Dec. 18, 1956 E. H. REMDE 2,774,437

OVERLOAD RESPONSIVE SWITCH MECHANISM FOR INDUSTRIAL ELEVATING TRUCK

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FIG. 1

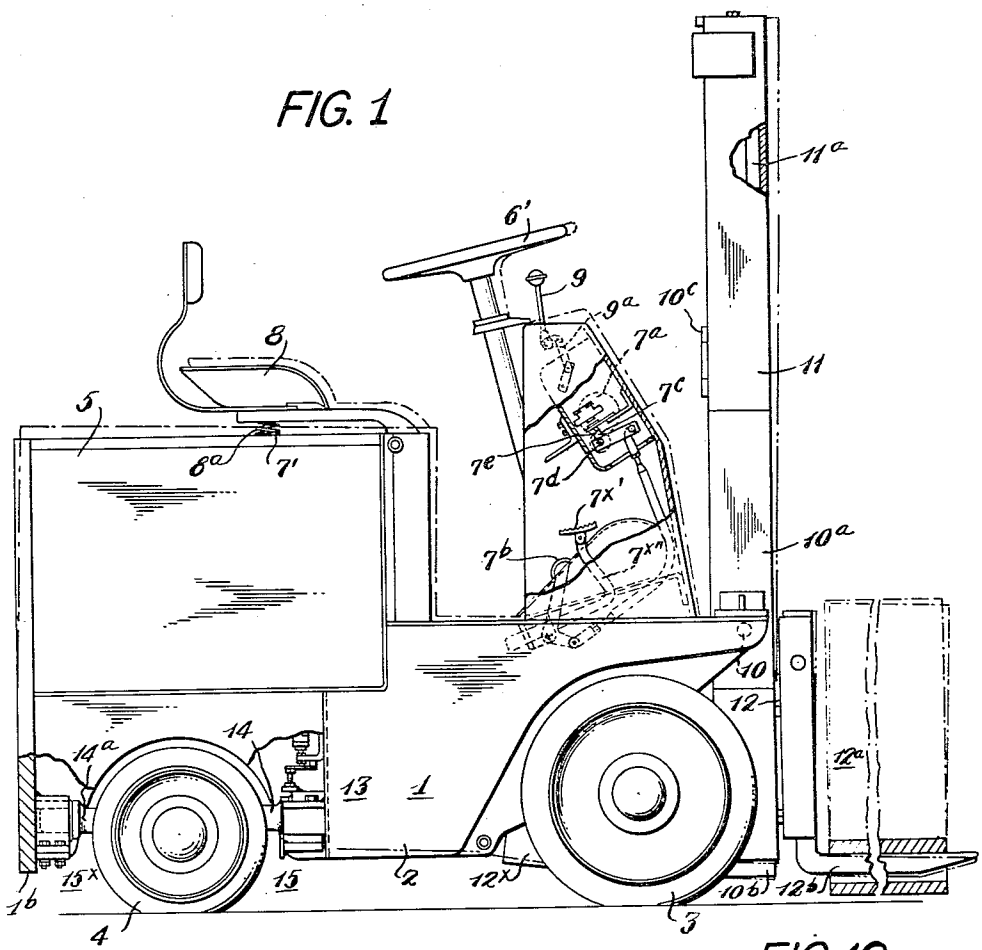


FIG. 5

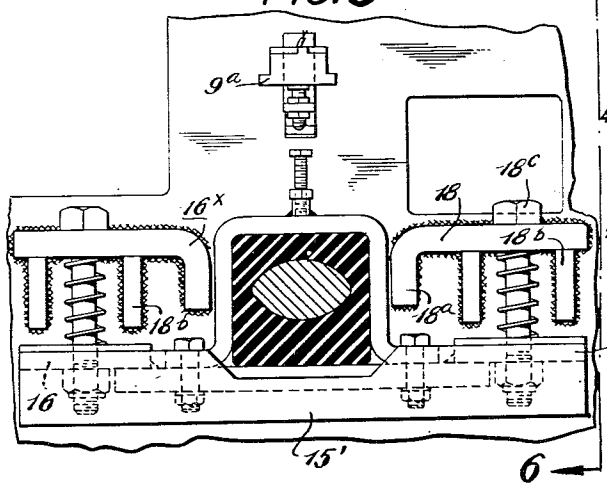
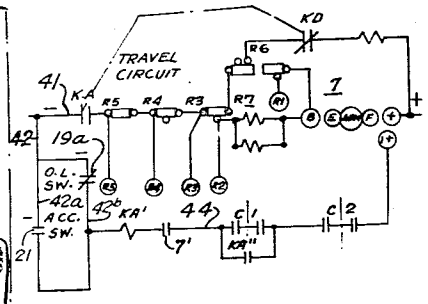


FIG. 12



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FIG. 2

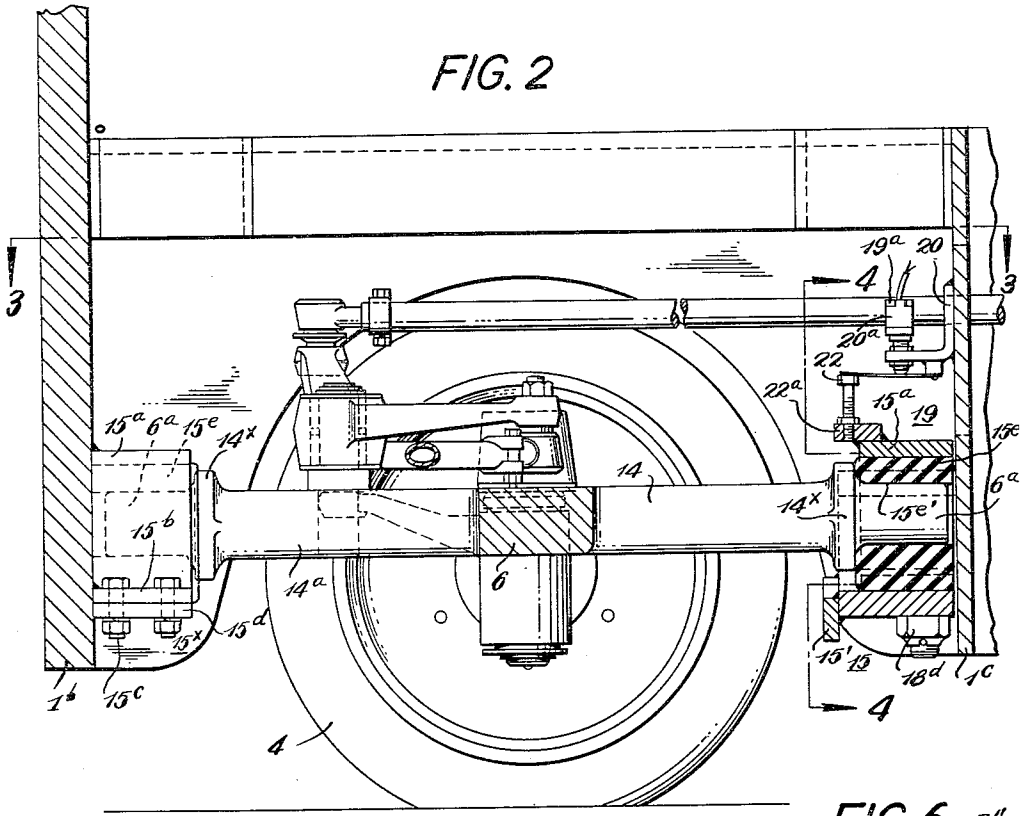
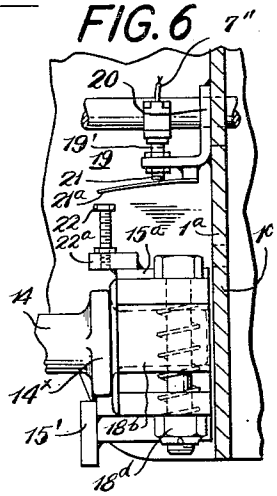


