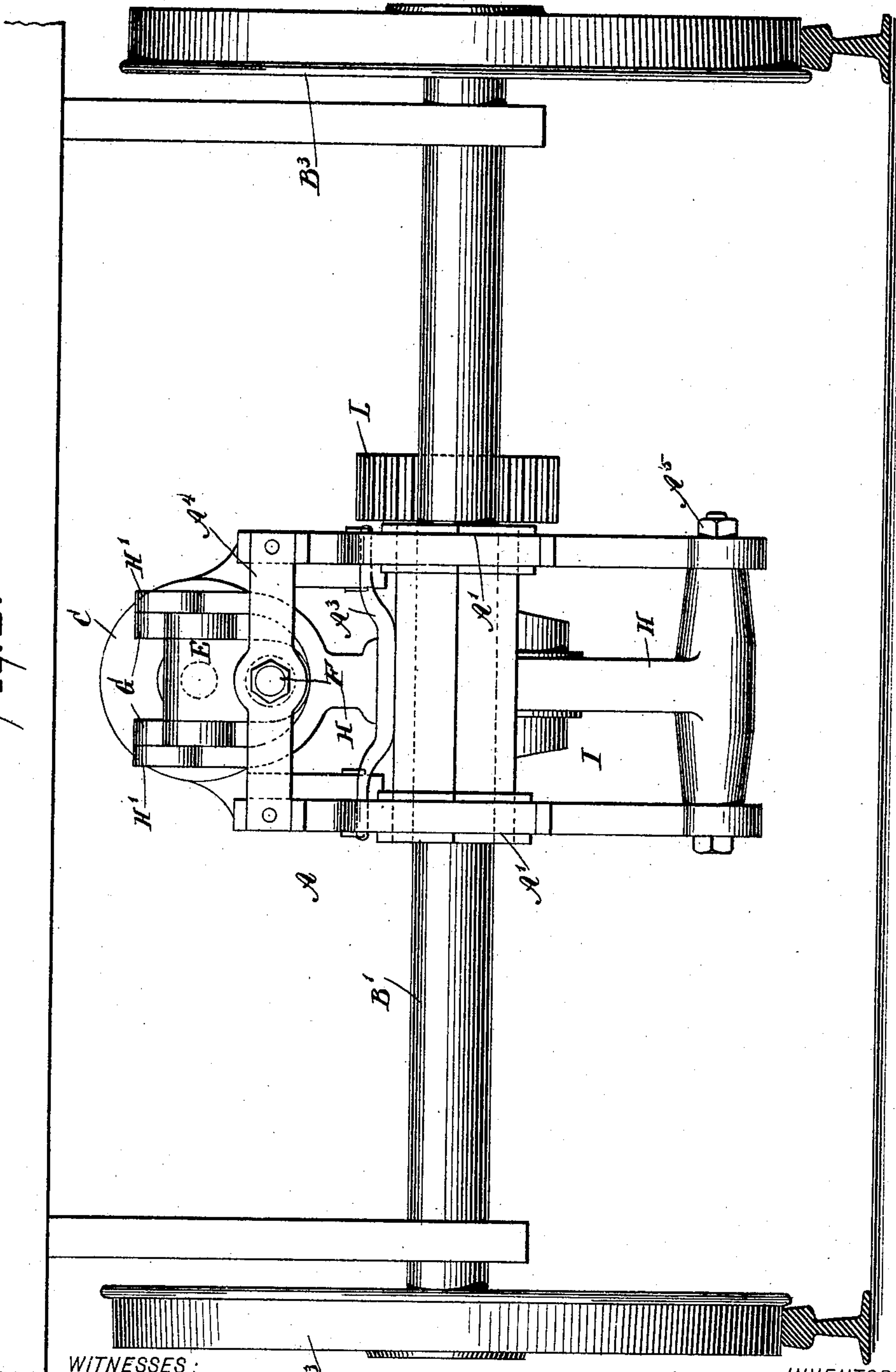
J. MCINTYRE & E. BALTZLEY.  
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4 Sheets—Sheet 2.

Fig. 2.



