

March 9, 1926.

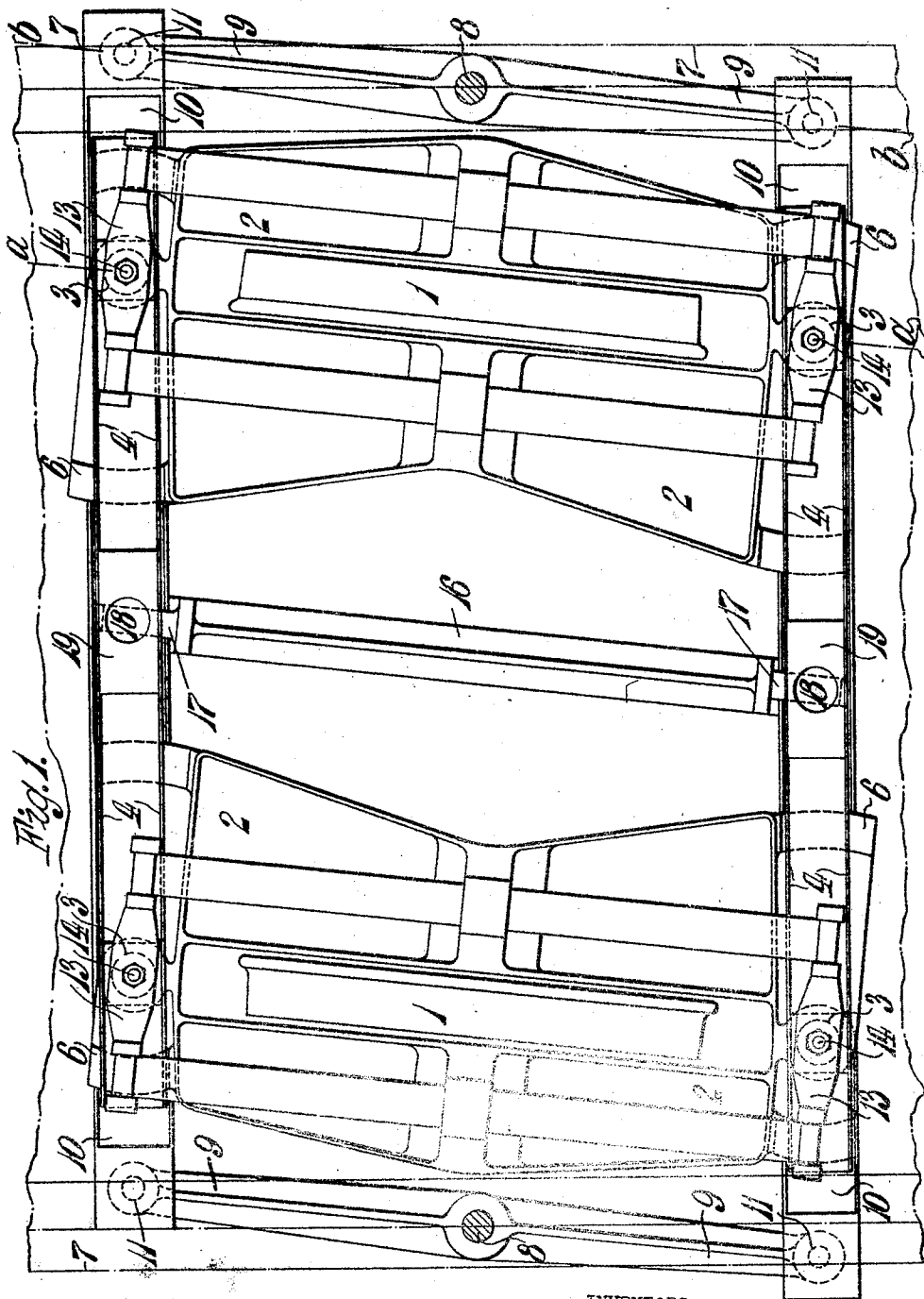
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C. BARBEY ET AL

ROLLING STOCK FOR RAILWAYS AND TRAMWAYS

Filed Sept. 6, 1923

8 Sheets-Sheet 1



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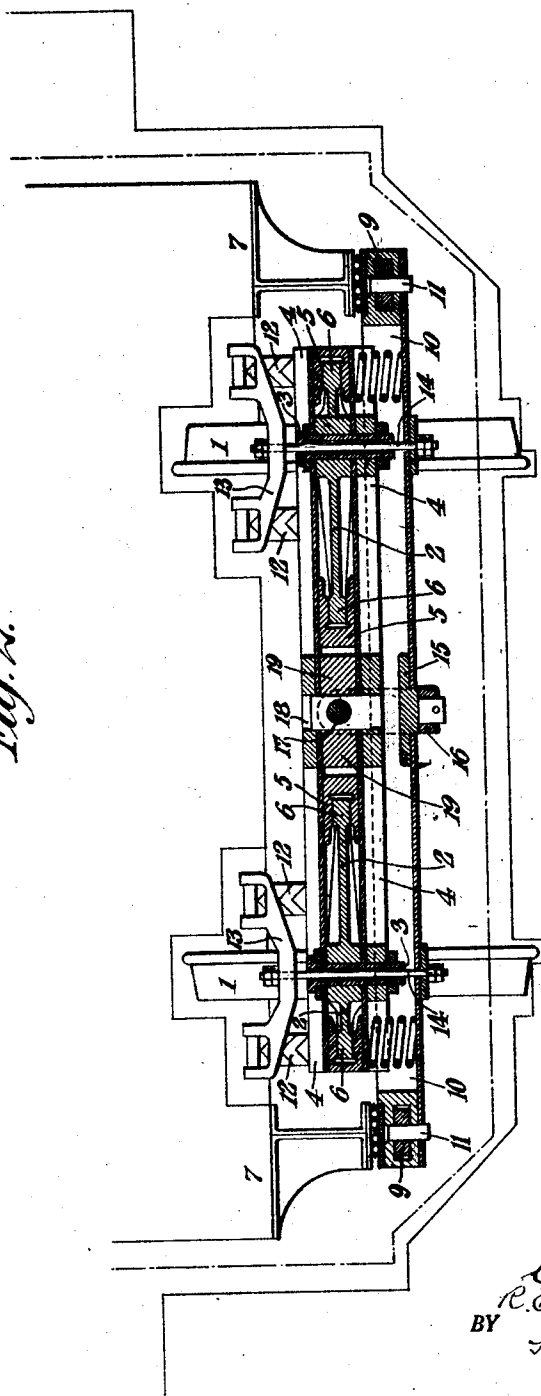
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Filed Sept. 6, 1923

