(No Model.)

5 Sheets—Sheet 1.

M. N. FORNEY.

LOCOMOTIVE ENGINE.

No. 485,344. Patented Nov. 1, 1892.

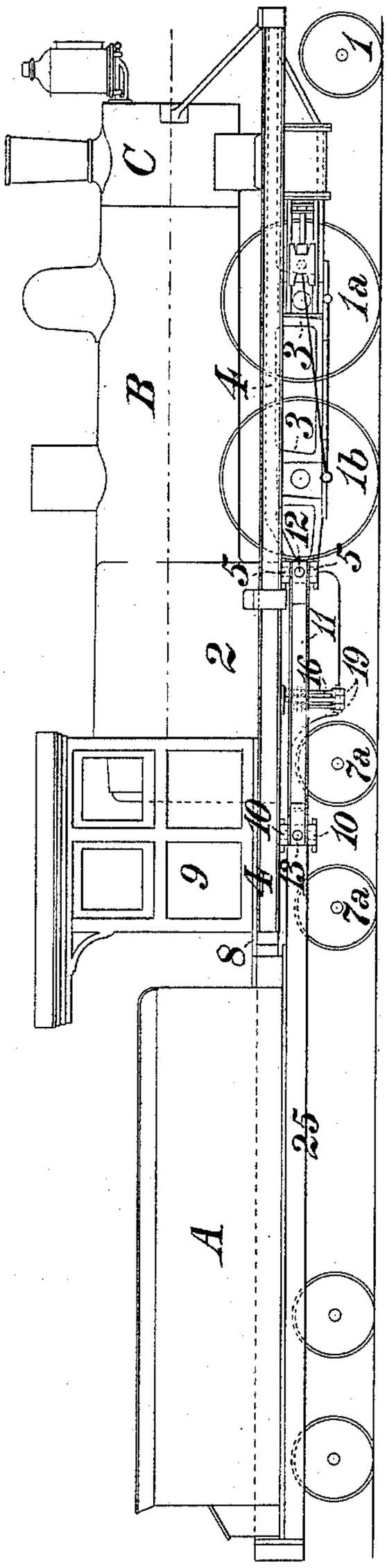

FIG. 1.

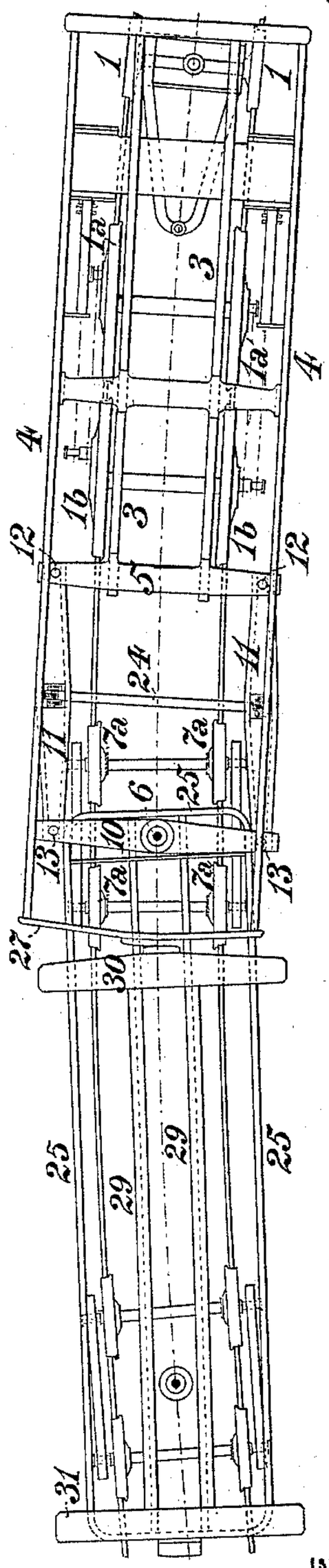

FIG. 2.

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(No Model.)