WITNESSES:

William P. Goebel.  
Rev. J. H. Foster.

INVENTORS  
J. McIntyre  
E. Baltzley  
BY  
M. W. Munn  
ATTORNEYS.

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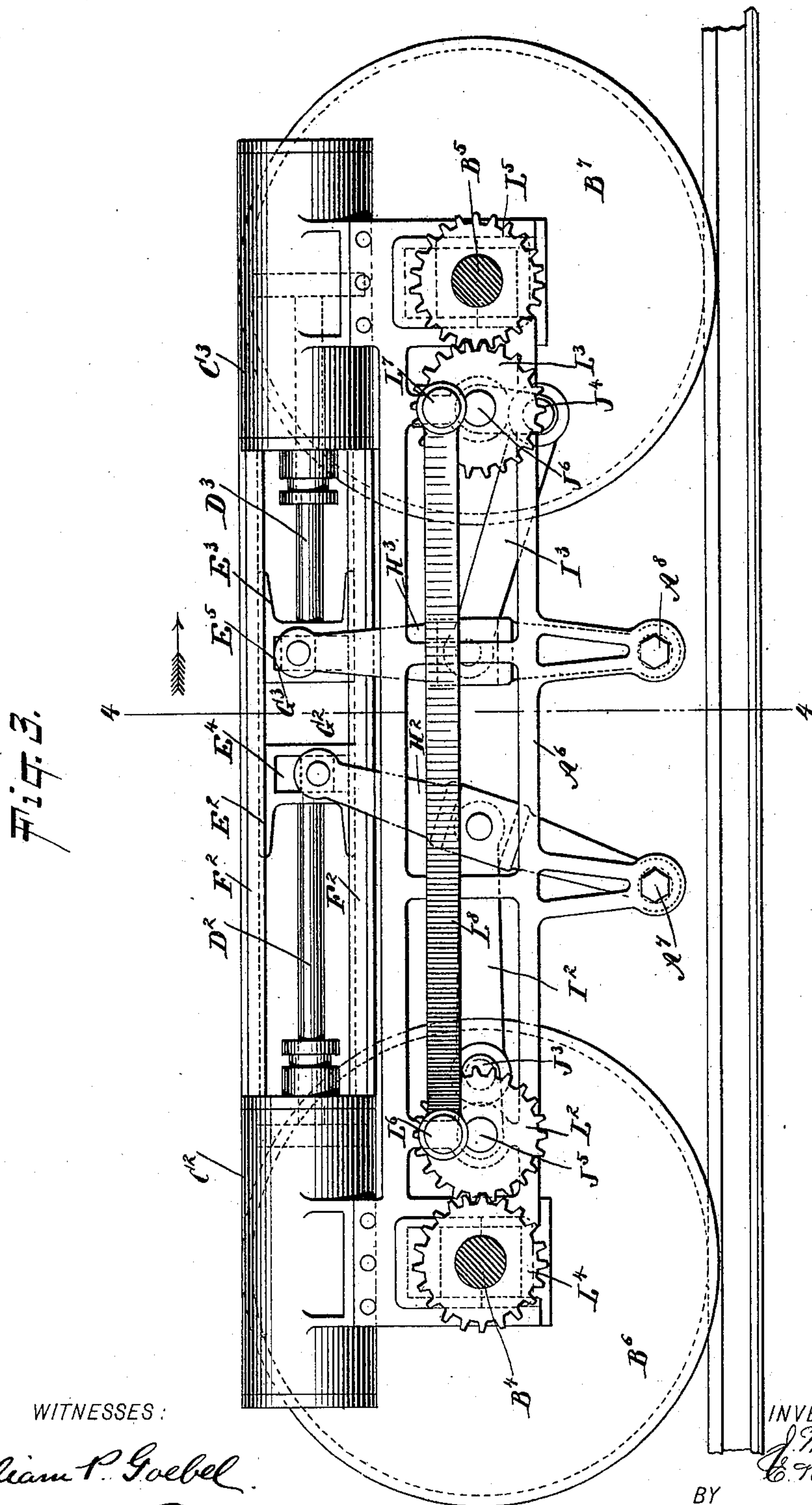
**J. MCINTYRE & E. BALTZLEY.**

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(Application filed Jan. 28, 1898.)