FIG. 6



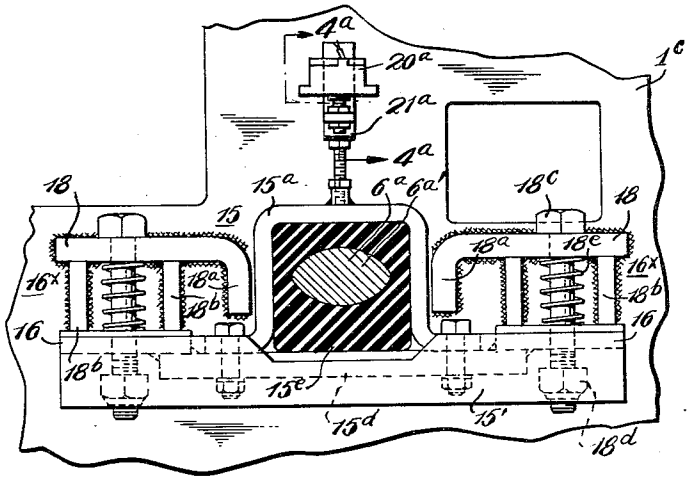


FIG. 4

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OVERLOAD RESPONSIVE SWITCH MECHANISM
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FIG. 3

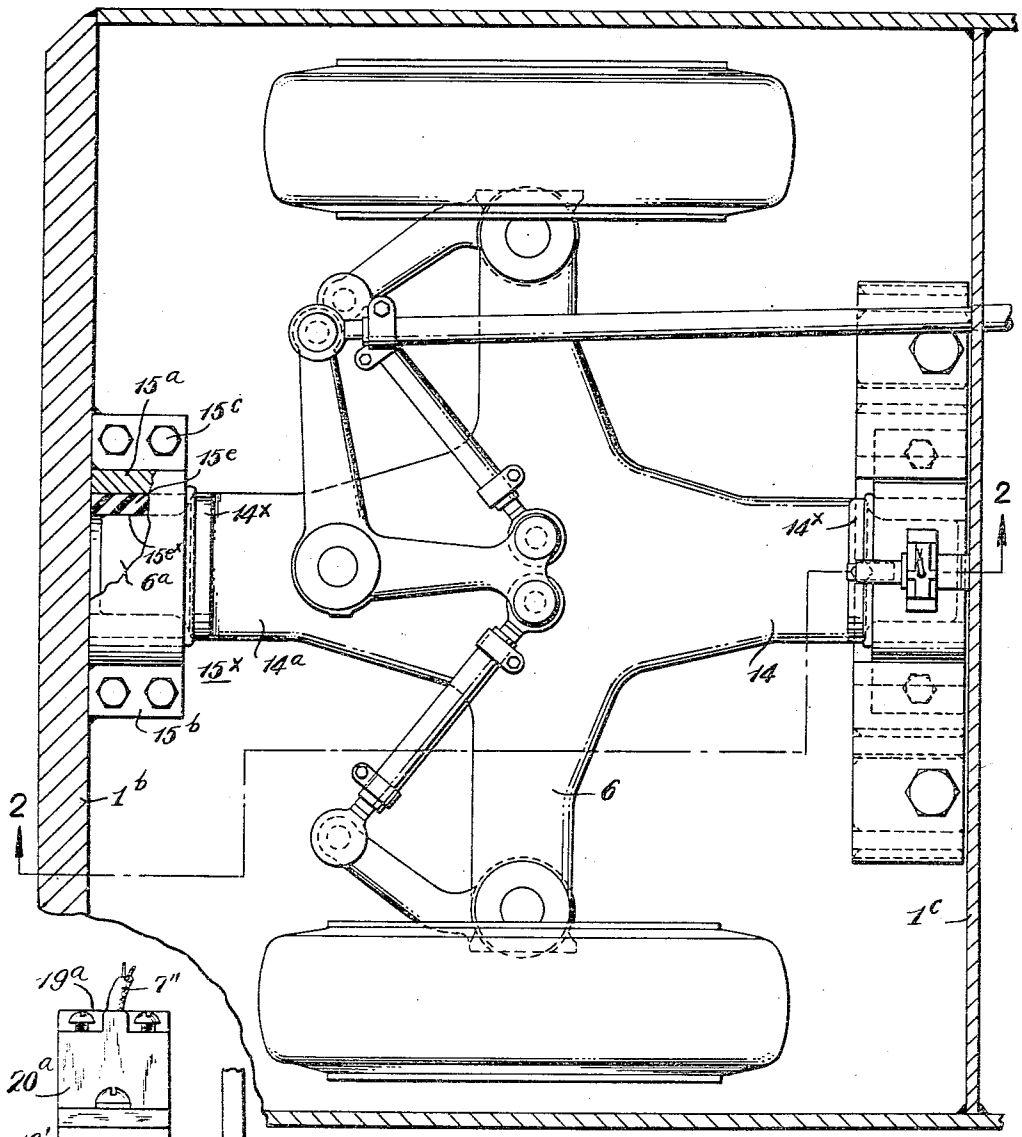


FIG. 4a

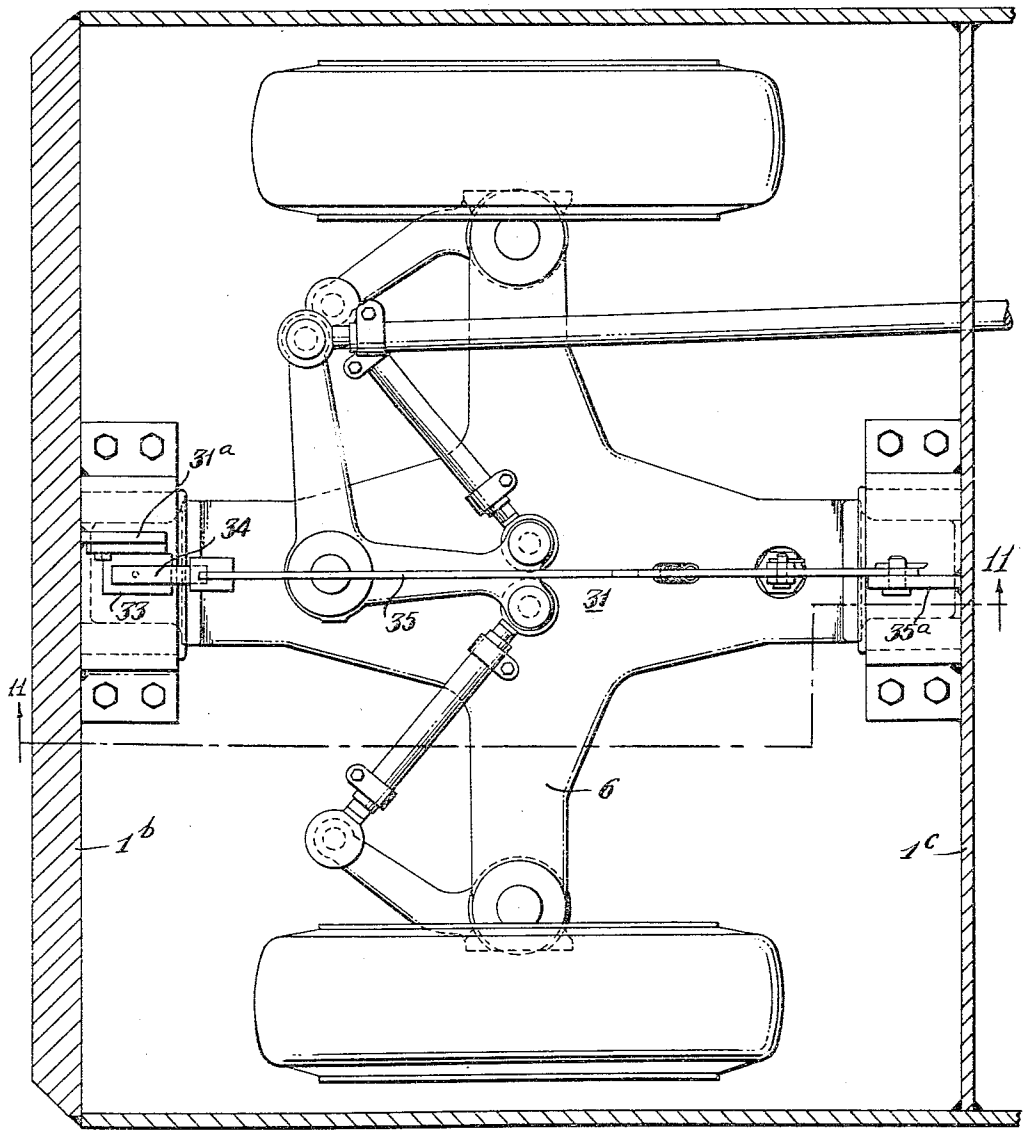
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OVERLOAD RESPONSIVE SWITCH MECHANISM FOR INDUSTRIAL ELEVATING TRUCK

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FIG. 10



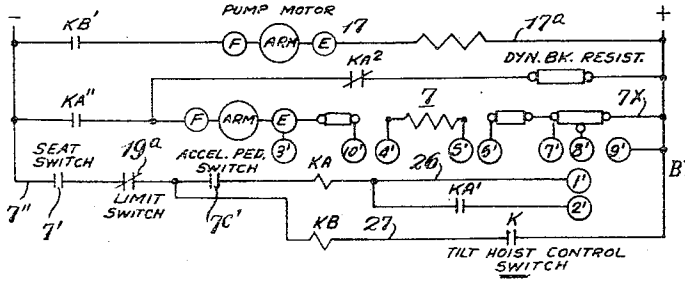


FIG. 7

