United States Patent

[11] 3,557,709

[72] Inventors **Karl E. Hülfing**
Ornskoldsvik;
Nils Artur Pettersson, Sidensjo, Sweden

[21] Appl. No. **763,069**
[22] Filed **Sept. 27, 1968**
[45] Patented **Jan. 26, 1971**

[73] Assignee **Aktiebolaget Hagglund & Soner**
Ornskoldsvik, Sweden
a corporation of Sweden

[54] **RAILWAY CAR**
2 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **105/199,**
105/197, 105/200, 105/208
[51] **Int. Cl.** **B61f 3/04,**
B61f 5/10, B61f 5/20
[50] **Field of Search** 105/141,
208.1, 208.2; 197, 199, 200, 208

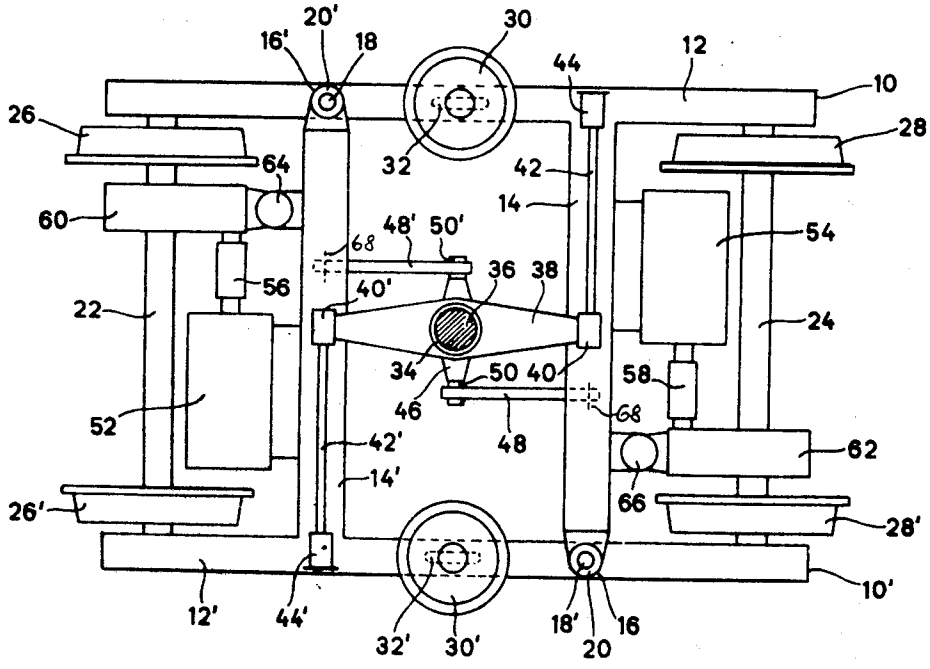
[56] **References Cited**

UNITED STATES PATENTS

2,515,812	7/1950	Waldvogel et al.	105/199
3,012,521	12/1961	Lich	105/141
3,398,700	8/1968	Baker	105/208.2
3,427,993	2/1969	Lich	105/197

Primary Examiner—Arthur L. La Point
Assistant Examiner—Howard Beltran
Attorney—Richards & Geier

ABSTRACT: A railcar has a bogie with front and rear frame sections, each of which has a frame consisting of two T-shaped elastically interconnected transoms, while the car body is supported upon the two frameworks by pneumatic springs connected in series with helical steel springs. The present invention is particularly characterized in that the pneumatic and helical springs are rigidly fixed at their interconnections to the outer ends of a U-shaped yoke the central portion of which consists of a torsionally stiff body extending the entire width of the car; this element is subject to torsion and is rotatably mounted in the car body. The cross-sectional central plane of the frame sections is shifted in the direction toward the corresponding end of the car body, whereby the forces exerted upon the car body are transmitted to the frame section through a pin rigidly fixed in the car body and coupling rods provided upon the upper end of the pin and extending transversely to the direction of motion. The acceleration forces between the frame section and the car body are transmitted from the lower end of said pin and through a contact point located upon the framework, the height of which above the edge of the rails is approximately equal to the height of the free passage of the frame section.