(No Model.)

**4 Sheets—Sheet 3.**



WITNESSES :

William P. Goebel.  
Rev. J. Hostetler.

INVENTORS

J. McIntyre.  
E. Battley.

BY

*Mumford*  
ATTORNEYS.



No. 617,470.

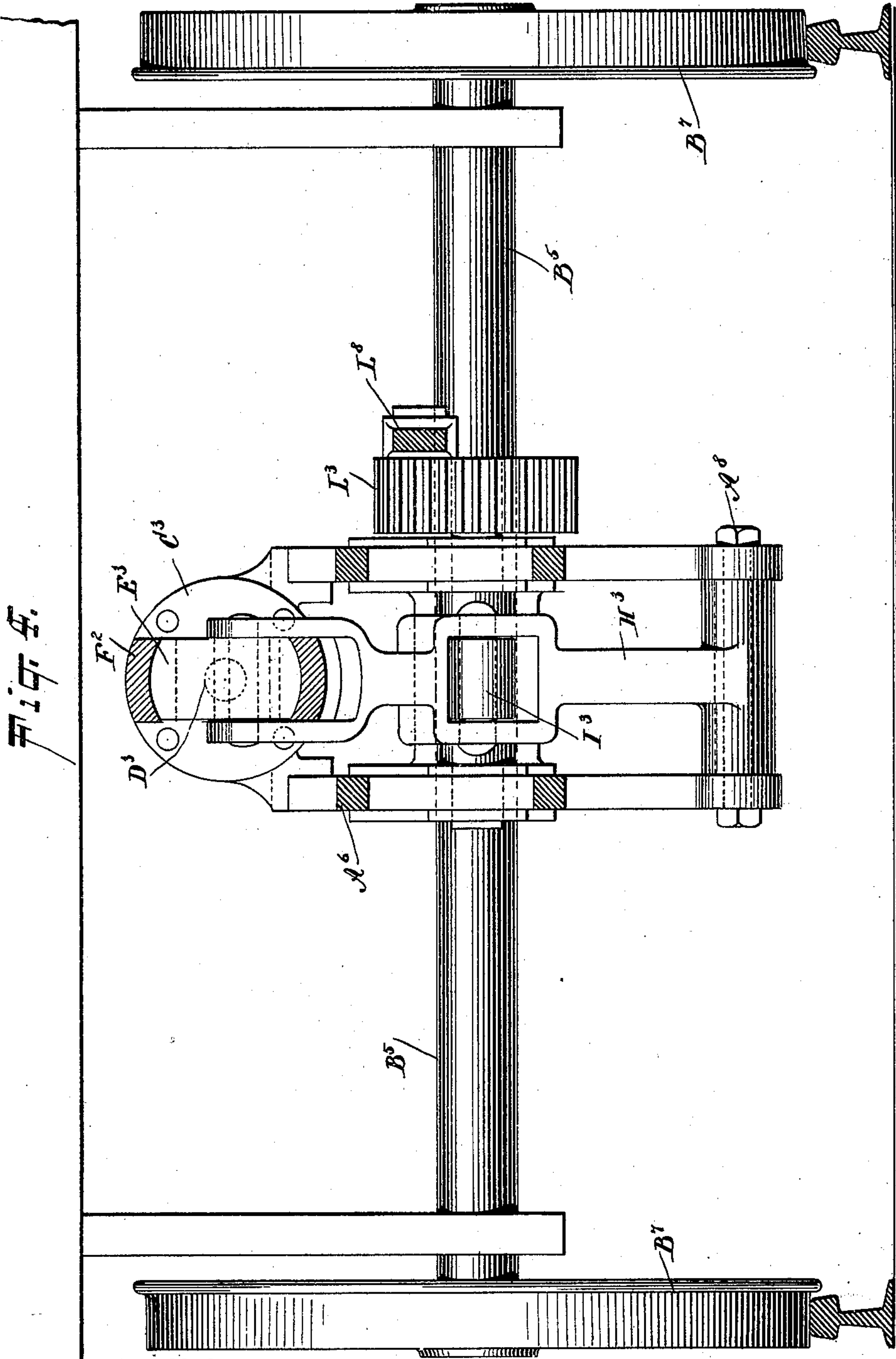
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J. MCINTYRE & E. BALTZLEY.  
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(No Model.)