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OVERLOAD RESPONSIVE SWITCH MECHANISM FOR INDUSTRIAL ELEVATING TRUCK

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FIG. 11

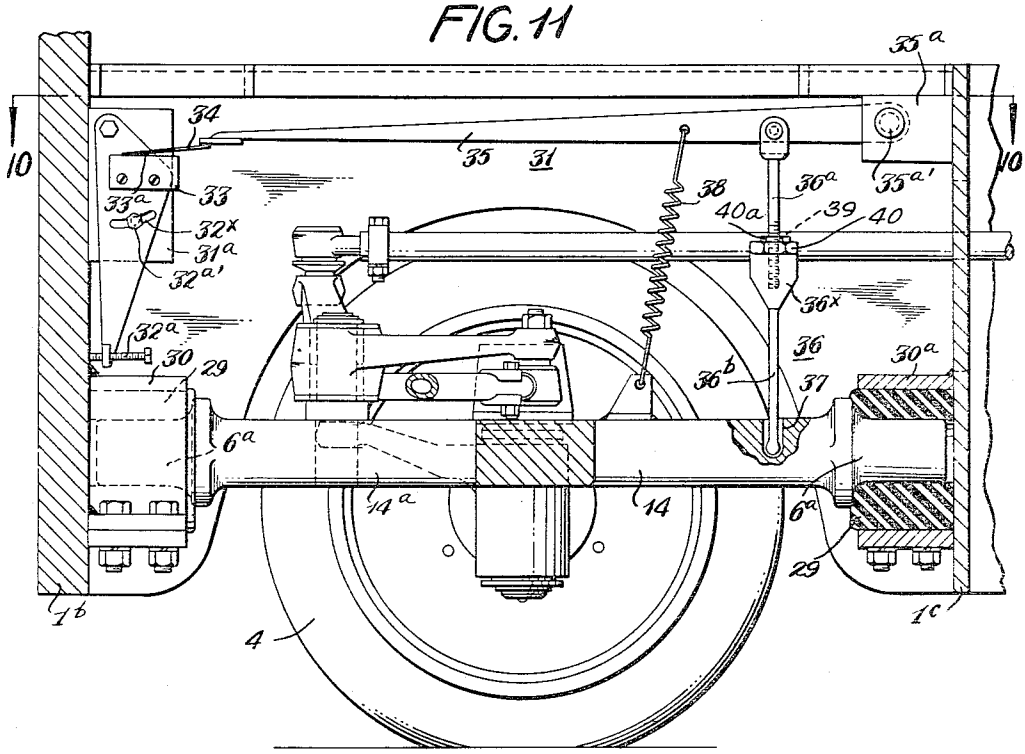
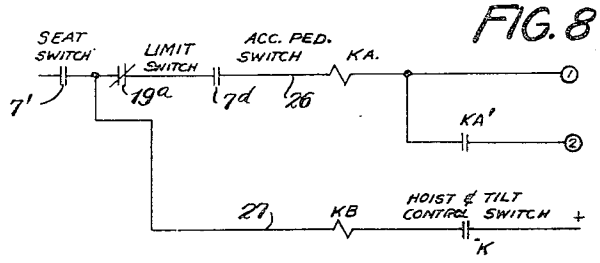


FIG. 8



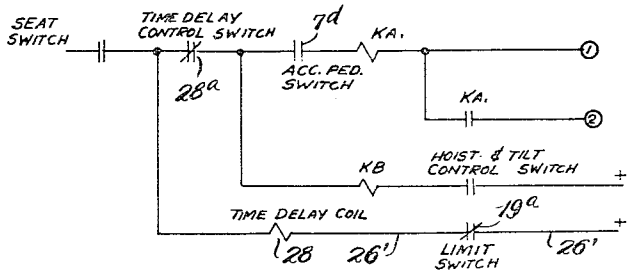


FIG. 9

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United States Patent Office 2,774,437 Patented Dec. 18, 1956

2,774,437

OVERLOAD RESPONSIVE SWITCH MECHANISM FOR INDUSTRIAL ELEVATING TRUCK

Edward H. Remde, Cleveland, Ohio, assignor, by mesne assignments, to The Baker-Raulang Company, a corporation of Delaware

