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SPRUNG AXLE ASSEMBLY AND METHOD FOR TOY VEHICLES

Filed April 15, 1969

Fig. 1

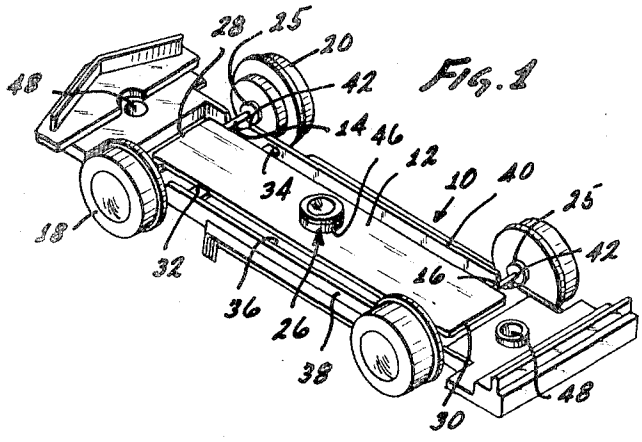


Fig. 2

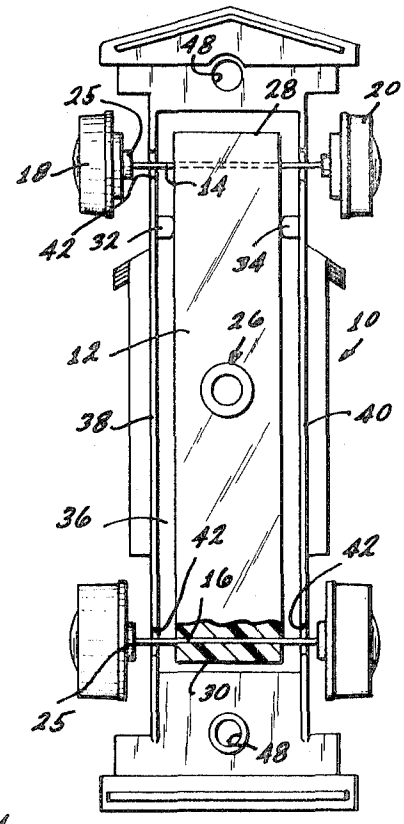


Fig. 4

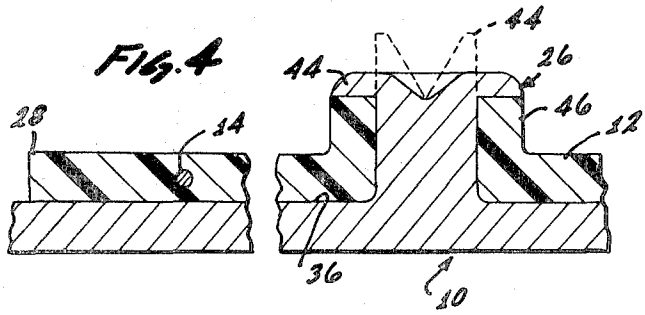
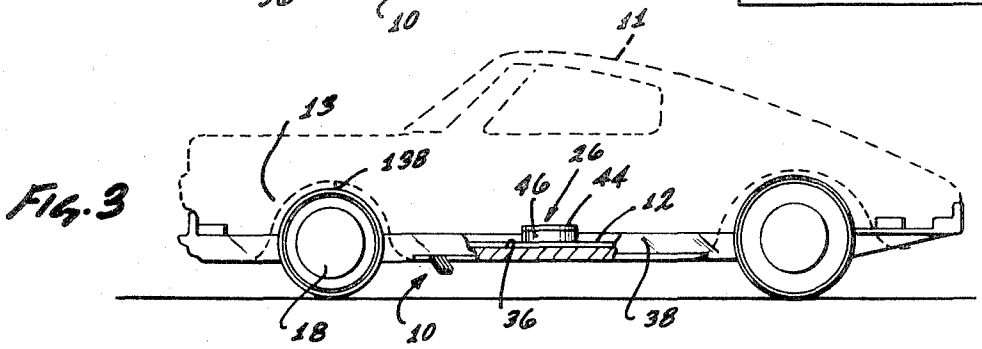