4 Sheets—Sheet 4.



WITNESSES:

William P. Goebel.  
Rev. J. Hostetler.

INVENTORS

J. McIntyre  
E. Baltzley.

BY

Wm. H. ...  
ATTORNEYS.



# UNITED STATES PATENT OFFICE.

JOHN MCINTYRE, OF JERSEY CITY, NEW JERSEY, AND EDWIN BALTZLEY, OF GLEN ECHO, MARYLAND; SAID BALTZLEY ASSIGNOR TO SAID MCINTYRE.

## RECIPROCATING CAR-ENGINE.

SPECIFICATION forming part of Letters Patent No. 617,470, dated January 10, 1899.

Application filed January 28, 1898. Serial No. 668,253. (No model.)

*To all whom it may concern:*

Be it known that we, JOHN MCINTYRE, of Jersey City, in the county of Hudson and State of New Jersey, and EDWIN BALTZLEY, of Glen Echo, in the county of Montgomery and State of Maryland, have invented a new and Improved Reciprocating Car-Engine, of which the following is a full, clear, and exact description.

10 The invention relates to reciprocating motors for propelling street-cars and other vehicles; and its object is to produce a new and improved car-engine which is simple and durable in construction, not liable to get out of order, and arranged within a small compass on and between adjacent car-axles on a frame between the sides of the truck-frame and applicable to any truck to transmit rotary motion to the driving-wheels in a very effective and economical manner.

20 The invention consists of novel features and parts and combinations of the same, as will be fully described hereinafter, and pointed out in the claims.

25 Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

30 Figure 1 is a sectional side elevation of the improvement on the line 1 1 of Fig. 2. Fig. 2 is an end elevation of the same. Fig. 3 is a sectional side elevation of a modified form of the improvement, and Fig. 4 is a transverse section of the same on the line 4 4 of Fig. 3.

35 In the construction of the reciprocating car-engine the engine-frame A is wholly supported on adjacent axles B B' of the car-truck and between the side frames of said truck. In order to relieve the engine of any jar or jolt, the frame A is provided with boxes or bearings A', fitted to slide vertically in suitable guideways A<sup>2</sup> on the frame and supported on springs A<sup>3</sup>, carried by the frame.

40 The cylinder C of the engine is preferably bolted to the top of the frame A above the axles, and the piston D, reciprocating in the cylinder, is connected by the piston-rod D' with the cross-head E, fitted to slide on the

guideway F, supported by the inner end of the cylinder and a cross-bar A<sup>4</sup> of the frame A.

45 As illustrated in Figs. 1 and 2, the frame A is provided with a cross-bar A<sup>5</sup>, forming the fulcrum or the lower end of a rocker-arm H, connected at its free forked end H' by links G G with the cross-head E. The rocker-arm H is connected between its fulcrum and its free end by a return connecting-rod I with a crank-arm J, formed on a crank-shaft J', journaled in suitable bearings J<sup>2</sup>, carried by the links K K', of which the link K is pivotally connected to the frame A and the link K' is journaled on the axle B and extends longitudinally or otherwise and loosely from the axle B, carrying the driving-wheel B<sup>2</sup>. The link K' is preferably extended beyond the shaft J<sup>2</sup>, and the extended end K<sup>2</sup> is carried by a box K<sup>3</sup> in the frame A and the free end is held between springs K<sup>4</sup>, carried by the frame. When the box K<sup>3</sup> is used, the link K and the springs K<sup>4</sup> may be dispensed with, and when the springs are used the box and the link K may be dispensed with; but all three or either one of the supports for the bearing may be used.