8 Sheets-Sheet 2

Fig. 2.



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8 Sheets-Sheet 3

Fig. 3.

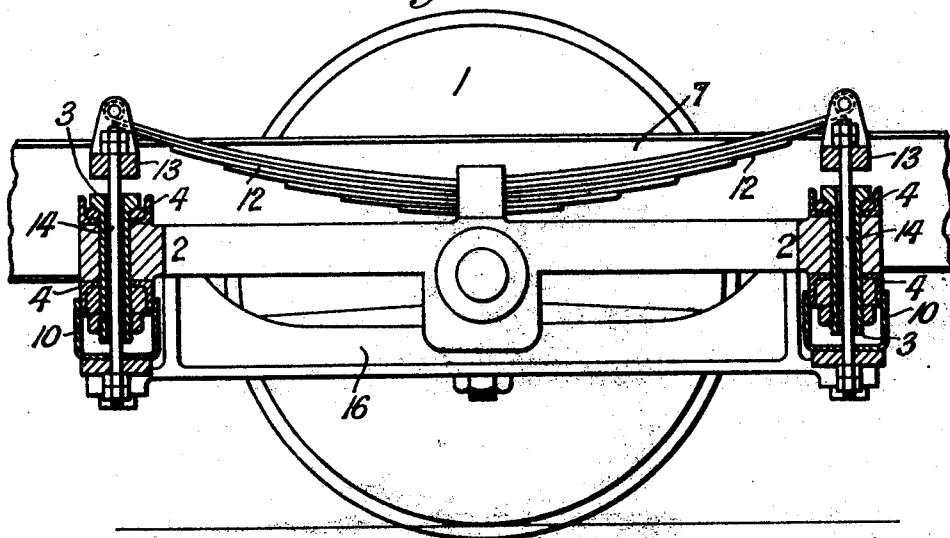
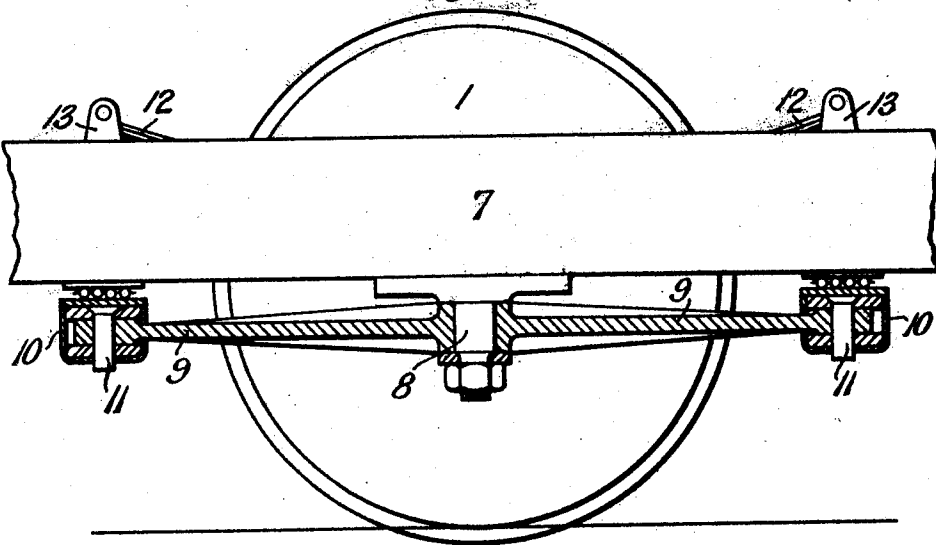


Fig. 4.