PATENTED JAN 26 1971

3,557,709

SHEET 1 OF 4

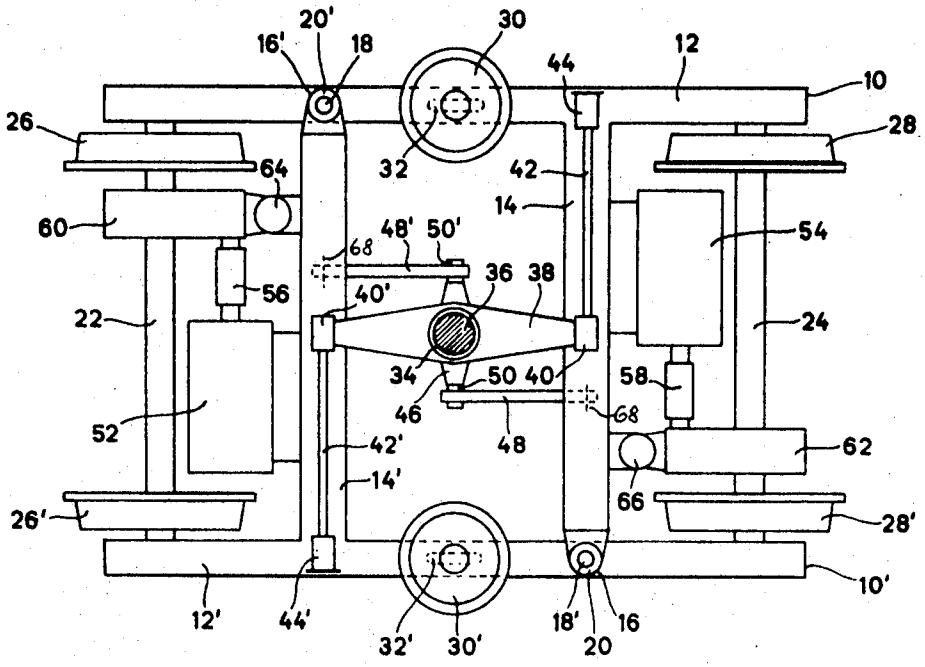
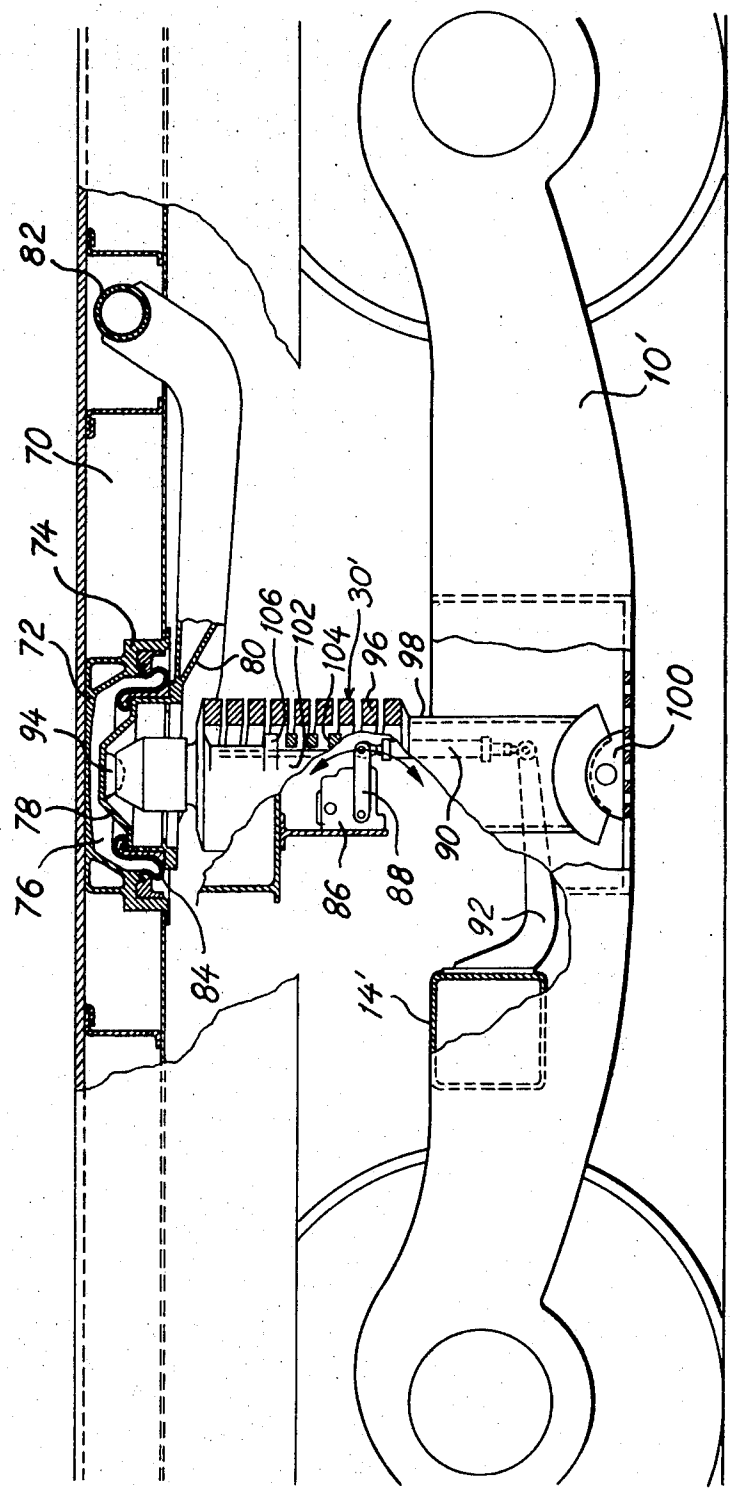