50 On the crank-shaft J' is secured a gear-wheel L in mesh with a gear-wheel L', attached to the axle B, so that when a rocking motion is given to the rocker-arm H then the return connecting-rod I and the crank-arm J impart a rotary motion to the said shaft J', which by the gear-wheels L L' transmits a rotary motion to the axle B and the drive-wheel B<sup>2</sup>. As shown, the rocker-arm H, connecting-rod I, crank-shaft J', and gear-wheel L are located in a very small space between the axles B and B', the latter carrying the wheels B<sup>2</sup>.

55 In the modified form shown in Figs. 3 and 4 the frame A<sup>6</sup> carries the cylinders C<sup>2</sup> and C<sup>3</sup>, having their piston-rods D<sup>2</sup> and D<sup>3</sup> connected with the cross-heads E<sup>2</sup> E<sup>3</sup>, respectively, fitted to slide on a guideway F<sup>2</sup>. On the cross-heads E<sup>2</sup> and E<sup>3</sup> are arranged vertically-disposed guideways E<sup>4</sup> and E<sup>5</sup>, engaged by the boxes G<sup>2</sup> and G<sup>3</sup>, respectively, carried on the upper end of the rocker-arms H<sup>2</sup> and H<sup>3</sup>, respectively, fulcrumed on the cross-bars A<sup>7</sup> and A<sup>8</sup> of the frame A<sup>6</sup> and extending be-



tween the adjacent axles  $B^4$  and  $B^5$ , the axles carrying the wheels  $B^6$   $B^7$ , respectively. The rocker-arms  $H^2$  and  $H^3$  are pivotally connected between their fulcrums and their free ends with the connecting-rods  $I^2$  and  $I^3$ , engaging the crank-arms  $J^3$  and  $J^4$  on the crank-shafts  $J^5$  and  $J^6$ , journaled in suitable bearings  $K^6$  and  $K^7$  on the frame  $A^6$ . On the crank-shafts  $J^5$  and  $J^6$  are secured the pinion-wheels  $L^2$  and  $L^3$  in mesh with the gear-wheels  $L^4$  and  $L^5$ , attached to the axles  $B^4$  and  $B^5$ , so that when a rocking motion is given to the rocker-arms  $H^2$  and  $H^3$  then the return connecting-rods  $I^2$  and  $I^3$  and the crank-arms  $J^3$  and  $J^4$  impart a rotary motion to the crank-shafts  $J^5$  and  $J^6$ , which by the gear-wheels  $L^2$  and  $L^3$  and  $L^4$  and  $L^5$  transmit a rotary motion to the axles  $B^4$  and  $B^5$  and the wheels  $B^6$  and  $B^7$  to propel the vehicle. Attached to the pinions  $L^2$  and  $L^3$  are the crank-pins  $L^6$  and  $L^7$ , embraced by a connecting-rod  $L^8$ , which serves to keep the crank-arms  $J^3$  and  $J^4$  at the best angle to each other to start up the car with and to equalize the power to each axle and prevent faster movement in one axle than in the other. It is understood that the sliding boxes  $G^2$  and  $G^3$  in the guideways  $E^4$  and  $E^5$  in this case take the place of the links  $G^1$  and  $G^2$ , previously described and shown in Figs. 1 and 2, it being, however, understood that both devices serve to compensate between the sliding cross-head and the oscillating end of the rocker-arm and to materially shorten the longitudinal space required for the motor and to admit of a shorter wheel-base than if the connection from cross-head to rocker-arm were forward of the cross-head in the usual manner.

By the arrangement described a reciprocating engine for cars is produced directly supported on adjacent axles, (and preferably spring-supported,) having a long stroke of the piston and short stroke of the crank, having a comparatively long single-ended rocker-arm, and a direct rearward connection between the rocker-arm and below the cylinder to a crank-shaft, so as to take up very little room and to transmit the power in the most direct manner. It is evident that by having the piston-stroke as long as possible and the return of the piston at less frequent intervals to the clearance-space and the dead-points considerable motive power which would otherwise be wasted in the clearance of the cylinder and the ports thereof and in turning the dead-points will be saved. This is of great importance if the device is applied to a car that takes on board its measure of power for a run.