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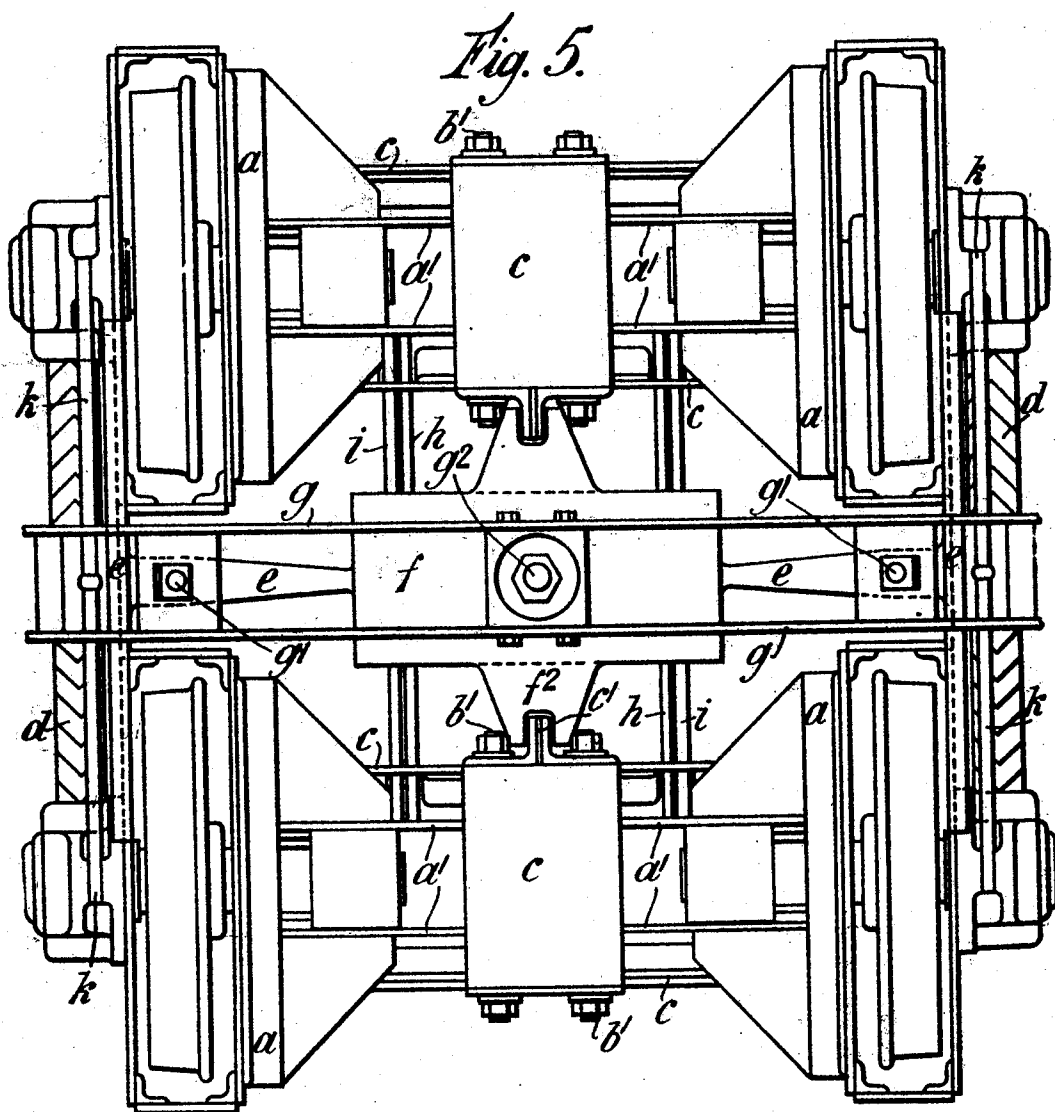
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Filed Sept. 6, 1923

8 Sheets-Sheet 4



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1,576,298

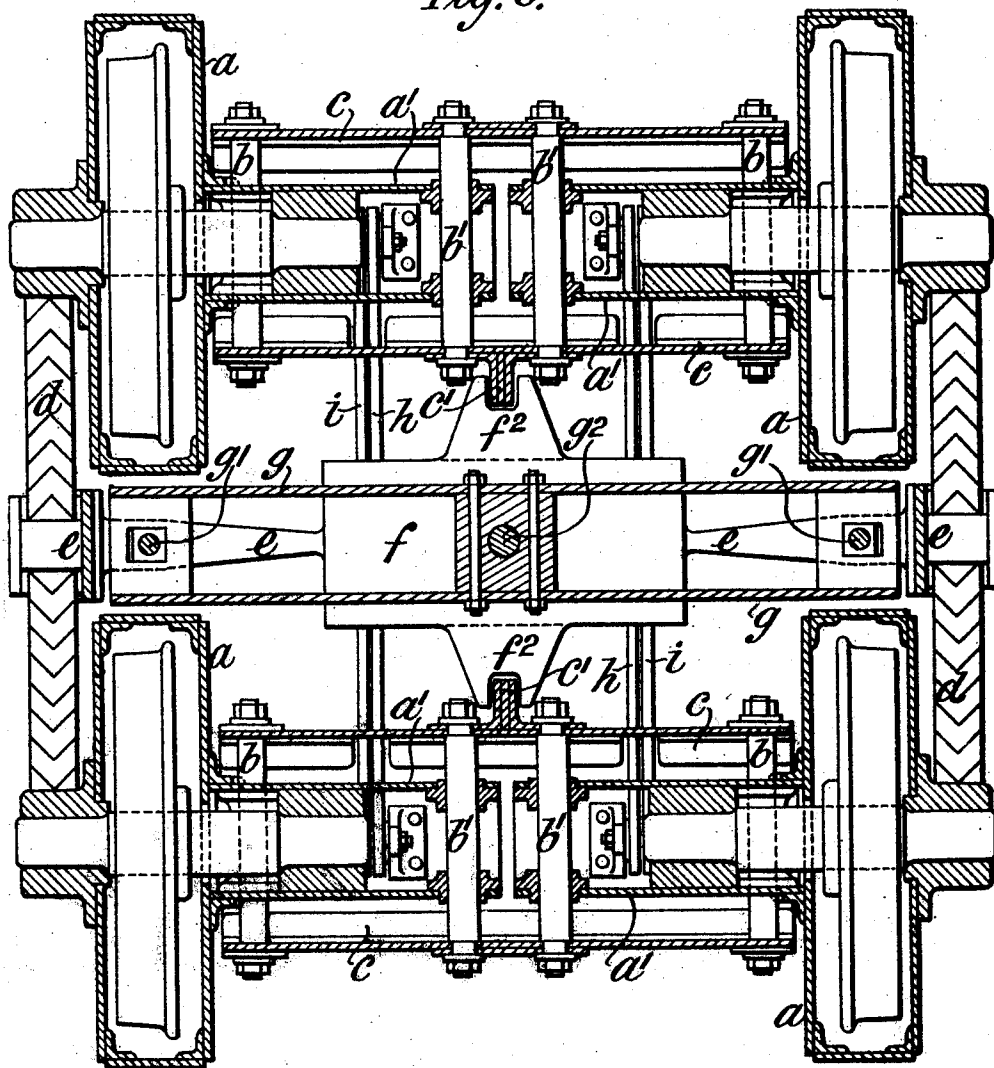
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8 Sheets-Sheet 5

Fig. 6.