5 Sheets—Sheet 2.

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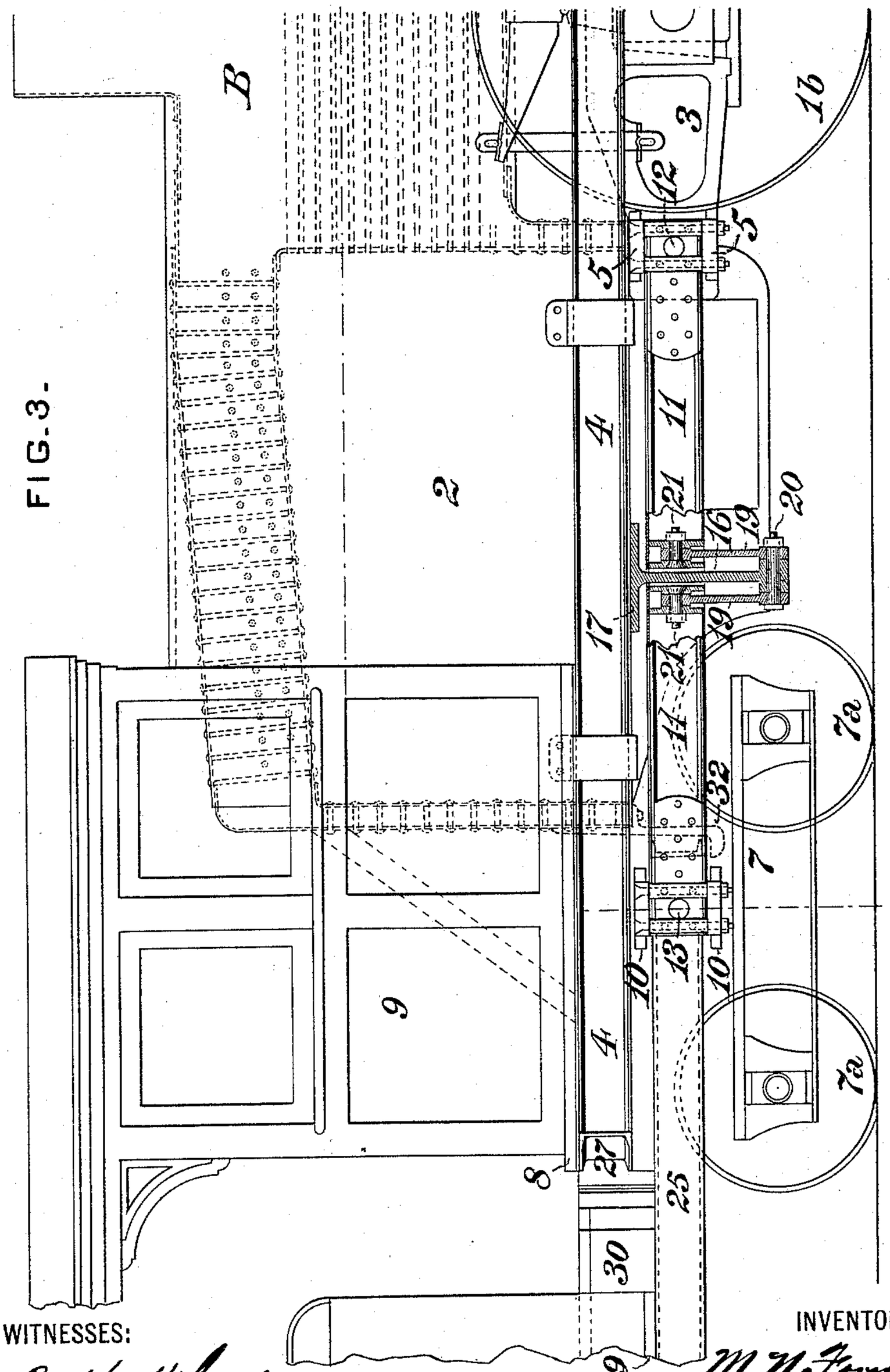
LOCOMOTIVE ENGINE.

No. 485,344. Patented Nov. 1, 1892.

FIG. 3.



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(No Model.) 5 Sheets—Sheet 3.

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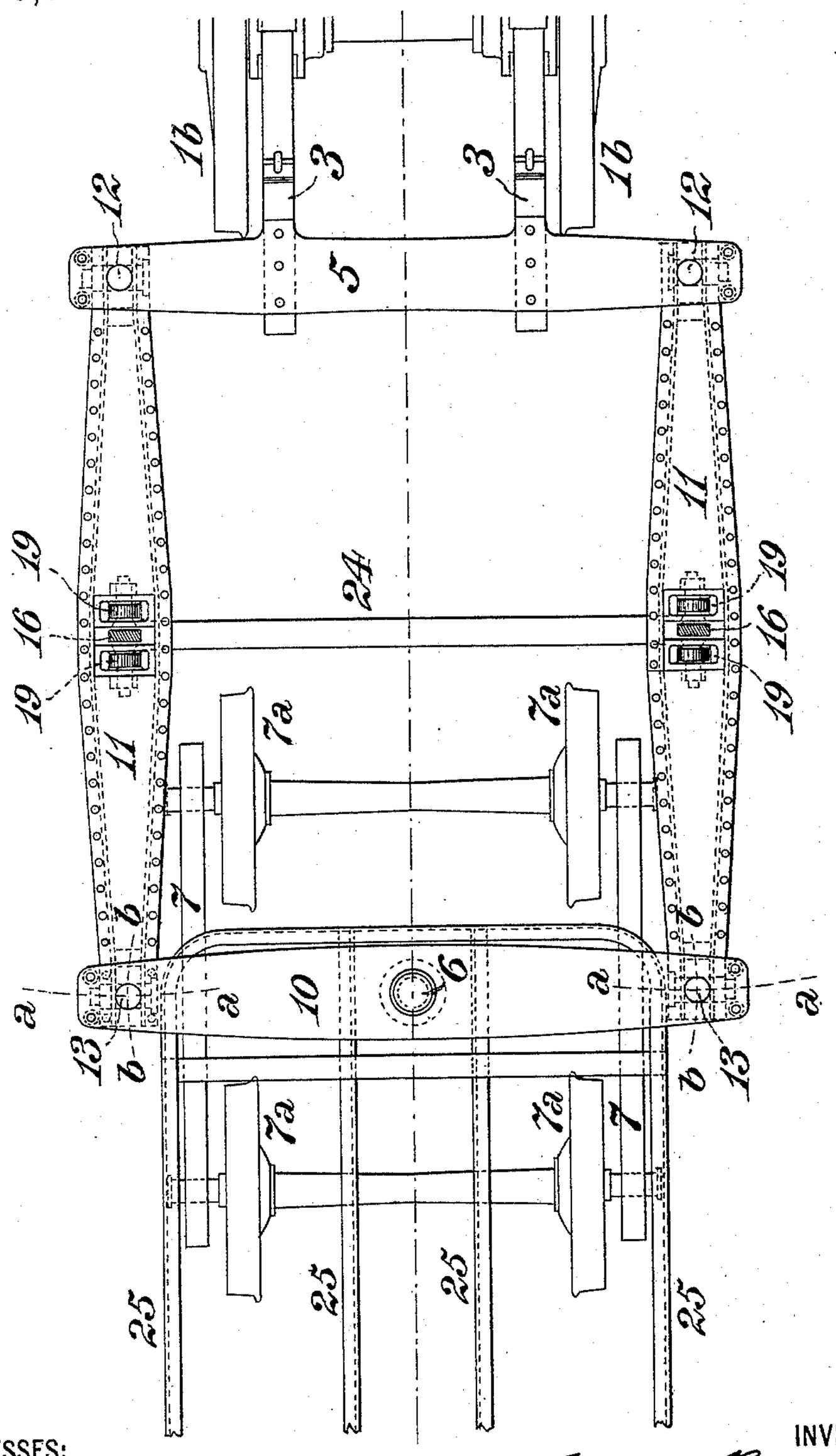
No. 485,344. Patented Nov. 1, 1892.