By having a long single-ended rocker-arm  $H^1$ ,  $H^2$ , or  $H^3$  less sliding motion and friction to the cross-head connection are the result, and consequently the friction on the cross-head and its guide-bars is reduced to a minimum. By extending the links  $G^1$  and  $G^2$  between the cross-head and the rocker-arm  $H$  and on each side of the unavoidable length space required by the piston-rod stuffing-box and also by con-

necting the rocker-arm to a guideway  $E^1$  we are enabled to use a shorter wheel-base with the motor in less longitudinal space than if the connection from the cross-head to the rocker-arm were forward of the cross-head.

Instead of gearing a double engine to one axle we preferably gear a single engine to each axle when the length between adjacent axles will permit the necessary movement of the rocker-arms in straight line with each other. By this means we are enabled to use the same frame and the same piston-rod cross-head guide-bars for both engines, and by connecting both engines with the side rod  $L^8$  or its equivalent we are enabled to arrange the angle of the respective engine crank-arms to each other to give us the benefit of a double engine (with its respective crank-arms at right angles to each other) to start up the car with and to equalize the power to each axle and to prevent the one axle moving faster than the other.

In the construction shown in Figs. 3 and 4 the springs  $A^3$  for the boxes  $A^1$  are replaced by rubber blocks, and, if desired, such springs may also be placed on the under side of the axle, or, if desired, the springs may be entirely dispensed with.

It will be seen that instead of using meshing gear to transmit the motion from the engine to the axle sprocket wheels and chains may be used; also, that the return connecting-rod  $I$  may directly embrace a crank-arm formed on the axle.

It is understood that the double engine shown in Figs. 3 and 4 may be used on a car-truck having the axles  $B B'$ . (Illustrated in Figs. 1 and 2.) Any of the ordinary valve-gears are applicable to the engine, and hence no special detail is shown in this respect.

It is understood that in the construction set up in Figs. 1 and 2 we may also use two double engines having their piston-rod cross-head guides in common, as illustrated in Figs. 3 and 4.

The frame  $A$ , with its box  $A^1$ , is preferably journaled on the axle end of the link  $K^1$ , as shown in Fig. 1.

We do not limit ourselves to the special form given to the various parts and the peculiar arrangement of the parts, as it is evident that some of the parts may be changed in shape and differently located without, however, deviating from the spirit of our invention.

Having thus fully described our invention, we claim as new and desire to secure by Letters Patent—

1. A motor-car provided with a truck, a motor-frame wholly supported on adjacent axles of the said truck and between the side frames thereof, a motor mounted in the said frame, a rocker-arm pivoted at its lower end on the said frame and adapted to receive at its upper end a rocking motion from the said motor, and a driving connection between the middle portion of the said rocker-arm and the



car-truck axle, the motor, rocker-arm and connection being all arranged between the side frames of the truck, substantially as shown and described.

2. A motor-car provided with a truck, a motor-frame wholly supported on the adjacent axle of said truck and approximately midway between the side frames of the truck, a motor mounted on the said frame, a rocker-arm pivoted at its lower end to the said frame between adjacent axles, the upper end of the rocker-arm being connected with and receiving a rocking motion from the said motor, and an intermediate mechanism between the middle portion of the said rocker-arm and one of the axles of the said truck, for converting the rocking motion of the rocker-arm into a rotary motion at the axle to propel the car, substantially as shown and described.

3. A car-motor provided with a truck, a motor-frame wholly supported on the adjacent axle of said truck and approximately midway between the side frames of the truck, a motor mounted on the said frame, a rocker-arm pivoted at its lower end to the said frame between adjacent axles, the upper end of the rocker-arm being connected with and receiving a rocking motion from the said motor, and an intermediate mechanism between the middle portion of the said rocker-arm and one of the axles of the said truck, for converting the rocking motion of the rocker-arm into a rotary motion at the axle to propel the car, the said intermediate mechanism comprising a crank-shaft, a pitman for connecting the crank-shaft with the rocker-arm, and a driving connection between the crank-shaft and the car-axles, the entire intermediate mechanism and rocker-arm being arranged between the side frames of the truck, substantially as shown and described.