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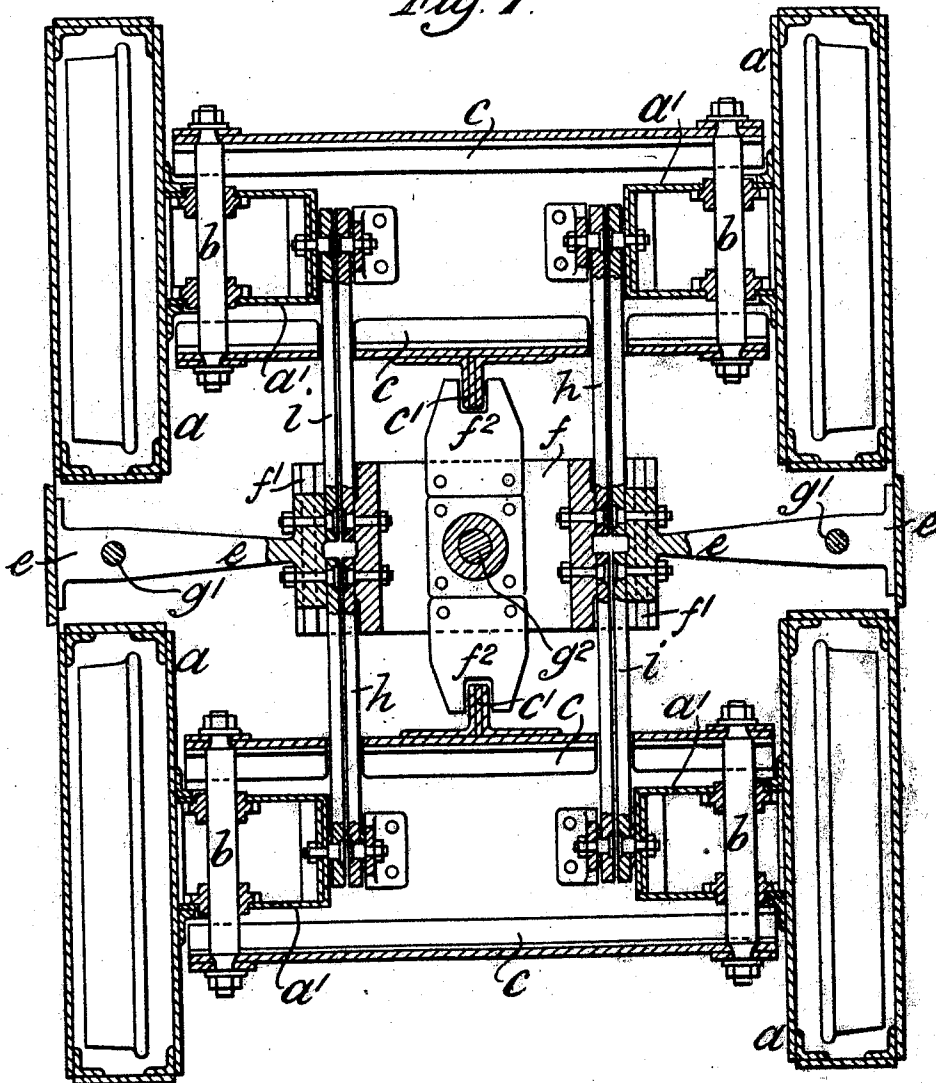
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ROLLING STOCK FOR RAILWAYS AND TRAMWAYS

Filed Sept. 6, 1923

8 Sheets-Sheet 6

Fig. 7.



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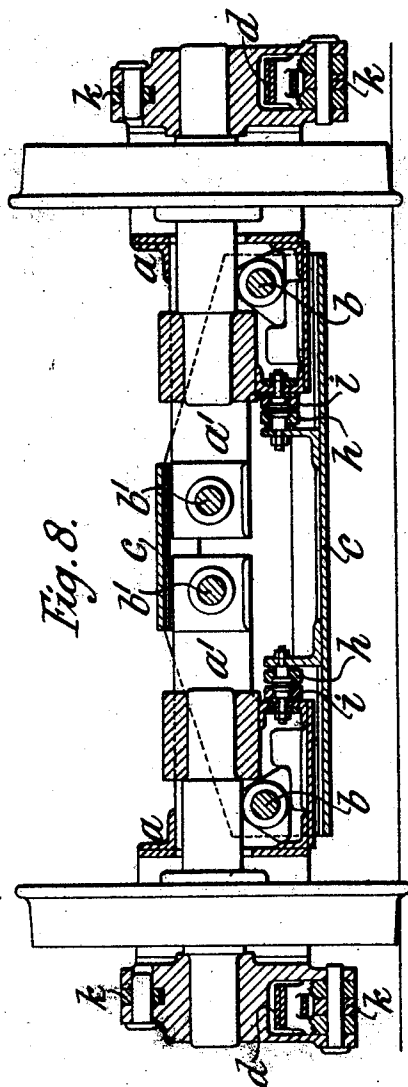
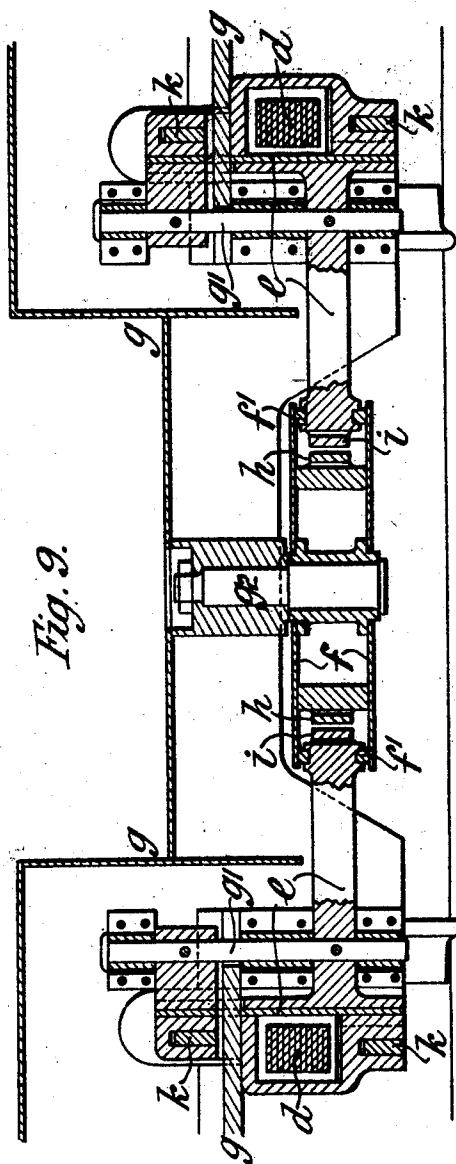
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1,576,298