Application May 12, 1953, Serial No. 354,524

5 Claims. (Cl. 180—82)

This invention relates to a vehicle for transporting loads having incorporated therein means adapted to be actuated when an overload is positioned on or engaged by the load carrier of the vehicle, whereby the power means for one or more operating mechanisms are made inoperative the effect of which is to prevent operation of the vehicle and/or a mechanism thereon until the overloading condition is remedied; by preventing overloading of the vehicle undue wear on and/or danger of breakdown thereof are reduced. Where the vehicle is provided with a vertically movable load carrying member, the latter may be operated to transport (*a*) loads consisting of bulk materials in bags, bales, rolls of paper and the like and (*b*) pick up and transport loads mounted on skids, dunnage and pallets. In the preferred application of the invention it is incorporated in a vehicle the overloading of which effects a tilting of the vehicle chassis about the wheel axle at one end thereof; in one form of vehicle construction referred to the load supporting member or carrier is suspended by means which are operable to raise and lower the member or carrier, whereas in another form of vehicle construction the load carrying member extends beyond the truck supporting wheels at one end of the truck frame. In the preferred form of construction the load supporting member or carrier is slidably supported on the truck chassis for vertical movement, for example, as in a truck of industrial elevating type, as shown herein, wherein the load carrier extends beyond the truck wheels at one end of the truck frame, and is supported on an elevating member which is raised and lowered on vertical guides supported on the truck frame. In trucks of this type, the weight of the end portion of the truck chassis remote from the load carrier and of all equipment mounted on such portion serves as a counter-weight for the load which may be positioned on the load carrier. As the load carrier extends outwardly at one end of the chassis beyond the adjacent truck supporting wheels, it will be seen that the axis on which these wheels rotate forms a fulcrum between the load carrier and the remote end portion of the chassis, so that the weight of such end portion and all equipment thereon on the adjacent side of the fulcrum determines the carrying capacity of the truck, since any overload on the load carrier exceeding the weight at the opposite or remote end of the chassis will cause the latter to tilt about its fulcrum.

While industrial trucks of this latter type are designed to carry loads having a predetermined carrying capacity as to weight, the truck driver is often induced, for sake of expediency or otherwise to overload the elevatable load carrier beyond the rated capacity of the truck. Such overloading obviously effects undue wear on various parts of the truck, resulting in a shorter life thereof or in causing repairs and breakdowns of the truck, whereby the expense of keeping the truck in service is increased.

In the form of construction shown, and as later set forth, any loading of the carrier with a load in excess of the rated carrying capacity of the truck has the effect

of making one or more operated mechanisms of the truck inoperative, whereby the truck driver at once becomes aware of the overloading condition, so that it can be promptly rectified. The mechanism or mechanisms to be made ineffective or inoperative depend upon the electrical circuit connections and the controlling switch therein, as later set forth.

One object of the invention is to provide an improved mechanism for automatically making an operating mechanism of a truck inoperative when a load, which exceeds the rated capacity of the truck, is placed on its load carrying support, whereby strains and/or breakdowns and undue wear on the truck, are eliminated.

Another object of the invention is to provide an improved load limiting mechanism inter-related to the raising means for the elevating member of a truck for preventing raising of the elevating member following the engagement of the load carrier with an overload but permitting the elevating member to be lowered, whereby the load carrier may be lowered, if necessary, and the load reduced or removed.

Another object of the invention is to provide, in a truck, an improved load limit mechanism of simple construction and capable of quickly responding to any attempt to place on the load carrier of a truck or raise a load which exceeds the capacity of the truck.

Another object of the invention is to provide, in a truck wherein the load carrier thereon extends outwardly beyond the wheels at one end of the chassis and the wheels at the opposite end of the chassis are mounted on an axle having forwardly and rearwardly extending members the outer ends of which are mounted on resilient supports on the chassis, improved means controlled by the movement of the chassis relative to one of said supports, due to an overload on the load carrier, for making one or more operating mechanisms on the truck inoperative.

Another object of the invention is to provide, in an elevating type of truck, the axle for one pair of supporting wheels at one end of the truck chassis having alined forwardly and rearwardly extending members the outer ends of which are mounted in resilient seats fixedly supported on the chassis and arranged to be compressed when the chassis is tilted, and the opposite end of the chassis is provided with a load carrier, improved load limiting mechanism adapted to make one or more mechanisms on the truck inoperative, due to tilting of the chassis when an overload is positioned on or engaged by the carrier.

Another object of the invention is to provide an improved load limiting mechanism for automatically making one or more mechanisms of a truck inoperative when a load exceeding a predetermined capacity thereof is placed on the truck carrier or engaged thereby preliminary to raising of the load, the mechanism including means arranged, during travel of the truck in transporting a load within the capacity of the truck, to make the load limiting mechanism ineffective during traverse of the truck wheels over rough surfaces.

A further object of the invention consists in certain improvements in the form of construction shown in my co-pending application filed February 8, 1950, Ser. No. 143,064.

Other objects of the invention will be apparent to those skilled in the art to which my invention relates from the following description taken in connection with the accompanying drawings, wherein

Fig. 1 is a side elevation of an elevating truck embodying my invention, parts being broken away;

Fig. 2 is a section on the line 2—2 of Fig. 3;

Fig. 3 is a section on the line 3—3 of Fig. 2, parts being broken away;

Fig. 4 is a fragmentary section on the line 4—4 of Fig. 2;

Fig. 4*a* is an enlarged view taken approximately along line 4*a*—4*a* of Fig. 4;

Fig. 5 is a section similar to Fig. 4, but showing the position of the parts when the truck carrier is overloaded;

Fig. 6 is a fragmentary section on the line 6—6 of Fig. 5;

Fig. 7 is a diagram of the circuits;

Figs. 8 and 9 are diagrams of modified circuits;

Fig. 10 is a section similar to Fig. 3, but showing a modified form of construction, on the line 10—10 of Fig. 11;

Fig. 11 is a section on the line 11—11 of Fig. 10; and

Fig. 12 is a diagram showing a modified circuit.

In the drawings, referring to Figs. 1 to 7, inclusive, **1** indicates as an entirety a truck comprising a frame or chassis **2** mounted at its front end on a pair of wheels **3** and at its rear end on wheels **4**. In the disclosed form of construction (*a*) the wheels **3** are driven by a suitable driving mechanism having a power supply unit mounted on the rear end portion of the chassis **2** and enclosed in a casing **5**; and (*b*) the wheels **4** are dirigibly mounted on the opposite ends of the axle member indicated as an entirety at **6** for steering by a manually operable device, such as a wheel **6'**. However, where found desirable, the rear wheels **4** may be driven and either the front or rear wheels may be mounted to effect steering of the truck.

In the present disclosure, the wheels **4** are dirigibly mounted in a well known manner on the opposite ends of the axle **6**, which in turn is mounted on the chassis **2** for swinging movement in a plane transverse to the chassis, as later set forth, so that the wheels **4** may traverse uneven surfaces during truck travel. As the mounting, indicated as an entirety at **13**, between the axle **6** and chassis **2** is disposed in a vertical plane cutting the longitudinal axis of the chassis, when either wheel **4** rides an uneven surface, during truck travel, the axle swings in a transverse plane relative to the chassis, so that stresses on the chassis are reduced to a minimum and traction between the wheels **3** and road or other surface is not affected.