4. A car driving-gear provided with a rocker-arm adapted to receive a rocking motion from the car-motor, and a crank-shaft connected with the said rocker-arm, and arranged with the latter between adjacent car-axles and the sides of the truck and below the motor-cylinder, and a driving connection between the crank-shaft and the car-axles and arranged between the sides of the truck, substantially as shown and described.

5. A car-motor provided with a crank-arm having a driving connection with the car-axles, a rocker-arm adapted to receive its motion from the car-motor and extending between adjacent axles of the car-truck, and a return connection between the said crank-arm and said rocker-arm between the sides of the truck, substantially as shown and described.

6. A motor-car provided with a driven crank-shaft connected with the axles to be driven and arranged between adjacent axles of the car-truck and between the sides of the truck, and link-bearings for the said crank-shaft, substantially as shown and described.

7. A motor-car provided with a driven

crank-shaft connected with the axles to be driven and arranged between adjacent axles of the car-truck, link-bearings for the said crank-shaft, and a rocker-arm having connection with the said crank-shaft, and actuated from the car-motor, the rocker-arm being also located between the car-axles and all between the sides of the truck, substantially as shown and described.

8. A motor-car provided with a rocker-arm, a crank-arm having connection with the car-axles, a return connecting-rod pivotally connecting the said rocker-arm with the said crank-arm, a reciprocating cross-head adapted to be actuated from the motor-cylinder and piston, and a pivotal compensating connection between the said cross-head and the said rocker-arm and all between the side frames of the truck, substantially as shown and described.

9. A car-engine comprising a cylinder containing a reciprocating piston, a cross-head mounted to slide and connected with the piston-rod of the said piston, a rocker-arm fulcrumed at its lower end on a cross-bar, a compensating connection between the upper free end of said rocker-arm and said cross-head, a return connecting-rod pivotally connected with the said rocker-arm between the fulcrum of the latter and its free end, and a crank-arm connected with the said return connecting-rod and with the car-axles to be rotated and all arranged between the side frames of the car-truck, substantially as shown and described.

10. A car-engine comprising a cylinder containing a reciprocating piston, a cross-head mounted on the outer end of the piston-rod for the said piston, a link extending from the said cross-head rearwardly toward the said cylinder, a rocker-arm fulcrumed at its lower end on a cross-bar and pivotally connected at its free end with said link, a return connecting-rod connected with said rocker-arm between the fulcrum of the latter and its free end, and a crank-arm connected with said return connecting-rod and the car-axles to be rotated and all arranged between the side frames of the car-truck, substantially as shown and described.

11. A car-engine comprising a cylinder containing a reciprocating piston, a cross-head mounted to slide and connected with the piston-rod of said piston, a rocker-arm fulcrumed at its lower end on a cross-bar, a compensating connection between the free upper end of the said rocker-arm and the said cross-head, a return connecting-rod pivotally connected with said rocker-arm between the fulcrum of the latter and its free end, a crank-shaft having its crank-arm connected with said connecting-rod, and a driving-gear for connecting said crank-shaft and the car-axle and wheels to be driven and all arranged between the side frames of the car-truck, substantially as shown and described.

12. A car-engine comprising a cylinder con-



5 taining a reciprocating piston, a cross-head  
 mounted to slide and connected with the  
 piston-rod of said piston, a rocker-arm ful-  
 crumed at its lower end on a cross-bar, a  
 10 compensating connection between the free  
 upper end of said rocker-arm and said cross-  
 head, a return connecting-rod pivotally con-  
 nected with said rocker-arm between the ful-  
 15 crum of the latter and its free end, a crank-  
 shaft before the cylinder-line, having its  
 crank-arm connecting with the said return  
 connecting-rod, a bearing for the said crank-  
 shaft and formed by a link suspended from  
 the said cylinder, and a link fulcrumed on  
 20 the adjacent car-axle, and a driving-gear for  
 connecting said crank-shaft with the car-axle  
 and wheel to be driven, substantially as shown  
 and described.

25 13. A motor-car provided with a doubled-  
 up engine having its crank-shaft beneath the  
 cylinder, and the engine-frame supported on  
 adjacent axles and located between the side  
 frames of the truck, substantially as shown  
 and described.