ROLLING STOCK FOR RAILWAYS AND TRAMWAYS

Filed Sept. 6, 1923

8 Sheets-Sheet 7



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Filed Sept. 6, 1923

8 Sheets-Sheet 8

Fig. 10.

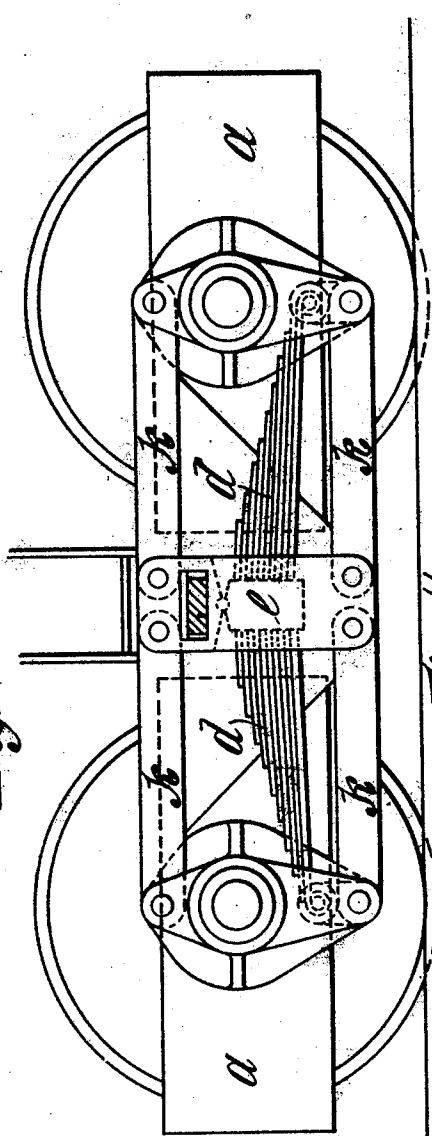
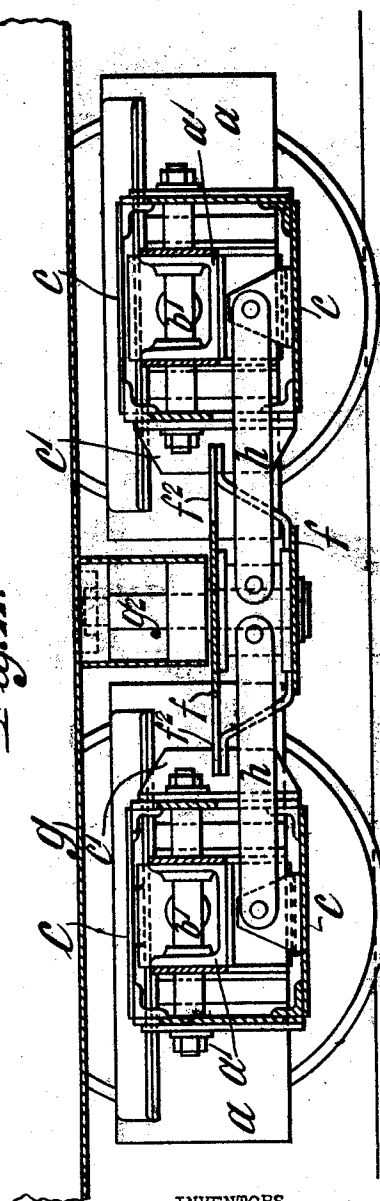


Fig. 11.



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UNITED STATES PATENT OFFICE.

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ROLLING STOCK FOR RAILWAYS AND TRAMWAYS.

Application filed September 6, 1923. Serial No. 661,310.

To all whom it may concern:

Be it known that we, CAMILLE BARBEY, a citizen of the Swiss Confederation, of Valeyres sous Rances, Vaud, Switzerland, and ROBERT EDWARD STOPPORD VENABLES, a subject of the King of Great Britain, of 5 Hartington Road, Chiswick, London, England, have invented new and useful Improvements in Rolling Stock for Railways and Tramways, of which the following is a specification.