The mounting **13** for the axle **6** consists of the following: **14**, **14***a*, indicate alined supporting members, respectively, preferably integral with the axle **6**, disposed intermediate the ends thereof and extending forwardly and rearwardly of the axle **6** substantially in the plane thereof. The member **14**, **14***a*, are provided with collars **14***x* (preferably integral therewith) and the end portions **6***a* of the members, outwardly of the collars **14***x*, are mounted in supports **15**, **15***x*, the support **15** for the member **14** being secured to a transversely extending suspension member **15'** (later referred to) and the support **15***x* for the member **14***a* being fixedly mounted on a transverse wall **1***b* forming part of the chassis **2**. The support **15***x* consists of an inverted U-shaped wall **15***a* the sides of which terminate at their lower ends in outturned flanges **15***b* suitably secured by bolts **15***c* to a bottom plate **15***d*. The inner edges of the wall **15***a* are suitably secured to the adjacent chassis wall **1***b*, which, with the walls **15***a* and plate **15***d*, form a casing for a resilient seat member **15***e* for the end portion **6***a* of the adjacent axle supporting member **14***a*. The seat member **15***e* is formed substantially centrally thereof with an inwardly extending opening **15***e'* (see Fig. 3) forming a seat into which adjacent end portion **6***a* extends. Each of the end portions **6***a* is provided on diametrical sides thereof with lateral extensions, as shown at **6***a'*. By preference, the extensions on the end portions **6***a* are provided by making the latter of substantially elliptical shape in cross section, as shown in Figs. 4 and 5 and the seats **15***e'* are of complementary shape in cross section to prevent rotation of the end portions **6***a* therein. The support **15** is similar in construction to the support **15***x* to nonrotatably support the end portion **6***a* of the adjacent axle supporting member **14** in the adjacent seat member **15***e*, except that (*a*) the wall **15***a* is not fixed to the chassis wall **1***c* and (*b*) the bottom plate **15***d* of the adjacent casing for the seat member **15***e* is suitably secured at its opposite end portions to a transverse plate or suspension **15'**, the latter having extensions **16**, which extend beyond the opposite sides of the adjacent support **15**, and are adapted to be normally engaged by spaced abutments **16***x* (later referred to) suitably fixed to the transverse chassis wall **1***c*. The seat members **15***e* are shaped so as to position the seats **15***e'* therein, when the axle **6** is in normal position, co-axially with the central longitudinal axis of the chassis. The walls of each seat member **15***e* are preferably formed of a compressible material having elastic or resilient characteristics, such as rubber or rubber compound, and have a length substantially equal to the width of the casing therefor and the exterior contour of these walls approximate the shape of the latter, but are initially somewhat larger than the area within and defined by the walls **15***a* and the plate **15***d* secured thereto, so that when each compressible seat member is initially positioned in the adjacent casing walls **15***a* its lower portion extends below the flanges **15***b* thereon. Accordingly, when the plate **15***d* is clamped in position by the bolts **15***c*, the material forming the walls of the seat member is compressed between the inner surfaces of the inverted wall **15***a*, the plate **15***d* and exterior surfaces of the adjacent extension **6***a* and also expanded outwardly into engagement with the adjacent collar **14***x* to form a cushion between the adjacent axle supporting member and the outer edges of the wall **15***a* to absorb stresses endwise outwardly on the adjacent supporting member. As the compressible resilient material of the seat members engages under pressure with the entire outer surfaces of the end portions **6***a* and such pressure is substantially equal radially inwardly on these surfaces, the end portions **6***a* are supported and yieldably maintained in normal position during truck travel over substantially smooth road surfaces. However, when one wheel rides an obstruction or a depression in the road surface, the axle **6** bodily swings substantially vertically relatively to the other wheel, but as the end portions **6***a* are fixed to the axle and non-rotatively fixed to the walls of the seats **15***e'*, as already set forth, the compressible material will yield to the pressure applied at diametrical sides of the extensions **6***a'* to compensate for the movement of the axle, and after the wheel has traversed the uneven surface, the compressed portions of the material will serve to center the end portions **6***a* into normal position. The axle and mountings **13** therefor, consisting of the members **14**, **14***a*, and supports **15**, **15***x*, for the latter, constitute the subject-matter disclosed and claimed in the co-pending application filed by Robert H. Davies, Ser. No. 513,655; accordingly, no claim thereto is made herein.

The travel of the truck is effected by a suitable driving mechanism which includes a motor **7** (see Fig. 7) in the circuit **7***x* and operated by the controller **7***a* preferably connected by a linkage to an accelerator pedal **7***b*, the circuit being connected to batteries enclosed in the casing **5**. As shown in Fig. 1, the linkage for the pedal **7***b* is connected to and rotates a shaft **7***c*, which is suitably connected by gearing to the controller **7***a* to rotate the latter. The shaft **7***c* is provided with a cam **7***d*, which, in the neutral position of the controller, engages a spring biased plunger **7***e* to maintain the switch **7***c'* open, but upon rotation of the shaft **7***c* relieves pressure on the plunger, whereby the switch closes, as later set forth. Referring to Fig. 7, **7'** indicates a separate normally open switch in a lead **7''** of the motor circuit **7***x* adapted to prevent operation of the motor, so that operation of the controller **7***a* is ineffective. The switch **7'** is positioned below a hinged seat **8** for the driver. The seat **8** is biased upwardly by a spring **8***a*, as shown in full lines in Fig. 1, in which position the switch **7'** is open; but when the driver occupies the seat **8**, his weight overcomes the tension of the spring **8***a*, so that the seat swings down-

wardly and closes the switch 7', thereby closing the circuit in lead 7''.

Where the construction of the chassis provides for truck operation with the driver in a standing position on a platform, a portion of the latter consists of a hinged, upwardly biased member (as shown in my co-pending application Ser. No. 143,064) on which the driver stands to close the normally open switch 7'.

7x' indicates a service brake pedal which is biased in one direction by a spring (not shown). The pedal 7x' is connected by a linkage 7x'' to a brake (not shown). By operation of the accelerator pedal 7b forward travel of the truck at different speeds is effected through fingers 1', 2', 3', etc.; whereas rearward travel at different speeds is effected through the same fingers, except that fingers 4' and 5' are interchanged by operation of a lever 9 connected to linkage 9a.