FIG. 1

INVENTORS
K. E. Hilfing and N. A. Pettersson
BY Richards & Geier
ATTORNEYS

FIG. 2

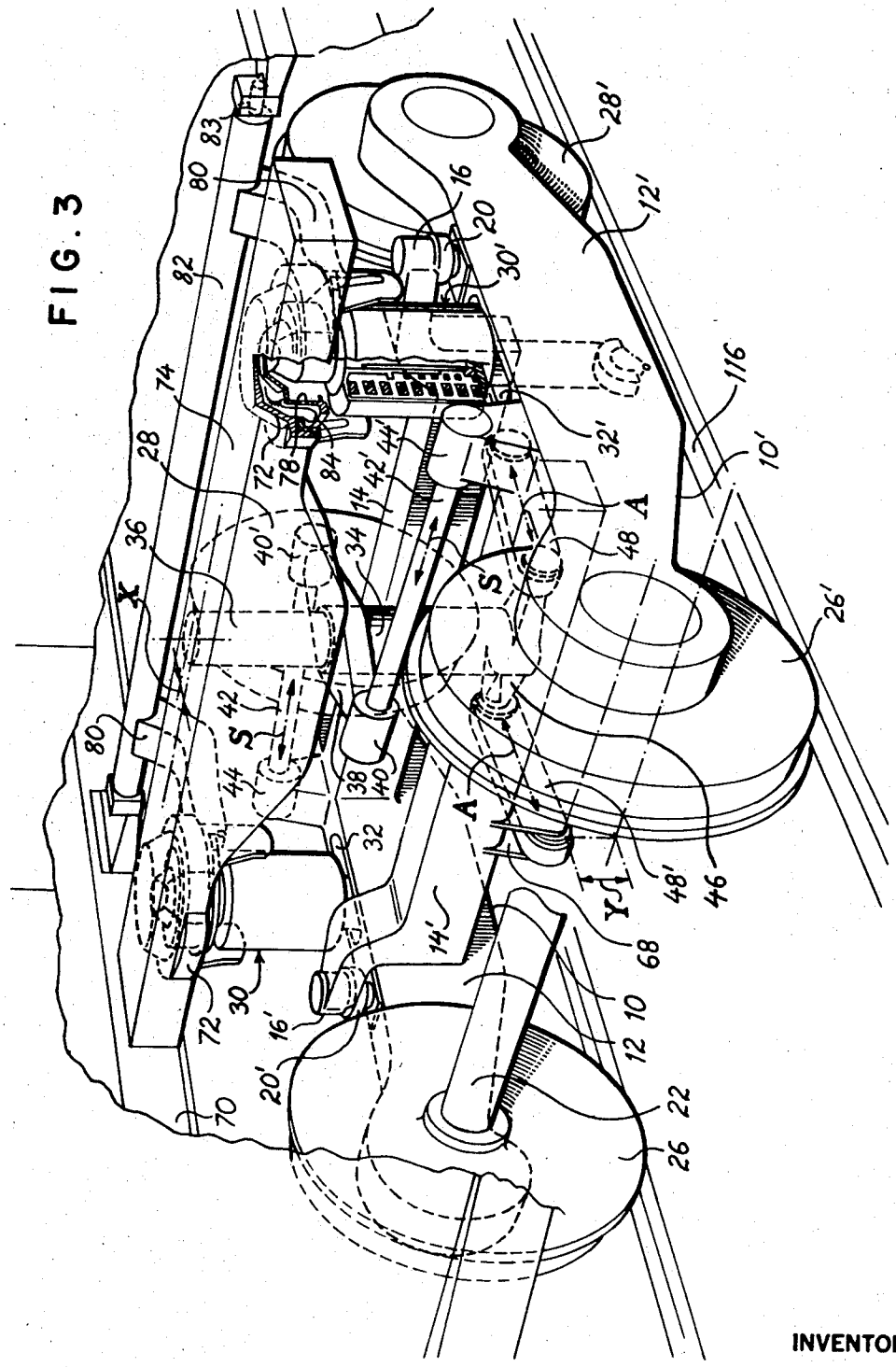


INVENTORS

K.E. Hilfing and N.A. Pettersson

BY Richards & Geier
ATTORNEYS

FIG. 3



INVENTORS

K. E. Hilfing and N. A. Pettersson

BY Richards & Geier

ATTORNEYS

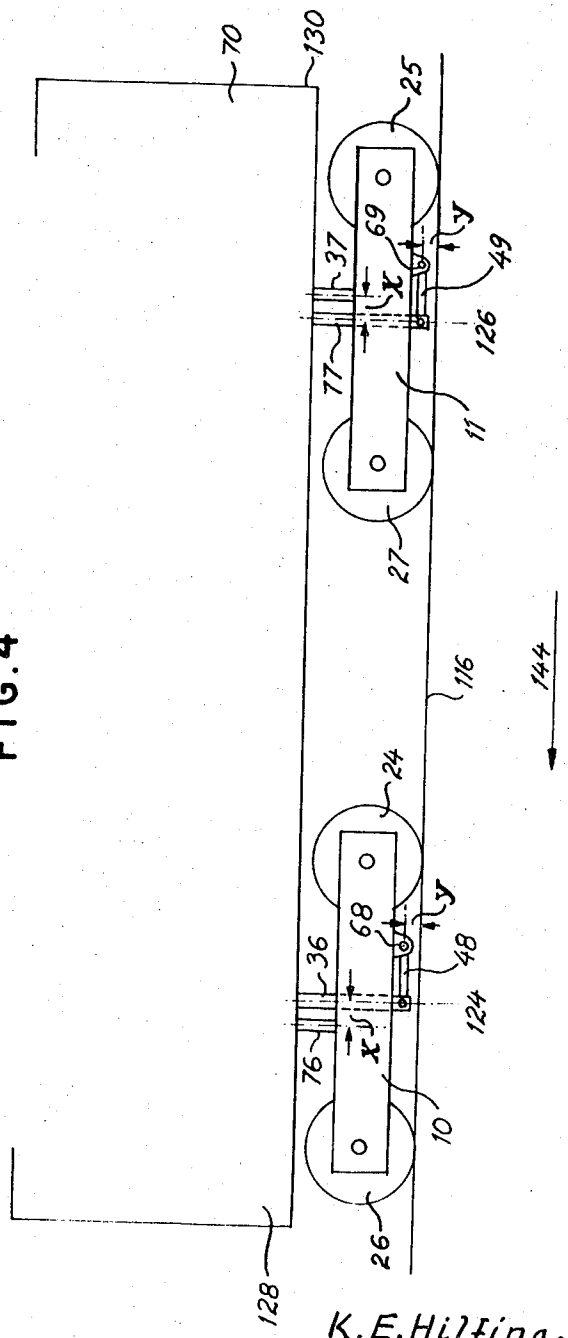


FIG. 4

INVENTORS

K. E. Hilfing and N. A. Pettersson

BY Richards & Geier

ATTORNEYS

RAILWAY CAR

DESCRIPTION OF THE INVENTION

This invention relates to rail cars having a frame consisting of two T-shaped elastically interconnected frame sections, the car body being supported upon two frameworks by pneumatic springs connected in series with helical steel springs.

Prior art cars of this type have numerous drawbacks which make difficult the operation of cars. Furthermore, the convenience provided for the passengers is not in conformity with the present day requirements. This is caused partly by the fact that, when pneumatic springs are used, their synchronous operation is possible only with great difficulty, since in the case of impacts each pneumatic spring swings by itself so that the car body has a tendency to roll. The quick start and braking, required by high speeds and short stops at stations, increase the danger that the wheels will slide upon rails. This produces a nonuniform wear of the wheels, since in case of a high negative or positive acceleration the axle pressure is not distributed uniformly and those wheels which are subjected to the least axial pressure begin to slide. These drawbacks greatly diminish the safety and the convenience of traveling and have as their consequence that the speed cannot be raised to the desired extent in order to be able to introduce a timetable having high speeds.

An object of the present invention is to eliminate these drawbacks to the greatest possible extent.

Another object is to increase the safety, speed and convenience of railcars.

A further object is to provide a railcar which will satisfy modern requirements.

Other objects will become apparent in the course of the following specification.

In the accomplishment of the objectives of the present invention it was found desirable to attach the connections between pneumatic and helical springs to outer ends of a U-shaped yoke, the central portion of which consists of a pipe extending the entire width of the car and rotatably mounted in the car body. Side forces exerted upon the car body are transmitted to the framework through a pin rigidly fixed in the car case and transverse coupling rods provided upon the upper end of the pin. Acceleration forces are transmitted from the lower end of this pin.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawings, showing by way of example, a preferred embodiment of the inventive idea.

IN THE DRAWINGS

FIG. 1 is a top view of a car framework constructed in accordance with the present invention.

FIG. 2 is a side view, partly in section.

FIG. 3 is a perspective view, also partly in section.

FIG. 4 is a diagrammatic side view showing parts distributing static and dynamic forces.