FIG. 4.



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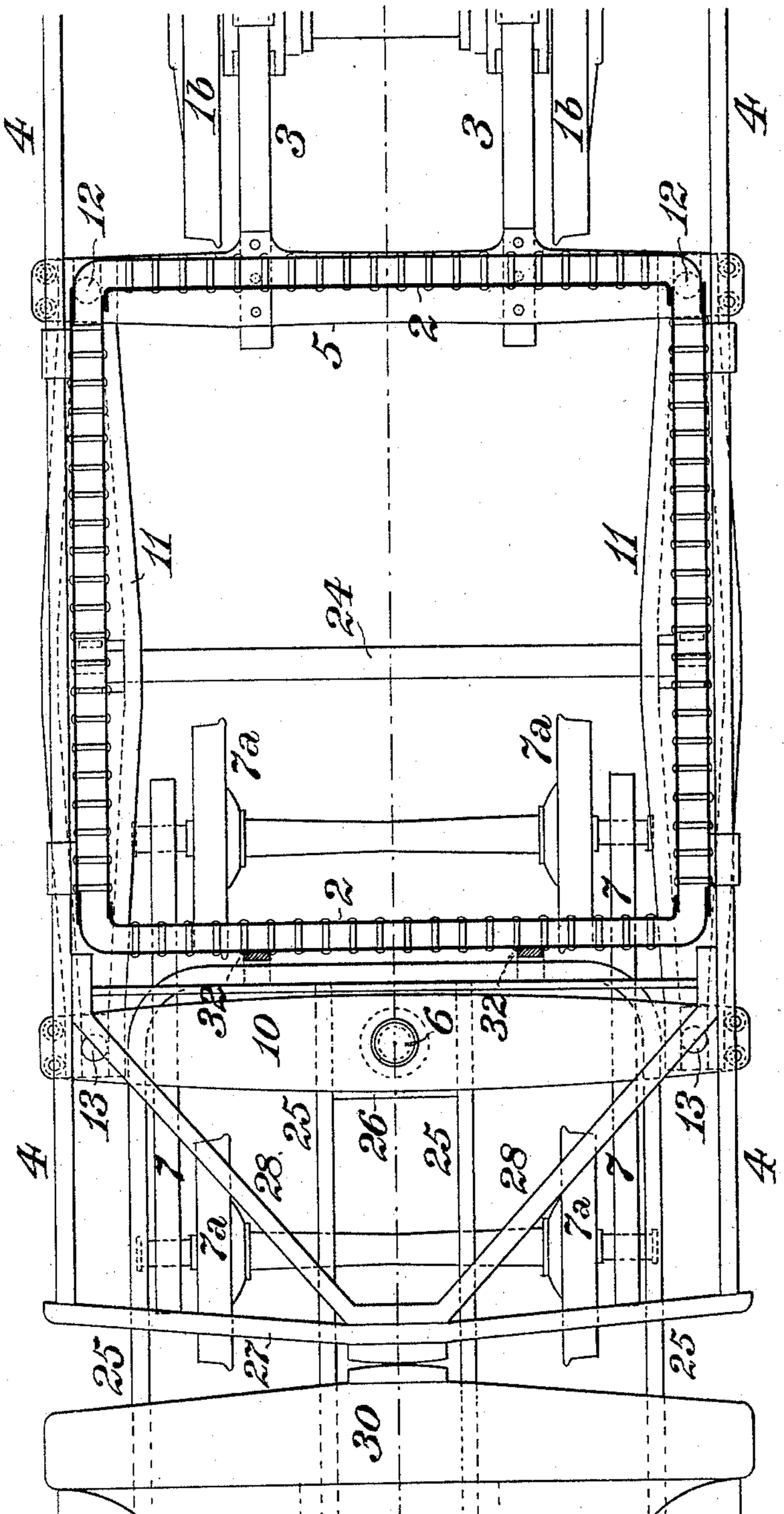
No. 485,344. Patented Nov. 1, 1892.

FIG. 5.



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5 Sheets—Sheet 5.