Fig. 3



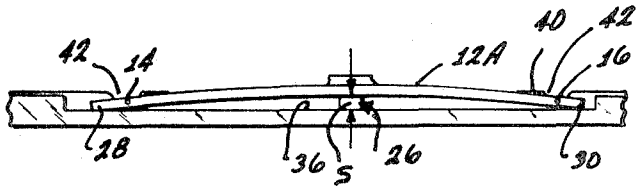
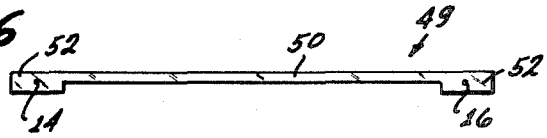


Fig. 5

Fig. 6



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SPRUNG AXLE ASSEMBLY AND METHOD FOR TOY VEHICLES

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Int. Cl. A63h 11/10
U.S. Cl. 46—201 11 Claims

ABSTRACT OF THE DISCLOSURE

A toy vehicle in which axle wires are molded into a thin block of resilient plastic to keep the axles well aligned. The block is attached to the vehicle frame at its center, so the opposite ends wherein the axles are held are free to deflect upwardly, thereby permitting greater wheel deflection by a child pressing down on the vehicle without causing deflection of the axles past their elastic limit.

BACKGROUND OF THE INVENTION

Field of the invention

This invention relates to toy vehicle apparatus and construction methods.

Description of the prior art

Unpowered toy vehicles of the type which may be started down an incline so as to gain speed for traversing a long track layout, can be made to run considerably faster by design features that reduce friction to a minimum. One way of reducing friction is to provide very narrow diameter axles on which wheels are rotatably mounted. However, precautions must be taken to prevent a child from breaking the axles when he presses down on the car. One way of preventing such breakage is to provide a long bent axle that can readily deflect until the wheels abut the fenders, or in other words, the fenders "bottom" on the wheels. Great care must be taken in bending and installing such axles, or else the wheels may be misaligned (not run straight ahead) which results in friction that slows the vehicle. Care must also be taken to make sure that all four wheels are installed at the same level so the car is stably supported on all four wheels. The complexity and close tolerances required to achieve low friction can add appreciable cost to the vehicle and decrease its ruggedness.

OBJECTS AND SUMMARY OF THE INVENTION

One object of the present invention is to provide a wheel suspension for toy vehicles which is simple, rugged and of low cost, and which produces a minimum of friction.

Another object is to provide a simple and rugged toy vehicle with wheels mounted for low bearing friction and good alignment.

In accordance with the present invention, a toy vehicle is provided in which axle wires are molded into a resilient axle-holding member. The axle-holding member is attached to the vehicle frame at a position spaced from the axle wires so that the portion containing the axle wires is free to deflect. This allows some of the wheel deflection, which occurs when a child presses down on the vehicle until the fenders bottom on the wheels, to be taken up by the resilient member so the axle is not deflected beyond its elastic limit.

In one embodiment of the invention, the axle-holding member is a thin solid block of plastic and the axle portions for all four wheels are molded into it. This enables the axle-holding member to retain all four axles in accurate alignment with each other over the life of the vehicle.

The molding operation can be accomplished by tensioning a pair of thin axle wires, one serving as the front axle and the other as the rear axle, and molding plastic around them. The tensioning assures accurate alignment of the two front wheels with each other and the two rear wheels with each other. Inasmuch as the tools for tensioning the wires can be accurately located during production, the front and rear wheels also can be accurately aligned with each other.

The novel features of the invention are set forth with particularity in the appended claims. The invention will be best understood from the following description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a toy vehicle chassis constructed in accordance with the invention;

FIG. 2 is a plan view of the chassis of FIG. 1;

FIG. 3 is a side elevation view of the chassis of FIG. 1;

FIG. 4 is an enlarged sectional side view of a portion of the chassis of FIG. 1;

FIG. 5 is a partial sectional side view of the chassis of FIG. 1 prior to complete installation of the axle assembly thereon; and

FIG. 6 is a side elevation view of an axle holding member constructed in accordance with another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a toy vehicle chassis constructed in accordance with the invention comprising a horizontally extending frame **10** which can support a body (not shown) representing an automobile. A horizontally extending axle-holding member **12** is mounted on the frame, and front and rear axles **14, 16** are mounted on the axle-holding member. A pair of front wheels **18, 20** are rotatably mounted on the rear axle. The vehicle is unpowered, although the invention can be applied to motor driven vehicles.