The railcar shown in the drawings has a bogie consisting of substantially equal side frame parts **10** and **10'** with elongated beams **12** and **12'**, respectively, as well as transverse beams or transoms **14** and **14'** rigidly connected to the beams **12** and **12'**, respectively, thereby providing two T-shaped sections. The transverse beam **14** is pivotally and elastically connected to the beam **12'** by a sleeve **16** enclosing a pin **18'** which is fixed to the beam **12'**. The beam **14'** is similarly connected to the beam **12** by a sleeve **16'** and a pin **18**. The spaces between the sleeves **16**, **16'** and the pins **18**, **18'** are filled with rubber sleeves **20** and **20'**, respectively. Thus the transverse beams **14** and **14'** have the capacity of an elastic movement upwardly and sidewise in relation to the longitudinal beams **12'** and **12**.

The ends of the longitudinal beams **12** and **12'** carry bearings for the axles **22** and **24** which carry pairs of wheels **26**, **26'** and **28**, **28'**, respectively. The bearings for the wheels are elastically mounted so that the axles have a certain freedom of movement in relation to the longitudinal beams **12** and **12'**. Due to the T-shape of the frame parts **10** and **10'** and their elastic connection, and also due to the elastic arrangement of the axle bearings in the frame parts, each wheel can be separately set upon the rails depending upon the height of the point of contact, with the result that pressure upon the rails is balanced to a great extent.

The car body **70**, best shown in FIG. 3, is mounted upon two spring suspensions **30** and **30'** which will be described in detail thereinafter. The spring suspensions **30** and **30'** are somewhat shifted in relation to the transverse central plane between the axles **22** and **24** for that purpose, two slots **32** and **32'** are provided in the longitudinal beams **12** and **12'**, respectively. While the weight of the body **70** is received by the spring suspensions **30** and **30'**, a pin **36** is used for the transmission of traction, acceleration and side forces between the body and the frame. The pin **36** extends telescopically into a sleeve **34** fixed to the frame. The upper end of the sleeve **34** is rigidly connected with a double arm **38** extending in the longitudinal direction of the body and having two ends which are shaped as rings **40** and **40'**, respectively. Transversely extending coupling rods **42** and **42'** extend into these rings, while their other ends extend into rings **44** and **44'**. The ring **44** is rigidly fixed to the longitudinal beam **12**, while the ring **44'** is rigidly fixed to the longitudinal beam **12'**. Rubber sleeves (not shown) are located between the ends of the rods **42** and **42'** and the inner surfaces of rings **40**, **40'**, **44** and **44'** which surround them so as to provide an elastic connection.

The double arm **38** and the coupling rods **42** and **42'** are used to transmit the side forces S of the body **70** (FIG. 3) to the frame. The lower end of the sleeve **34** is integral with a second transverse double arm **46** the two ends of which are elastically connected with separate longitudinally extending coupling members **48** and **48'**; these members engage brackets **68** which are fixed to the beams **14** and **14'** and extend below these beams. The point of contact of the coupling member **48** and **48'** with the brackets **68** is located only slightly above the upper edge of the rails **116** and is so low that it provides a free height Y for the movement of the framework. Rubber sleeves **50**, **51** are located between the double arm **46** and the two coupling members **48**, **48'** so as to provide an elastic connection.

The two wheel axles **22** and **24** are driven by separate motors **52** and **54** (FIG. 1), which are fixed to the transverse beams **14'** and **14**, respectively. The motors are connected by elastic couplings **56** and **58** and gear drives **60** and **62** with their respective axles **22** and **24**. The drives **60** and **62** are connected by rubber springs **64** and **66** with the transverse beams **14'** and **14**, respectively.

As shown in FIG. 2, the spring suspensions **30** and **30'** are constructed as follows:

A transverse beam **74** is fixed to the bottom of the car body **70** and has two ends shaped as shells **72** for pneumatic bellows **84**. A lower connecting member having the shape of a reversed smaller bell-like shell **78** engages each shell **72** and is mounted upon an outer end of a stabilizer arm **80**. The opposite end of the arm **80** is rigidly fixed to a torsion tube **82**. The tube **82** is supported at both ends by pivots **83** upon the bottom of the body **70** (FIG. 3). The arms **80** and the tube **82** constitute jointly a U-shaped torsional yoke which interconnects the two inner shells **78** of the pneumatic springs. The pneumatic bellows **83** located between the outer shells **72** and the inner shells **78** can consist, for example, of so-called roller bellows, so that the vertical distance between the shells **72** and **78** can be varied to a comparatively large extent, whereby the inner shell **78** with the arm **80** is swung about the pivots of the torsion tube **82**. This swinging movement is not detrimentally affected by the torsion tube **82**, provided that the movement of the two inner shells **78** is carried out synchronously and in the same manner. When deviations from this uniform movement take place, the two arms **80** are turned relatively to each other, so that the tube **82** is subjected to torsion. The torsion tube **82** is so constructed that the relative movement of the two arms **80** is small, so that the movement of the two inner

shells **78** can be considered as being substantially the same or synchronous. The purpose of the torsion tube **82** is to stabilize the car against rolling. Due to the provision of the torsion tube, the two pneumatic springs in each framework can communicate with each other and this assures an advantageous distribution of pressure upon the wheels and thus greatly diminishes the danger of skidding and derailing.

A level valve **86** is provided to maintain an essentially constant distance between the car body **70** and the frame **10** irrespective of the load upon the car body **70**. The valve **86** is connected to a source of compressed air (not shown) and it regulates air pressure within the interior **76** of the pneumatic springs in such manner that the distance between the car body and the frame remains the same. In the direction of retardation, the valve **86** is provided with a delaying device in the shape of an oil damper, so that a delay in opening and closing of about 3 seconds can be attained. The valve **86** is actuated by a setting arm **88** which is connected by an adjustable spring member **90** with a bracket **92** provided in the transverse beam **14'** of the frame.

The inner shell **78** of the pneumatic springs is supported by a ball joint **94** upon a coiled steel spring **96** which rests by a supporting member **98** and a rubber piece **100** upon the bottom of the hollow longitudinal beam **10'**. A shock absorber **102** is provided within the coiled spring **102**. After a certain compression of the spring **96**, a further spring **104** becomes effective. The spring **104** is located between the supporting member **98** and a flange **106** provided in a sleeve which extends downwardly from the upper end of the coiled spring **96**.

FIG. 4 shows that the points of engagement of the static and dynamic car forces on the frames are arranged in a special way. The axis of the combined pneumatic and coiled springs **76, 77** is shifted from the central planes **124** and **126** of the frames **10** and **11** to the extent of the distance *x* toward the respective outer ends **128** and **130** of the car case **70**. The reason for that is as follows:

Obviously, the springs **76** and **77** have only the task of transmitting the vertical weight of the car body **70** upon the frames **10** and **11**. On the other hand, in the case of a positive and negative acceleration of the car, the horizontal dynamic forces which are then produced are transmitted from the car body **70** to the frames by pins **36** and **37** which are rigidly fixed to the case **70** and the transverse beam **74**, respectively, the pins engaging by their coupling members the brackets **68, 69**.

When the braking or driving torque upon all wheel axles is the same, the maximum acceleration value of the car depends upon the axle which is subjected to the least wheel pressure. Acceleration must not exceed this specific highest value, since otherwise the wheel will slide upon the rail. Furthermore, during braking when the wheel is blocked, the wheel surface at the contact location is ground off and flattened, which is highly undesirable since it produces a nonuniform movement with shocks. It is, therefore, of great importance that the smallest permissible axial pressure should be as great as possible, namely, that the distribution of axial pressure should be as uniform as possible.