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FIG. 7.

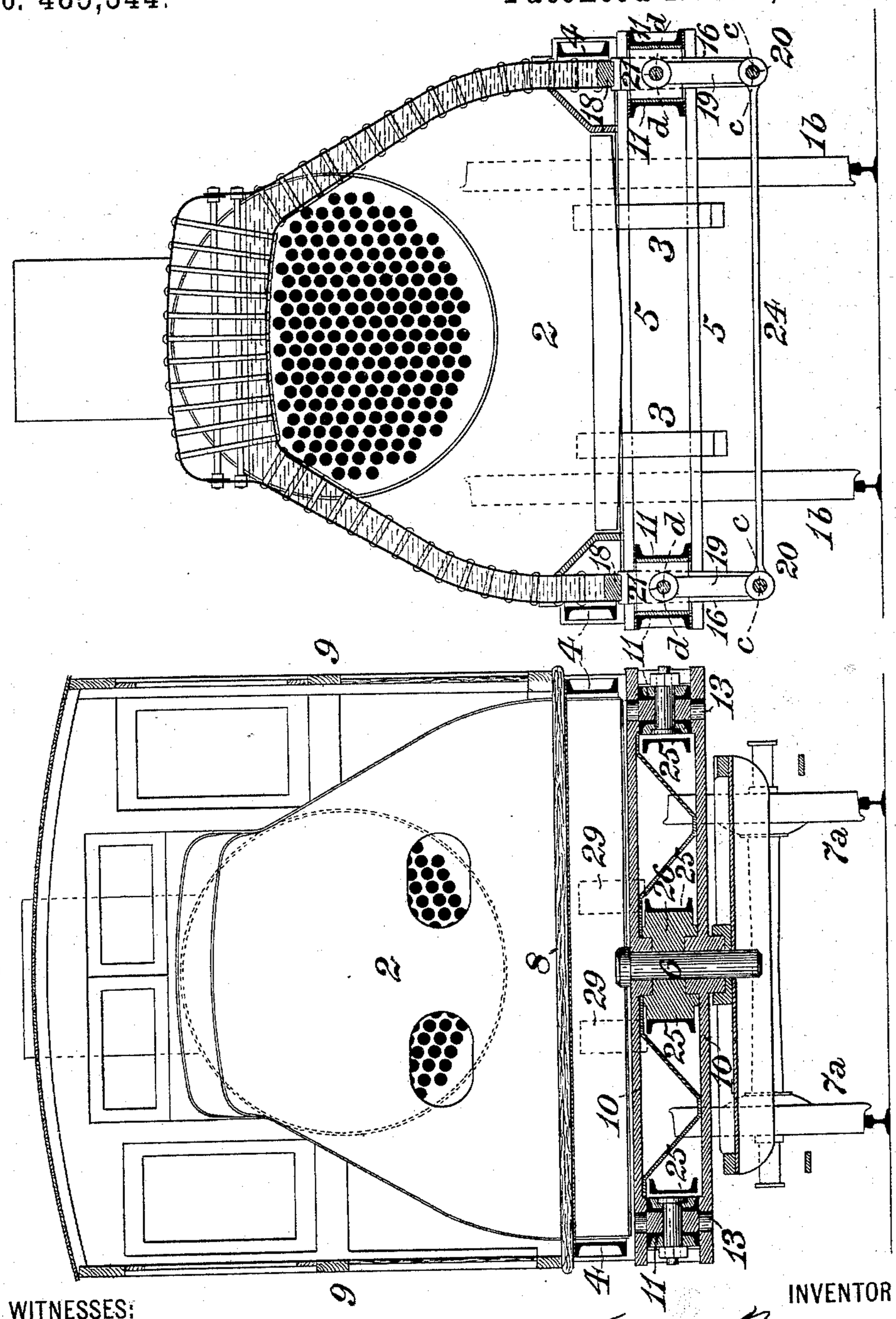

FIG. 6.

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UNITED STATES PATENT OFFICE.

MATTHIAS N. FORNEY, OF NEW YORK, N. Y.

LOCOMOTIVE-ENGINE.

SPECIFICATION forming part of Letters Patent No. 485,344, dated November 1, 1892.

Application filed July 19, 1892. Serial No. 440,480. (No model.)

To all whom it may concern:

Be it known that I, MATTHIAS N. FORNEY, of the city, county, and State of New York, have invented a certain new and useful Improvement in Locomotive Engines, of which improvement the following is a specification.

My present invention relates to improved means for coupling locomotive engines and tenders and other railroad-vehicles together, and is to a certain extent an improvement upon a construction which, among other features, is set forth in Letters Patent of the United States Nos. 266,685 and 408,004, granted and issued to me under dates of October 31, 1882, and July 30, 1889, respectively. I do not, however, limit my invention to the improvement of the plans of construction described in said Letters Patent, as it is applicable without substantial variation to locomotive engines and tenders of other types and to other railroad-vehicles, such as cars.

The principal object of this invention is to provide a system of articulated framing for coupling locomotive engines and tenders together which shall have the capacity of horizontal flexibility to allow the running-gear to adapt itself to the curvature and inequalities of the track and which will admit of the use of fire-boxes of greater width than the space between the wheels and of greater depth than is attainable in such fire-boxes with the ordinary constructions.