The chassis is designed to permit high speed and long distance travel when the vehicle is accelerated by initially running down an incline or by other means. In order to reduce friction to a minimum to allow long, high speed travel, the axles **14, 16** are constructed of narrow diameter wire, and the wheels have bearings **26** of low friction material such as Teflon. Care must also be taken to assure that the four wheels are aligned to run straight ahead, so there is a minimum of friction loss caused by misalignment. In addition, the bottoms of all four wheels must lie at close to the same level so the vehicle is supported on all four wheels and is therefore stable. The narrow diameter axles **14, 16** are not strong enough to support the force with which a child may press down on the vehicle in normal play. Accordingly, the body **11**, shown in phantom lines in FIG. 3, which is fastened to the chassis is designed so that the bottom surfaces or fender wells **13B** of the fenders **13** "bottom" on the wheels after a small downward deflection of the body, before the axle wires **14, 16** have been deflected beyond their elastic limit.

In accordance with the invention, the axle-holding member **12** is an elongated block or strip of resilient material such as a styrene type of plastic, and the axles **14, 16** are embedded in the member. The center of the axle-holding member is mounted on a flat surface **36** of the chassis frame by a stud **26**. The end portions **28, 30** of the member, at which the axles **14, 16** are mounted, are free from upward restraint so that they can be easily deflected up with respect to the frame **10** (until the wheels abut the fenders). A pair of locating bosses **32, 34** on the frame prevent rotation of the axle-holding member around the

center stud **26**. The axle-holding member **12** tends to deflect to the bowed configuration shown at **12A** in FIG. 5, but its center is held down by the stud **26**. Accordingly, the end portions **28**, **30** of the axle-holding member are preloaded down against the chassis frame.

The axles **14**, **16** are maintained parallel to each other by reason of their being embedded in the unitary axle-holding member, so they are closely surrounded by it. The accuracy of parallelism depends almost entirely upon the accuracy with which the axles are held parallel when the axle-holding member is formed. High accuracy is easily maintained in such production, so the alignment of the wheels can be accurately established and maintained. The accurate parallelism of the axles also assures that the bottom of all wheels are at the same level, so that the vehicle is stably supported on all four wheels. Such stable support also requires that the front wheels be made to have the same diameter, the back wheels be made to have the same diameter, and the upper frame surface **36** be made flat, all of which can be readily accomplished.

When a child pushes down on the front end of the vehicle, the front end **28** of the axle-holding member **12** deflects upwardly with respect to the frame **10**. The outer end portions of the front axle **14** will also deflect somewhat though most of the deflection is taken by the axle-holding member **12**. After a small amount of deflection the wheels will abut the fenders **13** and no further deflections of the axle or member occurs. A child may also push sideways on a wheel, and the narrow diameter of the axle may result in bending of the axle. A pair of rails **38**, **40** at each side of the frame have slots **42** therein through which the axle ends extend. If the slot is relatively narrow, its walls can help to prevent sideward bending of the axles by a child by lessening the distance from an axle support to the wheel when the axle is pressed hard to the side. The slot walls can also serve as a fulcrum for straightening out a bent axle. It should be noted that the slots **42** do not serve as guides to align, or maintain the positions of the axle ends, inasmuch as alignment is maintained by the fact that the axles are embedded in the axle-holding member **12**.

The axle assembly may be constructed using two wires, one for the front axle and one for the rear axle. The wires extend through a mold cavity in the form of the bowed axle-holding member **12A** shown in FIG. 5, and the wires are maintained in tension to assure that the portions to become axles are straight and aligned. Plastic or other material is then injected into the mold. The finished axle assembly is installed on a frame **10** by pressing it down against the frame surface **36** while deforming the top **44** of the stud **26** into the shape of a flange over a projection **46** on the axle-holding member, as shown in FIG. 4. The wheels are generally installed on the axles prior to such assembly, although they can be installed later. The body of the vehicle can then be placed on the frame, with body studs extending through holes **48** in the frame and staked in place.

The axles may lie at the center of the thickness of the axle-holding member, as shown in FIG. 4 for axle **14**, although the axles can also be molded in place near either face of the member. As shown in the figure, the position of the axle is maintained entirely by the axle-holding member **12**, and not by the frame **10** which it ordinarily does not contact, the frame being used to support the axle-holding member. In order to securely maintain the axle position, the material of the axle-holding member should have a greater coefficient of shrinkage when cooled, than the steel or other material of the axles. When the member **12** is molded with the axles therein, and cools, it tightly grips the axles to securely hold them.