In prior art frames wherein the stretch *x* is equal to 0 and *y* is, for example, 0.6 meters, when the car moves in the direction of the arrow **144** and a negative acceleration, that is braking, takes place, axial pressure of the pair of wheels **25** is the smallest and axial pressure of the pair of wheels **26** is the greatest. This is caused partly in that the pressure upon the frame **10** is increased and the pressure upon the frame **11** is diminished and partly in that the distribution of pressure within the frames **10, 11** causes an increase of pressure upon the front pairs of wheels **26, 27** and a diminution of pressure upon the rear pairs of wheels **24, 25**. In the case of positive acceleration, such as when starting the car, and when the points of contact are unchanged, a reverse condition takes place, that is, the greatest axial pressure is upon the pairs of wheels **25** and the smallest axial pressure is upon the pairs of wheels **26**. However, in accordance with the present invention the points of contact of the weight of the car case **70** upon the two frameworks **10** and **11** are shifted, namely, in case of the front framework **10** in the direction of the adjacent end of the car body **70** and in the body of the rear framework **11** in the direction of the rear end of the car body. At the same time the points of contact of the dynamic acceleration forces are shifted toward the rails **116** to the extent possible for the free movement of the frameworks so that, for example, *y* is equal to 20 centimeters above the upper surface of the rails. These features of the present invention greatly improve the axial pressure conditions, namely, the distribution of axial pressure values becomes considerably more uniform. By selecting optimal values for *x* and *y*, namely, for the more often appearing values for positive and negative acceleration and for the average car body load, a substantial improvement over prior art constructions of this type is achieved so that the speed of the car can be greatly increased; at the same time the maintenance costs for the car are noticeably reduced and the comfort of the traveling passengers is considerably raised by the greater stability of the car, soft spring mounting by the pneumatic springs and small travel noises.

It is apparent that the described example is subject to many variations and modifications within the scope of the present invention.

We claim:

1. A railcar comprising a bogie having two elongated parallel side beams and two parallel transverse beams, one of said transverse beams having an end firmly connected to one of said side beams, the other transverse beam having an end firmly connected to the other one of said side beams, means pivotally and elastically connecting the other end of said one transverse beam to said other side frame, means pivotally and elastically connecting the other end of said other transverse beam to said one side frame, a car body, two superposed vertically extending spring suspension devices, one of said spring suspension devices having a top end connected to said car body, the other one of said spring suspension devices having a bottom end connected to said one transverse beam, two other superposed vertically extending spring suspension devices, one of the last-mentioned spring suspension devices having a top end connected to said car body, the other one of the last-mentioned spring suspension devices having a bottom end connected to said other transverse beam, the first-mentioned two-spring suspension devices and the last-mentioned two-spring suspension devices having a common vertical central transverse plane which is shifted in the direction toward the end of the car nearest thereto relatively to the vertical transverse plane extending through the middles of said transverse beams, a U-shaped torsional yoke comprising a torsion tube pivotally carried by said car body and two arms, one of said arms having an end rigidly fixed between the two first-mentioned spring suspension devices, the other one of said arms having an end rigidly fixed between the two last-mentioned spring suspension devices, whereby said ends of the two arms can move vertically but can not move horizontally, a telescopic vertical member located centrally between said side beams, a double arm extending in the longitudinal direction of the car and firmly connected to opposite sides of said telescopic member, two coupling rods, extending transversely to the direction of the car a ring connecting one end of one of said coupling rods with one end of said double arm, another ring connecting one end of the other one of said coupling rods with the other end of said double arm, yet another ring connecting the other end of said one coupling rod with one of said side beams, a further ring connecting the other end of said other coupling rod with the other one of said side beams, the top of said telescopic vertical member being connected to said car body, whereby side forces of said car body are transmitted to said beams, another double arm located below the first-mentioned double arm, extending transversely to the direction of the car and firmly connected to opposite sides of said telescopic member, two coupling members, extending in the direction of the car each of said coupling members having an end connected to a different end of said other double arm, and

two brackets, each of said brackets being connected to different transverse beam and located below the beam, said coupling members having other ends connected with said brackets and situated at a height from the ground which is substantially equal to the free passage height of the bogie.

2. A car in accordance with claim 1 wherein said spring suspension devices comprise pneumatic springs and coiled steel springs.