30 14. A motor-car provided with a reciprocating  
 car-engine having its frame supported on  
 adjacent axles and between the side frames  
 of the truck, and a single-ended rocker-arm  
 fulcrumed on a cross-bar of the said engine-  
 frame, substantially as shown and described.

35 15. A motor-car provided with a reciprocating  
 engine having its frame journaled and  
 spring-supported on the axles of the car and  
 between the side frames of the car-truck, and  
 40 a single-ended rocker-arm pivotally and com-  
 pensatingly connected with its free end to  
 the cross-head of said engine, and all located  
 between the side frames of the car-truck,  
 substantially as shown and described.

45 16. The combination, with a car-truck, of a  
 reciprocating car-engine having its frame sup-  
 ported on adjacent axles of the car-truck, a  
 crank journaled in bearings in said frame,  
 a single-ended rocker-arm fulcrumed on a  
 50 cross-bar on said frame between the axles,  
 return-links for pivotally connecting the free  
 end of the rocker-arm to the piston-rod cross-  
 head, and a return connection between the  
 rocker-arm and the said crank-arm below the  
 cylinder-line of the engine, and all arranged  
 between the side frames of the car-truck,  
 substantially as shown and described.

55 17. A car-engine provided with a link-bearing  
 journaled at one end to the axle, and the  
 bearing of the engine-frame, and the other  
 end to a crank-shaft, the said link-bearing  
 being also pivotally supported on a sliding  
 box in a guideway of the engine-frame, sub-  
 stantially as shown and described.

60 18. The combination, with a car-truck, of  
 two reciprocating engines having their frame  
 supported on adjacent axles of the car-truck  
 and between the side frames of the truck and

the piston-rod cross-head operating between  
 the said engines, substantially as shown and  
 65 described.

19. The combination, with a car-truck, of  
 two reciprocating engines having their frame  
 supported on adjacent axles of the car-truck  
 and between the side frames of the truck,  
 70 the piston-rod cross-head guides being com-  
 mon to each other on and between the engine-  
 cylinders, substantially as shown and de-  
 scribed.

20. The combination, with a car-truck, of  
 75 two reciprocating engines having their frame  
 supported on adjacent axles of the car-truck  
 and between the side frames of the truck,  
 the engines being provided with single-ended  
 rocker-arms fulcrumed on cross-bars of the  
 80 said frame and having their free ends piv-  
 otally connected with the piston-rod cross-  
 heads, substantially as shown and described.

21. The combination, with a car-truck, of  
 85 two reciprocating engines having their frame  
 supported on adjacent axles of the car-truck  
 and between the side frames of the truck,  
 the engines being provided with single-ended  
 rocker-arms fulcrumed on cross-bars of the  
 90 said frame and having their free ends piv-  
 otally connected with the piston-rod cross-  
 heads, the said rocker-arms oscillating be-  
 tween the cylinders and adjacent car-axles,  
 substantially as shown and described.

22. The combination with a car-truck, of  
 95 two reciprocating engines having their frame  
 supported on adjacent axles of the car-truck  
 and between the side frames of the truck,  
 the engines being provided with rocker-arms,  
 crank-arms connected with the axles, and re-  
 100 turn connections between the rocker-arms  
 and the crank-arms and all arranged between  
 the side frames of the car-truck, substan-  
 tially as shown and described.

23. The combination with a car-truck, of  
 105 two reciprocating engines having their frame  
 supported on adjacent axles of the car-truck  
 and between the side frames of the truck,  
 the engines being provided with rocker-arms,  
 crank-shafts connected with the axles, return  
 110 connections between the rocker-arms and  
 the crank-shafts, and a connecting-rod piv-  
 otally connecting the said crank-shafts with  
 each other, all being arranged between the  
 115 side frames and adjacent axles of the car-  
 truck, substantially as shown and described.

JOHN MCINTYRE.

EDWIN BALTZLEY.

Witnesses to the signature of John McIntyre:

THEO. G. HOSTER,

EVERARD BOLTON MARSHALL.

Witnesses to the signature of Edwin Baltzley:

S. G. HOPKINS,

WM. C. WELLS.