Various modifications can be made in the chassis, using the axle-holding apparatus of the invention. For example, instead of using a parallelpiped member which is bowed before installation, an axle-holding member **49** shown in FIG. 6 could be used, in which the middle portion **50** of the member bridges the ends **52**, the middle portion being bowed down during installation to prestress the ends downwardly. Another variation is to make the upper surface of the frame concave and the axle-holding member initially straight. Instead of the rotation preventing bosses **32**, **34** a non-circular stud can be used to hold the axle-holding member to the frame, or an additional stud can be used that projects through another hole in the axle-holding member. Instead of using only two axles, four of them can be used, one for each wheel. In that case, each end portion **28**, **30** of the member **12** can be divided to allow independent movement of the wheels at each end of the vehicle.

Although particular embodiments of the invention have been described and illustrated herein, it is recognized that modifications and variations may readily occur to those skilled in the art. Consequently, it is intended that the claims be interpreted to cover such modifications and equivalents.

What is claimed is:

1. A toy vehicle comprising:
a frame;
axle means including an axle-holding member having embedded therein at least one axle; and
means for mounting said axle holding member on said frame, said axle holding member being constructed of resilient material and when mounted being biased against said frame with a preload.

2. The toy vehicle described in claim **1** wherein:
said axle-holding member is constructed of a moldable material having a higher temperature coefficient of shrinkage than the material of said axle, whereby after molding and during cooling the different temperature coefficients cause said axle-holding member to tightly grip said axle.

3. A toy vehicle comprising:
chassis means including a horizontally extending member constructed of resilient material and a frame constructed of rigid material, said horizontally extending member being biased with a preload against said frame;
axle wires embedded in said member with end portions protruding therefrom; and
wheels rotatably mounted on said protruding portions of said axle wires.

4. The toy vehicle described in claim **3** wherein:
said chassis means includes a frame with front and rear end portions; and
said horizontally extending member has front and rear portions from which said axle wires protrude, said front and rear portions being free to move upwardly with respect to said frame, and a central portion fastened to said frame.

5. A toy vehicle comprising:
chassis means including a horizontally extending member constructed of resilient material, and a rigid frame;
axle wires embedded in said member with end portions protruding therefrom, said horizontally extending member having opposite end portions formed about said axle wires, and said member being deformed against said frame so that said end portions of said member are biased against said frame with a preload; and
wheels rotatably mounted on said protruding portions of said axle wires.

6. A toy vehicle comprising:
a frame with an upwardly facing surface, said upper surface being substantially flat;
an axle-holding member constructed of a resilient material disposed against said frame surface;
a pair of axle wires with portions surrounded by said axle holding member so that said axle wires are parallel to each other, said axle wires having portions protruding from said axle-holding member, said axle-

holding member having opposite end portions with an axle wire embedded in each end portion and said member being constructed to have an initially bowed shape;

fastening means for holding down a center portion of said axle-holding member so that said end portions are preloaded against said upper surface of said frame; and

wheels rotatably mounted on said protruding portions of said axle wires.

7. The toy vehicle described in claim **6** wherein:

said axle-holding member is fastened to said frame at a position spaced from said protruding portions of said axle wires, to permit upward deflection of the portions of said members at said protruding axle wire portions away from said frame surface.

8. A toy vehicle comprising:

a rigid frame;

elongated axle-holding means constructed of resilient material having a center portion fastened to said frame in a manner to deform it so that its end portions abut said frame with a preload thereagainst;

a pair of axle wires extending laterally through each end portion of said axle-holding means with protruding end portions, said axle wires disposed parallel to each other; and

wheel rotatably mounted on said protruding end portions of said axle wires.

9. The toy vehicle described in claim **8** wherein:

said frame has an upwardly facing surface;

said axle-holding means is disposed against said frame surface; and

said protruding end portions of said axle wires lie at a level spaced upwardly from the level of said upwardly facing frame surface.

10. The toy vehicle described in claim **8** wherein:

said resilient material of said axle-holding means has a higher temperature coefficient of shrinkage from its melting temperature to room temperature than the material of said axle wires from the same temperature and said axle wires are molded into said axle-holding means, whereby to assure tight gripping of said axle wires.

11. The toy vehicle described in claim **8** wherein:

said axle-holding means is substantially in the form of a thin elongated block.

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