Many attempts have been made at various times so to arrange the wheels of vehicles which run on rails that they may adjust 15 themselves to any changes of direction of the track; complete stability for this adjustment for both directions of running has, however, not generally been obtained, but only a relative stability, often at the expense of a certain amount of play between 20 the carriage body and the wheels. With the higher accelerations used today in starting and stopping such play results in unpleasant shocks; also the oscillations resulting from incomplete stability cause considerable wear on the wheels and track, and much waste of power in propulsion.

The present invention has for its object to provide a vehicle in which the wheels 30 are so arranged that neutral or positive stability is ensured.

This object is attained by allowing each wheel or group of wheels to turn about a vertical axis so placed that all the reactions 35 between the rail and the wheel under all the different conditions of running, shall have practically no tendency to cause the wheel to take up a false position, or shall positively tend to make it take up a position 40 tangential to the curve.

True stability of this nature does not appear possible so long as a pair of wheels is rigidly mounted on a single axle, for even if this axle is placed radially on a curve, any 45 effort, such as those due to centrifugal force, which causes increased resistance to the movement of one wheel of the pair will tend to cause the axle to take up a false position. We therefore dispense with such rigid axles and provide the necessary cross connections 50 between each pair or set of wheels by other mechanical means.

According to this invention as applied to a single pair of wheels, we so mount the 55 wheels that each can turn about a vertical

axis passing through or very near to the point of contact between the wheel and the rail. As it is not possible to introduce at this point a sufficiently strong and rigid mechanical pivot, we make use of a virtual 60 pivot, which is obtained by mounting the bearings of each wheel in a frame forming one side of an articulated parallelogram, the ends or front and rear side of which are hinged to the front and rear ends of the 65 wheel frames respectively, by hinges made sufficiently rigid to maintain the wheels in their correct relative positions, in spite of all shocks and efforts to which they may be subjected under running conditions. 70

The body is virtually pivoted to the wheel parallelogram over the virtual pivots of the wheels, and may be actually pivoted to it at any two points in the vertical plane containing these. If the body is not spring 75 borne these actual pivots may be in the two side members of the wheel parallelogram or in any additional members parallel to them.

If the body is spring borne there may be 80 another parallelogram whose side members are thus pivoted to the body, and which is connected to the members of the wheel parallelogram by pivots which while allowing of vertical play between the parallelograms, 85 transmit the transverse and longitudinal forces from the wheels to the body.

It is not necessary that both these parallelograms should be complete, for one or more sides may be common to both, or may 90 be constituted by the springs.

The second parallelogram is preferably suspended from springs, which rest directly on the axle boxes, by forked hangers passing through the articulations of the first 95 parallelogram with sufficient play to avoid contact. This permits the wheel frames, which are not spring suspended, to be of light construction, as they have only to bear the stresses necessary to maintain the wheels 100 in position.

It will be seen that this construction enables us to modify the points around which the wheels pivot, in order to suit special conditions which may arise. For example, carriages which are always to move in the same 105 direction might have their pivots slightly in advance of the points of contact of the wheels.

A point to be noted in connection with 110

this arrangement is that when the wheels have turned through an angle θ in order to adapt themselves to a curve, their distance apart when viewed along the tangent to the curve is not the same as when viewed on the straight track, being less in the ratio of $\cos \theta$. This slight loosening of the gauge is negligible under all ordinary conditions, and would probably be permissible up to such extreme angles as $\theta=5^\circ$ or 6° but where it is desired to avoid this loosening we modify the construction somewhat.

This modification consists in providing each of the wheel frames with one or more rigid extensions whose ends are adapted to slide along horizontal guides formed on the other wheel frame and parallel to the wheel face. This arrangement maintains constant the distance between the wheels, as viewed along a tangent to the track, while not modifying the other movements in any way. Of course the pivots on the carriage will be spread to correspond in the ratio secant θ , and this requires that one or both of these pivots be allowed a small amount of play transversely to the length of the carriage.

It will be noticed that a single pair of wheels mounted in this manner possesses stability, but that the directive forces are not large, as the length of rail engaged with the flange of the wheel is but small. Greater directive effort can be obtained by two general methods, the first consists in coupling the frames of the pair of wheels to those of another pair on the same carriage, or to the carriage couplings, according to any of the known methods, such as those which are used in connection with radial axles. The second method consists in increasing the effective length and leverage of that part of the rail engaged by the flanges; this may be done by fitting two or even three wheels in line in the same wheel frame.

With regard to the first method, it may be pointed out that the action of the linkwork may in certain cases be rendered more efficient by placing the wheel pivots a small distance away from the points of contact of the wheels, in such a way that the small instabilities thus set up shall neutralize each other through the linkwork.

As to the second method, it will be noticed that the principle of the use of two wheels has led to the construction of the ordinary bogie truck, but it is necessary to point out that in this case the principle is applied to a system which is already stable in itself; so that whereas a bogie must be made of a certain length in order to reduce its inherent instability below the point at which it would cause jamming, in this case increase in length will only result in an unnecessary increase of directive power.

In the case of wheel frames with two wheels each it becomes possible to use a real

pivot instead of a virtual one for the frames, but in all other respects what was stated above as to the single wheel frame holds good, notably as regards the alternative use of hinged bars or of rigid arms and slides for the connection between the two wheel frames of a set. It may be mentioned that the rigid arms of the latter alternative offer convenient points for the attachment of motors in cases where such are fitted.

The invention is illustrated by the accompanying drawings, Figure 1 of which is a plan of a single pair of wheels, Figure 2 is a transverse section, and Figure 3 is a section on the line $a-a$ and Figure 4 a section on the line $b-b$ of Figure 1. Figures 5 to 11 illustrate a modified form of our invention, Figure 5 being a plan view, Figures 6 and 7 horizontal sections in different planes, Figure 8 a transverse section through the centres of one pair of wheels, Figure 9 a transverse central section, Figure 10 a side elevation, and Figure 11 a longitudinal section.