The front end of the chassis 2 is provided with trunnions 10 (one being shown in dotted lines—see Fig. 1—) on which a pair of plates 10a, only one of which appears in the drawing, are tiltably supported. The plates 10a are suitably fixed to outer guide channels 11 which slidably support inner guide channels 11a. The lower ends of the guides 11 are connected together by a base 10b and thereabove by a plate 10c, whereas the upper ends of the guides 11a are connected together by a member (not shown). 12 indicates as an entirety an elevating member supporting a carrier or load support 12a. The carrier 12a is shown as consisting of a pair of forks 12b adapted to be projected into a pallet whereby a load on the latter may be raised. The elevating member 12 is raised relative to the guides and the guides 11a are operated endwise upwardly relative to the guides 11 by an hydraulically operated mechanism preferably similar to that shown in Letters Patent No. 2,598,566 to Max Lehmann. As the hydraulically operated mechanism, the elevating member and load carrier and guides for the elevating member are mounted on the plates 10a and the latter are trunnioned at 10 on the chassis 2, as already described, the assembly may be tilted by operation of a mechanism 12x, preferably of the hydraulically operated type as shown in Letters Patent No. 2,471,429 to P. E. Hawkins and operated by a suitable lever (not shown). The raising mechanism and tilting mechanism are operated by fluid (such as oil) under pressure supplied thereto by operation of a pump, the latter being driven by a motor 17, connected in an electric circuit 17a, the liquid supply to these mechanisms being controlled by suitable levers (not shown) operatively connected to suitable valves (not shown). By preference, the motor 17 is driven only when pressure in the system is required to raise the elevating member 12 or to tilt the plates 10a and parts mounted thereon. In this arrangement, the levers are suitably connected to a switch KB', connected in the circuit 17a, so that when either one of the levers is operated it operates the switch to close the circuit 17a, whereby the motor 17 is set in operation to drive the pump and thus supply pressure to swing the elevating mechanism about the trunnions 10 or raise the elevating member 12 dependent upon which lever is operated.

The abutments 16x are disposed at opposite sides of the support 15 and each consists of a horizontally disposed bar 18 the inner end of which is provided with a downwardly extending element 18a, and a pair of spaced, downwardly extending legs 18b, which engage the adjacent extension 16 on the member 15'. The bars 18, elements 18a and legs 18b are suitably secured (preferably welded) to the wall 1c, so that the abutments 16x co-operate with the support 15x to support the adjacent end of the chassis on the axle 6 as shown in Figs. 1, 2 and 4. As shown, the elements 18a are in close relation to the side walls of the adjacent wall 15a to prevent lateral movement of the support 15, but are free to slide relative to these side walls when the chassis is tilted, as shown in dotted lines in Fig. 1, due to an overload on the carrier 12a, as later set forth. As the abutments 16x are disposed at opposite sides of the support 15 and engage the extensions 16, and the elements 18a are in close relation to the sides of the support 15 the latter is held against displacement and/or from turning during swinging movement of the axle 6.

The abutments 16x and member 15' are connected together by devices which serve to maintain them in associated relation and to adjustably limit the upward movement of the abutments relative to the support 15. These connecting devices consist of bolts 18c each extending through alined openings in one of the bars 18 and the adjacent extension 16, the bolt extending beyond the latter and provided with screw threads for a nut 18d. As shown, the nuts 18d are spaced from the bottom walls of the extensions 16 and serve to limit the upward movement of the abutments relative to the support 15. As will be observed, this relative movement can be adjusted by turning the nuts 18d on the bolts 18c. 18e indicates springs coiled around the bolts 18c and interposed between the bars 18 and extensions 16. As shown in Fig. 4, when the abutments 16x are seated on the extensions 16 the springs 18e are compressed and when the abutments 16x move upwardly, due to tilting of the chassis 2, the springs 18e prevent the support 15 from moving upwardly therewith due to any frictional engagement between the elements 18a and sides of the adjacent wall 15a.

19 indicates as an entirety the load limiting mechanism adapted, when operated, to make the operation of the motors 7 and 17 ineffective, so that the truck cannot be driven, the tilting mechanism 12x for the guides 11 cannot be operated and the mechanism for raising the elevating member 12 cannot be operated to raise the latter; however, when the elevating member 12 is in a raised position, it may be lowered as the member gravitates downwardly when the adjacent valve is operated to release the fluid pressure therefor. The mechanism 19 consists of the following: 19a indicates a normally closed switch in the lead 7'' of the circuit 7x. The switch 19a is mounted on a bracket 20 fixed to the wall 1c, the switch contacts being enclosed in a casing 20a and adapted to be engaged or disengaged by operation of a plunger 21 (formed of non-magnetic material) slidably fitting and extending through a tube 19' fixedly mounted in an opening formed in the laterally extending leg of the bracket 20 (see Fig. 4a). The plunger 21 is normally biased outwardly by a spring (not shown) in the casing 20a. 21a indicates a resilient metallic strip suitably mounted on the bracket 20 inwardly of the plunger 21 and extending outwardly in alinement with the latter for engagement with and disengagement from a rest 22, which is mounted on the top of the adjacent wall 15a (see Fig. 6). When the carrier 12a is not provided with a load or a load thereon is within the rated capacity of the truck, the spring strip, being in engagement with the rest 22, is biased upwardly and supports the plunger 21 in retracted position (see Figs. 1, 2 and 4) in which position the switch 19a is closed as shown in Fig. 7. If an overload is placed on the carrier 12a or the latter engages an overload preliminary to raising it, the chassis is tilted about the axle for the wheels 3 (see dotted lines in Fig. 1), thereby moving the abutments 16x to the position shown in Figs. 5 and 6 and disengaging the strip 21a from the rest 22 and allowing the strip to flex downwardly, thereby relieving pressure on the plunger 21 and permitting the latter to move endwise outwardly. The outward movement of the plunger serves to open the switch to control the circuits as later set forth. The rest 22 consists of an elongated member (preferably a bolt) screw threaded into an opening formed in a lug 22a suitably fixed to the top of the adjacent wall 15a. By adjusting the rest 22 relative to the lug 22a, the opening of the switch 19a can be controlled to meet specific conditions; for example, where

it is desired to transport loads in excess of the rated capacity of the truck.

Operation: If the truck is at rest and its driver not in driving position, relay coils of KA and KB in leads **26**, **27**, are de-energized, tilt-hoist switch K is open, accelerator operating switch **7***c*′ is open, the overload or pressure switch **19***a* is closed, the seat operated switch **7**′ is open, switches KA′ and KA″, which are closed by relay KA are open, switch KA², which is operated by relay KA is closed, and switch KB′, which is closed by relay KB, is open. If driver occupies seat **8**, switch **7**′ is closed. Next, the driver operates accelerator pedal **7***b* to close the circuit **7***x* between the controller and motor **7**. If the controller **7***a* is moved to finger **1**′ position relay coil KA is energized, switches KA′ and KA″ are closed, switch KA² is opened and current is supplied to motor **7** to effect travel of the truck; if the controller is moved to finger **2**′ position or succeeding finger positions, finger **1**′ is cut out so that the controller cannot be reversed to a lower speed position and then moved to a high speed position without first moving it to finger **1**′ position.

To tilt the elevating mechanism about the trunnions **10** or to raise the load carrier, the adjacent lever is operated, which operation (*a*) closes switch K to energize the coil of relay KB, whereby switch KB′ is closed to close circuit **17***a* for pump motor **17** and (*b*) operates the adjacent valve to supply the liquid under pressure to the cylinder of the mechanism to be operated, dependent on which lever was operated. Where the proposed operation is to raise and transport a load—for example, a load on a pallet, with the elevating member **12** in lowered position, the truck is driven forward to project the forks **12***b* into the pallet; next, the lever is operated to close switch K whereby switch KB′ will be closed by relay KB, the motor **17** will drive the pump and the valve connected with the adjacent lever will be opened to supply liquid under pressure to the cylinder and raise the elevating member, whereby the forks **12***b* will engage the pallet and raise it and the load thereon. However, if the load exceeds the rated carrying capacity of the truck (or such limit as may be set by the adjustment of the rest **22** to permit a predetermined movement of the abutments **16***x*), the load will react on the forks and effect a tilting of the chassis **2** as shown in Figs. 1, 5 and 6, where it will be noted that the abutments have moved upwardly relative to the member **15**′ and opened switch **19***a*. It will thus be seen that upon opening of switch **19***a*, coils of relays KA and KB are de-energized and switches KA′, KA″ and KB′ are opened to cut off the supply of current to motors **7** and **17** and thereby prevent raising of the elevating member, tilting of the mechanism and truck travel. This inoperative condition will continue until the load is removed from the forks **12***b* or the load is reduced to or below the load limit.