A further advantage attained by my present invention is the provision of two systems of framing in the engine and tender of such construction and in such relation to each other as to constitute a substantial safeguard to the men on the engine in cases of collision or derailment.

To these ends my invention, generally stated, consists in a locomotive-engine having frames coupled to a tender by a pair of longitudinal coupling-beams, which are pivotally connected to the engine-frames on each side of a longitudinal center line thereof, and to a transverse bolster-beam, which is centrally and pivotally connected to the tender. Equivalently the bolster may be transposed in position—that is, it may be centrally pivoted to the engine-frame instead of to the tender—and the coupling-beams may be connected to the tender-frame, or two bolsters—one connected to the engine and the other to the tender-frame—may be employed, without affecting the principle or operative features of the invention. The coupling-beams may be made to support part of the weight of the engine and transmit it to the wheels of the tender, or vice versa.

The improvement claimed is hereinafter fully set forth.

The location of the main frames and axle-bearings of a locomotive on the inside of the driving-wheels attains well-recognized advantages; but if they are so placed and a fire-box which is wider than the distance between the wheels is located between the rear driving-axle and the tender and the frames be extended so far backward that the tender can be connected to them then the fire-box must be placed above them which results in the center of gravity of the boiler being very high or the fire-box being very shallow, or both, and even then the frames are in the way of the ash-pan. If the rear extension of the frame is carried down so low as not to interfere materially with a wide fire-box, their strength is very much reduced, especially to resist concussions. For these reasons the general method of construction which I have adopted in my prior-recited patents and in my present invention is to locate the main engine-frames in the usual position inside of the wheels and to attach to them a transverse beam, which extends laterally outside of and beyond them. In my present invention longitudinal coupling-beams are pivotally connected to the ends of this transverse beam, and these are placed sufficiently far apart to afford room enough between them for the fire-box or ash-pan. If a narrow fire-box is used, the coupling-beams may be connected directly to the inside frames. The back ends of the coupling-beams, as already explained, are pivotally connected to the ends of a transverse bolster-beam, which is centrally and pivotally connected to the tender-frame. This affords a multiple-jointed or "articulated" connection between the engine and tender, which is capable of adjusting itself to any curvature of the track and will permit the wheels to conform thereto. If desired, vertical flexibility may also be given to the framing, so as to permit the wheels of the engine and

tender to adjust themselves to vertical inequalities of the track.

In the accompanying drawings, Figure 1 is a diagrammatic side view of a locomotive engine and tender, illustrating an application of my invention. Fig. 2 is a similar plan view showing the running-gear, frames, wheels, &c., of the engine and tender in the position occupied on a curve; Fig. 3, a side view, on an enlarged scale, showing the parts of the engine and tender which are coupled together; Fig. 4, a plan view, on a similar scale, showing the rear ends of the main frames, part of the rear driving-wheels and axle, the transverse and longitudinal coupling-beams, the front tender-truck, and part of the tender-frame; Fig. 5, a similar plan of the same parts as are represented in Fig. 4, but showing, also, a sectional plan of the fire-box and a plan view of the supplemental engine-frames and the front end of the tank; Fig. 6, a transverse sectional view through the center of the front tender-truck, looking toward the engine; and Fig. 7, a transverse sectional view through the fire-box, looking toward the front of the engine.

The locomotive-engine herein illustrated accords with that set forth in Letters Patent Nos. 266,685 and 408,004 aforesaid in the general features of having its forward portion supported upon a leading-truck 1, its middle portion upon driving-wheels 1^a 1^b, and part of the rear overhanging weight of its fire-box, cab, and foot-plate upon the forward truck 7 of an independent tender A. The waist B and smoke-box C of the boiler are located above the driving-wheels 1^a 1^b and leading-truck 1, the driving and truck wheels varying in number in accordance with the characteristics of the special type or pattern of engine in which my improvement is applied. The main frames 3 of the engine, which carry the journal-bearings of the driving-axles, as already explained, are located between the wheels, and rigid supplemental frames 4, extending from the front end of the engine rearwardly to the tender, are located outside of the driving-wheels, as described in the Letters Patent before referred to. The fire-box 2 is located wholly in the rear of the back driving-axle, a foot-plate 8 and cab 9 being provided in the proper position relatively to the fire-box and being attached to and supported by the supplemental frames. A transverse beam 5 is rigidly secured to the rear ends of the main frames 3, and may also be attached to the supplemental frames. The front truck 7 of the tender A is shown as provided with four wheels 7^a, which may vary in number, as desired, and is located below the foot-plate and cab 9, as set forth in the Letters Patent before referred to. A vibrating bolster-beam 10 is pivotally connected to the center pin or king-bolt 6 of the front tender-truck 7, so as to be adapted to turn freely about said pin as a center, or, if preferred, the bolster may be pivotally connected to some portion of the tender-frame, or, as before stated, it might be connected to the engine-frame. The ends of the transverse beams 5 and 10 are coupled together by longitudinal coupling-beams 11, which are connected to the ends of the transverse beams by single or double pivotal joints 12 13, so that they can move freely about their points of connection. If horizontal movement only of the coupling-beams is required, single-pivoted joints only are needed for their connections; but if it is desirable that these beams should also have the capacity for vertical movement about their pivots what are known as "universal" or "double-pivoted" joints may be employed. The transverse and longitudinal beams are made of proper strength to resist the transverse, tensile, and compressive strains to which they will be subjected in service. By referring to Figs. 2 and 4, the latter showing an enlarged plan of these beams, it will be seen that the longitudinal coupling-beams can vibrate freely about their front pivotal connections 12 and that the rear ends of these beams have the capacity of movement transversely in the arcs *a a*, and also that the bolster-beam 10 can vibrate freely about the king-bolt 6, or the pin by which it is coupled to the tender or tender-truck frame, as a center, its ends then moving in the longitudinal arcs *b b*. It will be obvious that with such a connection of the engine and tender frames the driving-wheels and the front tender-truck will be entirely free to adjust themselves to any curvature or horizontal configuration of the tracks. This system of construction is also applicable to tenders which have no trucks, but which are carried by wheels and axles mounted directly on the tender-frame and which have no capacity for horizontal movement relatively thereto.