Referring to Figures 1 to 4, 1, 1 are the wheels each of which is mounted in a frame 2. Each end of a frame embraces a tubular bolt 3 which acts as a hinge pin and is carried by a transverse member formed by channels 4, 4. These members carry guides 5, 5, in which the sides 6 of the ends of the frames 2 can move. The two frames 2 and the two transverse members 4 thus form an articulated parallelogram.

The vehicle body 7 is pivoted by pins 8 to the middle points of the side members 9 of another parallelogram, the end members of which are formed of channels 10, the parts 9 and 10 being connected together by hinge pins 11. 12 are the springs which rest upon the frames 2 above the bearings of the wheels and carry forked hangers 13 from which are suspended rods 14 which pass down through the tubular bolts 3 and on which are supported the channels 10. The parallelogram formed of the frames 2 and the members 4 is connected to the parallelogram formed of the side members 9 and the channels 10 as follows:—

To the middle of each of the channels 10 is secured a block 15 and these two blocks are pivoted to the ends of a longitudinal bar 16 on each end of which is a stud 17 entering a block 18 which can move up and down between filling pieces 19 in and between the channels 4.

It will be seen that each wheel can turn about a virtual pivot which passes through the point of contact between the wheel and the rail and lies in the intersection of the vertical plane through the axes of the pivots 8 and the vertical plane through the axes of the two pivots 3 of the wheel.

Referring particularly to Figs. 5 to 11, 130

each wheel is journalled in a frame a which has a transverse projection a' which can slide on longitudinal bolts $b\ b'$, the four bolts $b\ b', b', b'$ of the two wheels which are opposite to one another being carried by an end member c of the parallelogram. The two frames $a\ a$ on each side are connected to one another by springs d which at their middle parts are connected to a member e .

The carriage g rests on the centres of the springs d through the members $e\ e$ which are hinged to the carriage by the pivots g' which have a small play in the carriage in a direction at right angles to the center line thereof. The extremities of the springs d are linked directly to the outer axle boxes of the four wheels 1 through which the weight is transmitted to the wheels and rails. A member e , a spring d , and the wheel bearing thus constitute an incomplete longitudinal wheel frame carrying two wheels and pivoted over the rail at g' , but as this frame is flexible in a vertical plane, all parts required to complete it must allow of the same flexibility, while still providing the necessary rigidity in a horizontal plane.

The longitudinal wheel frame is therefore completed by the two frames $a\ a$ which pass round the front and rear wheels so as to unite the outer and inner bearings of the wheels, and each of these frames is then joined to the member e , by three equal parallel links $h\ h\ i$. Of these links the pair $h\ h$ prevent any tendency of the frame a , to rotate round the wheel center, even should the brakes, be attached to this frame, while the links $h\ h$ on the one hand and i on the other, maintain the wheel axle always parallel to the member e , and at the right distance from it, while permitting vertical play between a and e .

The transverse end members $c\ c$ maintain the wheels parallel and at the right distance apart, and each consists of a frame which is connected to each one of a pair (front or rear) of the wheel frames a by means of the two bolts $b\ b'$ which can slide in bearings provided in the projection a' of the frame a , in a direction parallel to the rail.

The truck so far constituted possesses its essential organs, and could be made to work in this form, but it will be seen that the transverse members $c\ c$ are free, except on the sharpest curves, to take up unsymmetrical positions, and also that the centrifugal force of the carriage is transmitted to the rail through the pivots g' which have side play, and through the links $h\ h\ i$ by a bending stress. This would cause bumps when the carriage enters a curve, and would require a special construction of the links.

These disadvantages are avoided by fitting a third pivot g^2 in the carriage, around which turns, without play, the block f . The transverse members $c\ c$ are linked to this

block f by the bars $h\ h$ which are equal in length and parallel to the links $h\ i$, so that f has the same vertical freedom relative to $c\ c$ as have the members $c\ c$ to the wheel frame $a\ a\ a\ a$. For the proper distribution of the centrifugal forces, the transverse members c are provided with vertical guides $c' c'$ which engage with forks f^2 on the block f , so that all transverse efforts on the carriage are taken on the central pivot g^2 , and from there, through f and the guides $f^2 c'$ to $c\ c$. Thence they pass through the bolts $b\ b'$ to the frames $a\ a$ and by the wheels and flanges to the rail. Any tendency of c to swing round the guide $f^2 c'$ is prevented by the links $h\ h$, which are set well apart for this reason. Any tendency of c to rotate round the pins of these links is prevented by the bolts $b\ b'$, for, as stated above, the frames a are kept from rotating in this direction by the links $h\ h$.

As shown in Fig. 7, the members c are provided with extensions which, besides forming points of attachment for the links $i\ i$, are also adapted to slide on guides f' formed in the block f , the relative movement here being exactly the same as that between a and c along the bolts b . The effect of thus guiding c in f is to maintain the pivots g' always in their correct position relatively to the wheels, and also to relieve these pivots from any bending stress due to the eccentric position of the springs d . In this way the lateral longitudinal members of the parallelogram are freed from all transverse efforts, and only transmit to their pivots g' , the longitudinal efforts due to track resistance, brakes or motors, while transverse efforts due to centrifugal force or wind pressure are transmitted to the pivot g^2 through the central member which is built up of $c\ f\ c$ and their connecting links $h\ h$.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. In a four wheel truck for use on rails, the combination of side members to which the carriage body is connected by vertical pivots, a frame for each wheel, links connecting to said side members the frames of the two wheels on each side of the truck, transverse members at each end of the truck, said members connected to the wheel frames by bolts slidable in said frames.