Fig. 8 illustrates a modified circuit wherein the lead **27**, in which switch K is connected, is connected to lead **26** at a point outwardly of the switch **19***a*, so that in the event of an overload on the carrier and operation of switch **19***a*, switches KA′ and KA″ are opened to cut off supply of current to motor **7**, but switch KB′ remains closed to permit operation of motor **17**.

Fig. 9 shows another modified circuit, similar to the circuit shown in Fig. 8, except that the switch **19***a* is connected in a lead **26**′ in which a time delay coil **28** is connected for controlling a normally closed switch **28***a*, whereby the circuits to motors **7** and **17** are maintained closed for a limited time period, to take care of a momentarily upward movement of the abutments **16***x* relative to the member **15**′ and prevent opening of switch **19***a* resulting from rough surface conditions during truck travel.

Figs. 10 and 11 illustrate a modified form of construction wherein the outer end portions **6***a* of the axle supporting members **14**, **14***a*, are non-rotatably mounted in resilient seat members **29**, which in turn are enclosed in casings **30**, **30***a*, but the latter are suitably fixed (preferably welded) to the walls **1***b*, **1***c*, respectively, of the chassis **2**; in this arrangement, when an overload is positioned on the carrier the resilient seat members **29** permit relative movement between the chassis **2** and supporting members **14**, **14***a*, due to tilting of the chassis about the axle for the front wheels **3** and operate the normally closed switch **19***a*, whereby the mechanisms cannot be operated as hereinbefore described. As the compression of the seat members **29** limits the tilting movement of the chassis as compared to that in the form of construction shown in Figs. 1 to 6, by employing a multiplying leverage system, indicated as an entirety at **31**, the switch **19***a* is readily controlled. The system **31** consists of the following: **31***a* indicates a bracket suitably fixed to the inner side of the chassis wall **1***b* and disposed above the adjacent casing **30**. **32** indicates a support pivotally mounted at its upper end adjacent the upper end of the bracket **31***a* and depending downwardly and adapted to be adjustably related to the wall **1***b* by a screw **32***a* for a purpose later set forth. **33** indicates a housing fixed to support **32** and enclosing the normally closed switch **19***a* which is controlled by an outwardly spring biased plunger **33***a* to close and open the circuit for the switch. **34** indicates a resilient metallic strip suitably fixed to the top wall of the housing **33** inwardly of the plunger **33***a* and extending outwardly in alinement with and engaging the latter for holding the plunger inwardly, as later set forth, whereby the circuit for the switch is closed. **35** indicates an elongated lever the inner end of which is pivotally mounted at **35***a*′ on a bracket **35***a* suitably fixed to the inner side of the chassis wall **1***c*. The outer end portion of the lever **35** engages the outer end portion of the resilient strip **34** and operates to maintain the strip under spring tension in a predetermined position, whereby the plunger **33***a* is maintained in switch closing position. **36** indicates as an entirety an adjustable fulcrum for the lever **35** consisting of the following: **36***a*, **36***b*, indicate upper and lower endwise related members, the inner ends of which are adjustably connected together for a purpose later set forth, the lower end of the member **36***b* being pivotally seated on the bottom wall of an inwardly extending recess **37** formed in the axle supporting member **14**. The recess **37** is enlarged to permit swinging movement of the members **36***a*, **36***b*. The upper end of the member **36***a* is pivotally connected to the lever **35**. A spring **38**, which is suitably anchored at its opposite ends to the member **14** and lever **35** between the fulcrum **36** and strip **34**, serves to bias the lever **35** downwardly and co-operates with the bracket **35***a* to maintain the member **36***b* in its seat in the recess **37**. As will be observed, when the chassis is tilted about the axle for the wheels **3**, the rear end portion of the chassis **2** and supporting members **14**, **14***a*, move upwardly, the end portions **6***a* of the latter in turn operating to compress the lower walls of the seat members **29**, so that relative movement between the walls **1***b*, **1***c*, and supporting members **14**, **14***a*, takes place, the effect of which is to swing the outer end of the lever **35** upwardly, thereby relieving tension on the resilient strip **34** and permitting the plunger **33***a* to move outwardly, such movement of the plunger serving to open the switch **19***a* and break the circuit **7***x*. It will also be observed that the fulcrum **36** for the lever **35** is located in close relation to the pivot **35***a*′ for the latter to insure an adequate range of movement of the outer end of the lever. As the relative movement between the chassis and the axle supporting members **14**, **14***a*, incident to overloading conditions, is limited, I provide separate correlated adjustment means for the switch housing **33** and fulcrum on which the lever **35** rocks, whereby, with the chassis **2** in normal position, the strip **34** is maintained by the lever **35** in a predetermined relation to the switch plunger **33***a*, so that the latter may be effective to open the switch **19***a* upon rocking movement of the

lever 35. One of the adjusting means consists of the screw 32*a* (already referred to) the adjustment of which positions the support 32 relative to the chassis wall 1*b*, the support 32 being fixed to the bracket 31*a* in adjusted position by a screw 32*a'* extending through an elongated arcuate slot 32*x* and threaded into an opening formed in the bracket 31*a*, such adjustment serving to raise or lower the switch housing 33 and support the latter in the desired position. The adjusting means 36*x* between the fulcrum members 36*a*, 36*b*, serve to increase or decrease the length of the fulcrum 36, whereby the latter co-operates with the pivot 35*a'* to support the lever 35 in that position wherein its outer end, through its engagement with the resilient strip 34, maintains the switch plunger 33*a* in switch closed position.

The adjustment means 36*x* preferably consist in enlarging the upper end of the member 36*b* and forming therein an inwardly extending screw threaded opening 39 and providing screw threads on the inner end portion of the member 36*a* for adjustable engagement with the screw threads in the opening 39, as shown in Fig. 11. The members 36*a*, 36*b*, are secured together in adjusted position by a nut 40 threaded on the member 36*a* and a lock nut 40*a*.