In Letters Patent No. 266,685 aforesaid a plan for supporting part of the weight of the overhanging fire-box, cab, foot-plate, &c., on the front tender-wheels was described. The construction proposed therein involved the support of the rear ends of the supplemental frames on the front tender-truck, and the supplemental frames were rigid throughout their length, lateral flexibility being obtained by giving the support on the front tender-truck lateral swing motion. In order to move the rear end of the engine laterally on a curve, the inertia due to its weight had to be overcome by the action of the flanges of the front wheels against the rails. The pressure exerted against these flanges by the rails acted on the front end of the frames, the flange of one of the driving-wheels forming a fulcrum at the rail about which the engine turned. With this plan of engine the force which was required to be exerted to move the engine laterally was therefore exerted at the front end of the frame which formed the short arm of a lever. This force was resisted by the weight attached to the rear end of the engine-frames which formed the long arm of a lever. To overcome the inertia of the weight at the rear end, a con-

siderable force had therefore to be exerted against the flanges of the front wheels. The tractive power of the engine was also exerted through the supplemental frames and was transmitted to the train at the rear end of the supplemental frames, which, as before explained, forms the long arm of a lever. When this force was exerted on a curve, its action tended to draw the engine and train into a straight line, and a lateral force was thus exerted at the rear end of the engine, which tended to pull it toward the inside of the curve and to push the front end toward the outside. The lateral force exerted at the front end was increased by the relative proportion of the two ends of the lever by which it was transmitted from the rear end. These objections are due in great part to the distance between the rear driving-axle and the bearing which sustains the overhanging weight of the rear part of the engine and transmits it to the tender-truck and to the consequent amount of leverage and lateral movement of the truck and this bearing relatively to each other in running on a curved track. In order to obviate these objections, instead of locating the bearing for the support of the overhanging weight on the tender-truck or over the tender-wheels, as described in the Letters Patent aforesaid, I provide under my present invention two bearings, which are located about midway between the ends or connections of the coupling-beams. This shortens the distance from the rear driving-axle and lessens very materially the effect due to the leverage of that distance, and also reduces the relative horizontal movement of the parts in contact at the bearing-points, as it will readily be seen from Figs. 2, 4, or 5 that the lateral motion of bearings on these beams in relation to other parts of the engine is less the nearer they are located to the rear axle. To provide for this lateral motion in running to and from curves, either frictional bearings are provided, or preferably the overhanging weight is supported by swing-links, which are connected to the coupling-beams and to the back part of the engine, thus allowing the latter to move freely in relation to the beams. The overhanging weight is supported by the coupling-beams and part of it is transmitted by them to the front tender-wheels. To illustrate this construction more clearly, a portion of the longitudinal coupling-beam 11 on the right-hand side of the engine is indicated as broken away in Fig. 3 in order to show the manner in which the fire-box is supported on the beams 11. Vertical posts or supports 16, which are most plainly shown in Figs. 3 and 7, are bolted through flanges 17 to the mud-ring 18 at the bottom of the fire-box 2. Swing-links 19 are pivotally connected at their lower ends to the lower ends of the posts 16 by pins 20, the upper ends of the links 19 being similarly connected to the longitudinal coupling-beams 11 by pins 21. The weight of the fire-box and of the back part of the engine is thus transmitted by the swing-links 19 to the beams 11, and at the same time the lower ends of the links are free to swing in the arcs *c c*, Fig. 7, about their upper pivot-pins 21 as centers. The fire-box is thus free to move laterally independently of the coupling-beams, and as the upper ends of the links 19 are free to swing in the arcs *d d* about their lower pivot-pins 20 as centers the coupling-beams 11 are free to move laterally independently of the fire-box. To insure greater stability, the posts 16 are connected together at their lower ends by a transverse tie-rod 24, Figs. 5 and 7. It will be seen that while this construction affords fully adequate support for the fire-box it also permits the frames, wheels, and the connections of the engine to adjust themselves with entire freedom to horizontal or vertical inequalities of the track. If desired, springs may be interposed between the support of the fire-box and the coupling-beams 11, in order to provide an elastic bearing, which would afford a more perfect adjustment of the engine and tender to vertical inequalities of the track.

More particularly when springs are used between the fire-box and the coupling-beams the latter should be connected to the transverse beams by universal joints of sufficient strength to resist the tractive force of the engine and the concussions to which the couplings of the engine and tender will be subjected. Such universal joints, which are shown at 12 and 13 in the drawings, I make, preferably, of heavy wrought-iron or steel disks, having a vertical trunnion at the top and another at the bottom, which are held in suitable bearings in the transverse beams. The coupling-beams are then connected to these disks by horizontal cylindrical pins, which latter form the axes for any vertical movement of the coupling-beams that may be required, while the trunnions of the disks form the axes for the horizontal movement of the beam.