2. In a four wheel truck for use on rails, the combination of side members to which the car body is connected by vertical pivots, a frame for each wheel which unites its outer and inner bearings, an extension on said frames, links connecting to said side members the frames of the two wheels on each side of the truck, two of said links being attached to the outside of each frame at points above and below the axle bearing,

and a third link connecting the side member and the frame extension, transverse members at each end of the truck, said members connected to the wheel frames by bolts slidable in the extensions to said frames, the wheels on each side of the truck being mounted independently of those on the other.

3. In a four wheel truck for use on rails, the combination of side members to which the car is connected by vertical pivots, said pivots having a small play in the carriage at right angles to the centre line thereof, and being located between the wheels on each side of the truck and near the rail on which the wheels run, a frame for each wheel which unites its outer and inner bearings, an extension on said frames, outer and inner links connecting to said side members the frames of the two wheels on each side of the truck, transverse members at each end of the truck, said members connected to the wheel frames by bolts slidable in the extensions to said frames, the wheels on each side of the truck being mounted independently of those on the other.

4. In a four wheel truck for use on rails, the combination of side members to which the car body is connected by vertical pivots, said pivotal connections located between the wheels on each side and parallel to each other, another pivotal connection to the car body centralized between said vertical pivots, a block mounted on said central pivot around which it turns, a frame for each wheel which unites its outer end inner bearings, extensions on said frames, outer and inner links connecting to said side members the frames of the two wheels on each side of the truck, transverse members located at each end of the truck and carrying bolts slidable in the frame extensions, connections between the two transverse members and the centralized block, the wheels on each side of the truck being mounted independently of those on the other, substantially as and for the purpose set forth.

5. The structure as specified in claim 4, in which the connections between the two transverse members and the centralized block consist of links, and of jaws in the centralized block which embrace lugs projecting from the transverse members.

6. The structure as specified in claim 4, in which the side members are provided with extensions, and the central block with guides on which said extensions slide.

7. The structure as specified in claim 4 in which the two wheel frames on each side are connected to one another by springs which, at their middle parts, are connected to the side members to which the car body is pivoted.

8. In a four wheel truck for use on rails, the combination of a frame carrying each wheel and having a transverse extension, a

transverse member at each end carrying guides on which slide the extensions of the wheel frames, and connections between the two transverse members.

9. The structure as specified in claim 8, having a central member linked at each side to each end member.

10. In a four wheel truck for use on rails, the combination of a frame carrying each wheel and having a transverse extension, a transverse member at each end carrying guides on which slide the extensions of the wheel frames, a central member linked at each side to each transverse member, and side members between the two wheels on each side, said side members being adapted to slide in the central member.

11. A truck according to claim 10, in which each transverse member is linked to the extensions of the wheel frames in front of and behind it.

12. A truck according to claim 10 in which each wheel frame is linked to a central member by upper and lower longitudinal links.

13. In a vehicle truck for use on rails, the combination of a frame in which a wheel is mounted, spaced channel members, tubular bolts carried by said channel members, each end of the frame embracing one of said bolts, side and end members in hinged relation, rods carried by the frame and extending through said tubular bolts to support the said side members, and means for pivoting the vehicle body to said side members.

14. In a vehicle truck for use on rails, the combination of a frame in which the wheel is mounted, spaced channel members, tubular bolts carried by said channel members, each end of the frame embracing one of said bolts, said frame and channel members forming an articulated parallelogram, side and end members in hinged relation forming a second parallelogram, rods carried by the frame and extending through said tubular bolts to support the last named parallelogram, and means for pivoting the vehicle body to said last named parallelogram.

15. In a vehicle truck for use on rails, the combination of a frame in which a wheel is mounted, spaced channel members, tubular bolts carried by said channel members, each end of the frame embracing one of said bolts, said frame and channel members forming an articulated parallelogram, guides carried by said channel members in which the sides of the frame move, side and end members in hinged relation forming a second parallelogram, rods carried by the frame and extending through said tubular bolts to support the last named parallelogram, and means for pivoting the vehicle body to said last named parallelogram.

16. In a vehicle truck for use on rails, the combination of frames in each of which a wheel is mounted, spaced channel members,

tubular bolts carried by said channel members, each end of a frame embracing one of said bolts, said frames and channel members forming an articulated parallelogram, guides carried by said channel members in which the sides of frames move, side and end members in hinged relation forming a second parallelogram, springs resting upon the frame above the bearings of each wheel therein, hangers carried by said springs, rods connected to said hangers and extending through said tubular bolts to support the last named parallelogram, and means for pivoting the vehicle body to said last named parallelogram.

17. The structure set forth in claim 16. in which the parallelograms are connected by means movable up and down in the first named channel members.

18. In a vehicle truck for use on rails, the combination of two articulated parallelograms, one formed of frames carrying the wheels and of end members in hinged relation, and the other of side members and of end members, in hinged relation, the side members carrying the vehicle body, and means for connecting the end members of the two parallelograms, substantially as described.

19. The combination set forth in claim 18, in which the means for connecting the end members of the two parallelograms comprise springs which rest on the wheel frames, rods suspended from said springs, and tubular bolts carried by the first parallelogram, through which said rods extend and on which are suspended the end members of the second parallelogram.

20. In a vehicle truck for use on rails, the combination of two articulated parallelograms, one formed of frames carrying the wheels and of end members in hinged relation, and the other of side members and of end members, in hinged relation, the side members carrying the vehicle body, and means for connecting the end members of the two parallelograms comprising springs which rest on the wheel frames from which are suspended the end members of the second parallelogram, said end members being so suspended at the articulations of the first parallelogram.

In testimony that we claim the foregoing as our invention, we have signed our names this 23rd day of August 1923.

CAMILLE BARBEY.

ROBERT EDWARD STOPFORD VENABLES.