Fig. 12 is a diagram showing a modified circuit for the travel motor, switch controls for the chassis tilting mechanism and raising mechanism for the elevating member, and wherein the normally closed switch 19*a* is ineffective where, during travel of the truck in transporting a load within the rated capacity thereof, the wheels 3 traverse rough surfaces and cause a bumping of the load. In this view, the motor 7 is connected in the circuit 41 controlled by the controller 7*a*. The circuit 41 includes a lead 42 having branches 42*a*, 42*b*, and branch 42*b* being connected to lead 44, in which the normally open switch 7' (controlled by the driver's seat) is connected. The overload normally closed switch 19*a* is provided in branch 42*b*, whereas the accelerator switch 21 is provided in branch 42*a*. In the neutral position of the controller 7*a*, main contacts KA of a contactor KA' and switches C1 and C2 are open. If an overload is on or engaged by the carrier for the purpose of raising the latter and the load, switch 19*a* opens and breaks the circuits for the travel motor 7 and pump motor 17. To effect truck travel, with the seat switch 7' closed, lever 9 is initially operated to insure travel forward or reawardly and next the accelerator pedal 7*b* is operated to first position, contact on controller engages finger 1, switches C1 and C2 (which are cam operated to closed position similarly to switch 7*c'*—see Fig. 1) close thereby energizing contactor KA' to close the contacts KA to complete a circuit through resistors and motor 7. Contacts KA and KD are mechanically interlocked, so that when KA closes KD opens; truck travels in the direction selected by operation of lever 9. If accelerator pedal 7*b* is returned to off position, switch C2 opens, thereby breaking the control circuit. However, if truck travel in first speed position continues and pedal 7*b* is moved to second speed position, switch C1 opens, but circuit is maintained through now closed normally open contacts KA'' of contactor KA' and fingers R4 and R5 are connected together shorting out a section of the resistance; in the third speed position, finger R3 is connected to fingers R4 and R5, thereby shorting out another section of the resistance; in the fourth speed position finger R2 is connected to fingers R4, R5 and R3, thereby shorting out all external resistance; in the fifth speed position, finger R1 is connected to fingers R2, R3, R4 and R5, thereby inserting a resistance in parallel with the motor field, effecting truck travel at maximum speed. To effect dynamic braking, lever 9 is moved to its opposite position, thereby reversing the current through motor armature and finger 1 disengages contact on controller, contactor KA' is deenergized opening its contacts KA and KA'', and switch KD (which is spring loaded to close) closes. Truck speed cannot again be accelerated until controller is returned to first speed position. As the circuit is completed through the switch 21 in the second, third, fourth and fifth speed positions, switch 19*a* is ineffective in the event of load bumping.

To those skilled in the art to which my invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. My disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

What I claim is:

1. In a vehicle having a frame assembly, means for supporting one end of said frame assembly comprising a wheel, means for connecting said wheel to said frame assembly including a longitudinal member extending longitudinally of said frame assembly, means connecting one end of said longitudinal member to said frame assembly and comprising a cross member carried by said longitudinal member at said one end thereof and extending transversely thereof and on opposite sides thereof, abutment means fixed to said frame assembly on opposite sides of said longitudinal member, said cross member being positioned below said abutment means, means connecting said abutment means and said cross member for limited relative movement from a position in engagement with each other, spring means operatively connected between said abutment means and said cross member for urging said abutment means and said cross member apart and yieldable to permit engagement thereof, said spring means urging said abutment means and cross member to produce relative movement therebetween and separation thereof upon upward tilting movement of said one end of said frame assembly due to a load applied to said frame assembly at the opposite end thereof, a switch device, a switch actuating device for said switch device, means operatively connecting one of said devices to said frame assembly for movement therewith, and means operatively connecting the other of said devices to said longitudinal member for movement therewith, said switch actuating device operating said switch device upon a predetermined relative movement between said abutment members due to said upward movement of said frame assembly.

2. In a vehicle having a frame assembly, means comprising a wheel for supporting one end of said frame assembly, an axle assembly including a longitudinal member operatively connected to said wheel and extending longitudinally of the frame assembly, and means operatively connecting said longitudinal member to said frame assembly comprising a casing having a resilient seat member therein, said seat member having an opening therein for receiving one of the end portions of said longitudinal member, an abutment means on said frame assembly, said casing having a part movable therewith for cooperating with said abutment means in supporting said frame assembly, spring means operatively connected between said frame assembly and said casing for urging said casing and said part away from said abutment means, means for limiting the movement of said abutment means and said part in a direction away from each other, a switch device, a switch actuating device, means operatively connecting one of said devices to said longitudinal member for relative movement therewith with respect to said frame assembly and means operatively connecting the other of said devices to said frame assembly, said switch actuating device being operable to actuate said switch device upon a predetermined relative movement between said devices.

3. In a vehicle having a frame assembly, means comprising a wheel for supporting one end of said frame assembly, an axle assembly including a longitudinal member operatively connected to said wheel and extending longitudinally of the frame assembly, and means operatively connecting said longitudinal member to said frame

assembly comprising a casing having a resilient seat member therein, said seat member having an opening therein for receiving one of the end portions of said longitudinal member, an abutment member on said frame assembly, a transverse member carried by said longitudinal member adjacent to said casing and positioned below said abutment member, means interconnecting said abutment member and said transverse member for limited relative movement and comprising spring means for urging said transverse member from said abutment member, a switch device, a switch actuating device, means operatively connecting one of said devices to said longitudinal member for relative movement therewith with respect to said frame assembly and means connecting the other of said devices to said frame assembly for movement therewith, said switch actuating device being operable to actuate said switch device upon a predetermined relative movement between said devices.

4. In a vehicle having a frame assembly, means comprising a wheel for supporting one end of said frame assembly, an axle assembly including a longitudinal member operatively connected to said wheel and extending longitudinally of the frame assembly, and means operatively connecting said longitudinal member to said frame assembly comprising a casing having a resilient seat member therein, said seat member having an opening therein for receiving one of the end portions of said longitudinal member, spaced horizontally aligned members on said frame assembly on opposite sides of said longitudinal member, a generally horizontal transverse member carried by said longitudinal member and extending transversely of said longitudinal member on opposite sides thereof below said aligned members carried by said frame assembly, means interconnecting said aligned members and said transverse member for limited relative movement, spring means operatively connected between said aligned members and said transverse member for urging the transverse member and the aligned members in a direction away from each other and yieldable to permit engagement thereof, a switch device, a switch actuating device, means operatively connecting one of said devices to said longitudinal member for relative movement therewith with respect to said frame assembly and means operatively connecting the other of said devices to said frame assembly, said switch actuating device being operable to actuate said switch device upon a predetermined relative movement between said devices.

5. In a vehicle having a frame assembly; a pair of wheels for supporting one end of said frame assembly; an axle assembly including a longitudinal member intermediate and operatively connected to said wheels and extending longitudinally of the frame assembly; and means operatively connecting said longitudinal member to said frame assembly comprising a first and second casing each having a resilient seat member therein and respectively disposed adjacent to opposite end portions of said longitudinal member, said seat members each having an opening therein for receiving the adjacent end portion of said longitudinal member, means connecting said first casing to said frame assembly, and means operatively connecting the other of said casings to said frame assembly comprising abutment means on said frame assembly on opposite sides of said longitudinal member, a generally horizontal transverse member carried by said longitudinal member and extending transversely of said longitudinal member on opposite sides thereof below said abutment means carried by said frame assembly, means interconnecting said transverse member and said abutment means for limited relative movement, spring means operatively connected between said abutment means and said transverse member for urging the latter in a direction away from the abutment means and yieldable to permit engagement of said transverse member and said abutment means; a switch device; a switch actuating device; means operatively connecting one of said devices to said longitudinal member for relative movement therewith with respect to said frame assembly; and means operatively connecting the other of said devices to said frame assembly; said switch actuating device being operable to actuate said switch device upon a predetermined relative movement between said devices.

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