The supplemental frames are extended in rear of the fire-box and, as before stated, support the foot-plate and the cab. As shown in the drawings, they are not intended to have direct support on the tender-truck; but, if desired, a bearing may be provided which would permit a part or all of the weight carried on the back ends of these frames to rest on the tender-truck.

In the construction of an engine in accordance with my invention the transverse beams 5 are preferably formed double—that is to say, composed of two connected bars, one of which, as shown in Fig. 7, is placed above or on top of the main frames and the other below them. The upper and lower bars are suitably strengthened by intermediate braces, which are not shown in the drawings. The transverse or bolster beam 10 of the front tender-truck is also preferably composed of two bars with interposed bracing, as shown in Fig. 6, the king-bolt 6 passing through both bars. The longitudinal coupling-beams 11 are composed of two channel-bars, with plates riveted

to their top and bottom flanges, and the channel-bars are bent so as to be farther apart at the middle of their length than at their ends, in order to give room between them for the suspension or swing links 19, as well as to give greater capacity for resisting strains and shocks of compression.

In addition to the advantages before stated, the construction herein described affords materially-greater protection than heretofore to the men who run locomotives in the event of collision or derailment. It is well known that one of the most frequent causes of injury and loss of life to locomotive runners and firemen is that they are crushed between the engine and tender in collisions or when these run off the tracks. My improvement affords a double safeguard against accidents of this character by providing two systems of framing, one above the other, each having the capacity of resisting shocks in collisions.

The main or under tender-frame 25, as shown herein and in my Letters Patent before referred to, may be made of metal or wooden beams, as in ordinary practice. The center plate 26, Fig. 6, to which the front tender-truck 7 and the transverse bolster-beam 10 are connected, is secured to the under tender-frame, which is shown in the drawings as composed of metal channel-bars and is of a form ordinarily used. The bolster-beam 10 is securely connected to the center plate 26 by the king-bolt 6 and is connected to the main engine-frames by the longitudinal coupling-beams 11. All these members are made of great strength and have a corresponding capacity to resist shocks resultant upon collisions or derailments. The rear ends of the supplemental frames 4 are united by an end or tail brace 27, Fig. 5, which is strengthened by diagonal braces 28. The foot-plate 8 is bolted or riveted to the supplemental frames and adds materially to their capability of resistance to shock. In addition to the lower tender-frame 25, as ordinarily employed, I provide an upper or supplemental tender-frame 29, Figs. 2 and 3, which is shown as composed of wooden beams, but may, if preferred, be of metal. The supplemental tender-frame extends from the rear end of the engine to the rear end of the tender, and its longitudinal beams 29 are united by substantial transverse timbers 30 31 at their ends, the forward transverse timber 30 being provided with a buffer or chafing plate, which abuts against a corresponding plate on the tail-brace 27 of the supplemental engine-frame 4, as seen in Figs. 2, 3, and 5. These longitudinal and transverse timbers are securely fastened to the lower tender-frame, thus having great capacity for resisting shocks due to collisions, and by their position transmitting such shocks to or from the supplemental frames of the engine. This system of upper or supplemental frames thus has, independently of the lower or main frames, capacity for resisting strains of compression or concussion to which the engine and tender may be subjected.

It will be seen that while the main or inside engine-frames, the lower tender-frame, and their connections, as above described, have unitedly great capacity for resisting shocks of collisions the supplemental frames have great additional strength to resist such shocks. The construction and connection of engine and tender frames which obtain in present standard practice are such that in cases of collisions the frame of the tender will very frequently mount upon or override that of the engine, and in so doing crush the engine-attendants. In the construction hereinbefore described it will be seen that the supplemental engine-frames overlap the lower tender-frame, and that therefore if the tender should be forced upward it would carry the engine with it, or if the engine should be raised it would take the tender with it. As an additional means of securing this result, I attach guards 32 to the rear part of the engine-frame, or, as shown, to the rear of the fire-box which is connected to said frame, said guards being made to engage with the tender-frame, so that the engine would carry the tender-frame up with it in case of a collision. The construction described therefore reduces in a very large degree the liability of overriding of engines and tenders, as compared with the ordinary practice, and in this particular affords a material safeguard in cases of collision or derailment of locomotives.

It will be observed that the fire-box of the engine is placed entirely behind the driving-wheels, and that it is rectangular in plan, of as great depth as is desirable, and may be extended laterally to a width substantially equal to that of the cab, so that a very large amount of grate area and heating-surface is obtainable without involving any objectionable restrictions in other particulars.

The fire-box may be made of any of the forms mentioned in my Letters Patent before referred to, or of any other preferred constructon, without departure from the principle or essential characteristics of my present invention.

I claim as my invention and desire to secure by Letters Patent—

1. A locomotive engine and tender coupled together by means of a bolster centrally and pivotally connected to one of the coupled vehicles and a pair of longitudinal coupling-beams which are pivotally connected to the bolster on each side of its central pivot and connected by their opposite ends to the other coupled vehicle, said beams having the capacity for independent lateral movement relatively to the engine or tender, substantially as set forth.

2. A locomotive engine and tender coupled together by means of a bolster centrally and pivotally connected to one of the coupled vehicles and a pair of longitudinal coupling-

beams which are pivotally connected by universal joints to the bolster on each side of its central pivot and connected by their opposite ends to the other coupled vehicle, whereby independent vertical and lateral movement of the frames is permitted relatively to the engine or tender, substantially as set forth.

3. The combination, with a locomotive engine and tender, of a transverse beam rigidly attached to the frame of one of said vehicles, a bolster centrally and pivotally connected to the other vehicle, and a pair of longitudinal coupling-beams which are pivotally connected to the bolster on each side of its central pivot and connected by their opposite ends to the transverse beam, said coupling-beams having the capacity for independent lateral movement in relation to the engine or tender, substantially as set forth.

4. The combination of a tender, a locomotive having its fire-box located behind the rear driving-axle and laterally extended to a width greater than the distance between the wheels, a transverse beam rigidly attached to the frame of one of the vehicles aforesaid, a bolster centrally and pivotally connected to the other vehicle, and a pair of longitudinal coupling-beams which are pivotally connected to the bolster on each side of its central pivot and connected by their opposite ends to the transverse beams, said coupling-beams having the capacity for independent lateral movement relatively to the engine or tender, substantially as set forth.

5. The combination, with a locomotive engine and tender, of a bolster centrally and pivotally connected to one of said vehicles, a pair of longitudinal coupling-beams which are pivotally connected to the bolster on each side of its central pivot and connected by their opposite ends with the frame of the other vehicle and are adapted to support part of the weight of said vehicle, and movable connections, supports, or bearings between the coupling-beams and said vehicle, whereby part of the weight of the latter is supported by the coupling-beams and they are adapted to have independent lateral movement relatively thereto, substantially as set forth.

6. The combination, with a locomotive engine and tender, of a bolster centrally and pivotally connected to one of said vehicles, a pair of longitudinal coupling-beams which are pivotally connected to the bolster on each side of its central pivot and connected by their opposite ends with the frame of the other vehicle, posts, pillars, or supports attached to said vehicle, and swing links or hangers pivotally connected to the supports and to the coupling-beams and adapted to support part of the weight of said vehicle and to allow said beams and said vehicle to move laterally in relation to each other, substantially as set forth.

7. The combination, with a locomotive engine and tender, of a bolster centrally and pivotally connected to one of said vehicles and a pair of coupling-beams which are pivotally connected to the bolster on each side of its central pivot and connected by their opposite ends to the frame of the other vehicle, with the capacity of lateral motion relatively to said last-named vehicle and of supporting and transmitting part of the weight thereof to wheels which carry part of the weight of both vehicles, substantially as set forth.

8. The combination of a locomotive engine and tender, a fire-box located between the rear driving-axle and the tender, a transverse bolster centrally and pivotally connected to one of the vehicles aforesaid, and longitudinal coupling-beams pivotally connected to the other vehicle on each side of a longitudinal center line thereof and to the transverse bolster-beam, said coupling-beams having capacity for independent lateral movement relatively to said last-named vehicle and for supporting part of the weight thereof and transmitting it to wheels adapted to carrying part of the weight of both vehicles, substantially as set forth.

9. The combination of a locomotive-engine having main frames inside of its driving-wheels and outside supplemental frames which project rearwardly back of the driving-wheels, a tender having a main frame which is located below and extends in front of the back end of the supplemental engine-frame, a supplemental tender-frame located above the main tender-frame and abutting against the rear end of the supplemental engine-frame, a transverse bolster pivoted centrally to one of the vehicles aforesaid, and longitudinal coupling-beams pivotally connected to the bolster and with the main frame of the other vehicle, substantially as set forth.

10. The combination of a locomotive-engine having a fire-box located behind its rear driving-axle and having main frames inside of the driving-wheels and outside supplemental frames which project in rear of the driving-wheels, a tender having a main frame which is located below and extends in front of the back end of the supplemental engine-frame, a supplemental tender-frame located above the main tender-frame and abutting against the rear end of the supplemental engine-frame, a transverse bolster pivoted centrally to one of the vehicles aforesaid, and longitudinal coupling-beams pivotally connected to the bolster and with the main frame of the other vehicle, substantially as set forth.

11. The combination of a locomotive-engine having main frames inside of its driving-wheels and outside supplemental frames which project in rear of the driving-wheels, a tender having a main frame which is located below and extends in front of the back end of the supplemental engine-frame, a supplemental tender-frame located above the main tender-frame and abutting against the rear end of the supplemental engine-frame, a transverse bolster-beam pivoted centrally to the frame of one of the vehicles aforesaid, and

longitudinal coupling-beams pivotally connected to the bolster-beam and with the main frame of the other vehicle, and wheels adapted to carry part of the weight of both vehicles, substantially as set forth.

12. The combination of a locomotive-engine having main frames inside of its driving-wheels and outside supplemental frames which project in rear of the driving-wheels, a tender having a main frame which is located below and extends in front of the back end of the supplemental engine-frame, a tender-frame located above the main tender-frame and abutting against the rear end of the supplemental engine-frame, and a guard or guards connected with a frame of one of the vehicles aforesaid and adapted to engage with a frame of the other vehicle, substantially as set forth.

MATTHIAS N. FORNEY.

Witnesses:
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W. H. NIEHOFF.