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(54) **Propulsion and steering system for hovering models**

(57) The model (1) having hovering capability includes one or more air cushions (10,12) that are capable of tilting and rotating simultaneously. By tilting one or more air cushions (10,12), the frictional contact with the ground surface is increased and the air bearing effect of that cushion is lost. By rotating that same air cushion

(10,12) while tilted, the model (1) with hovering capability is provided with propulsion and steering capability. The tilting and rotating of the air cushions (10,12) provides increase propulsion over rougher terrains, and enables the vehicle (1) to be amphibious by traversing both water and land.

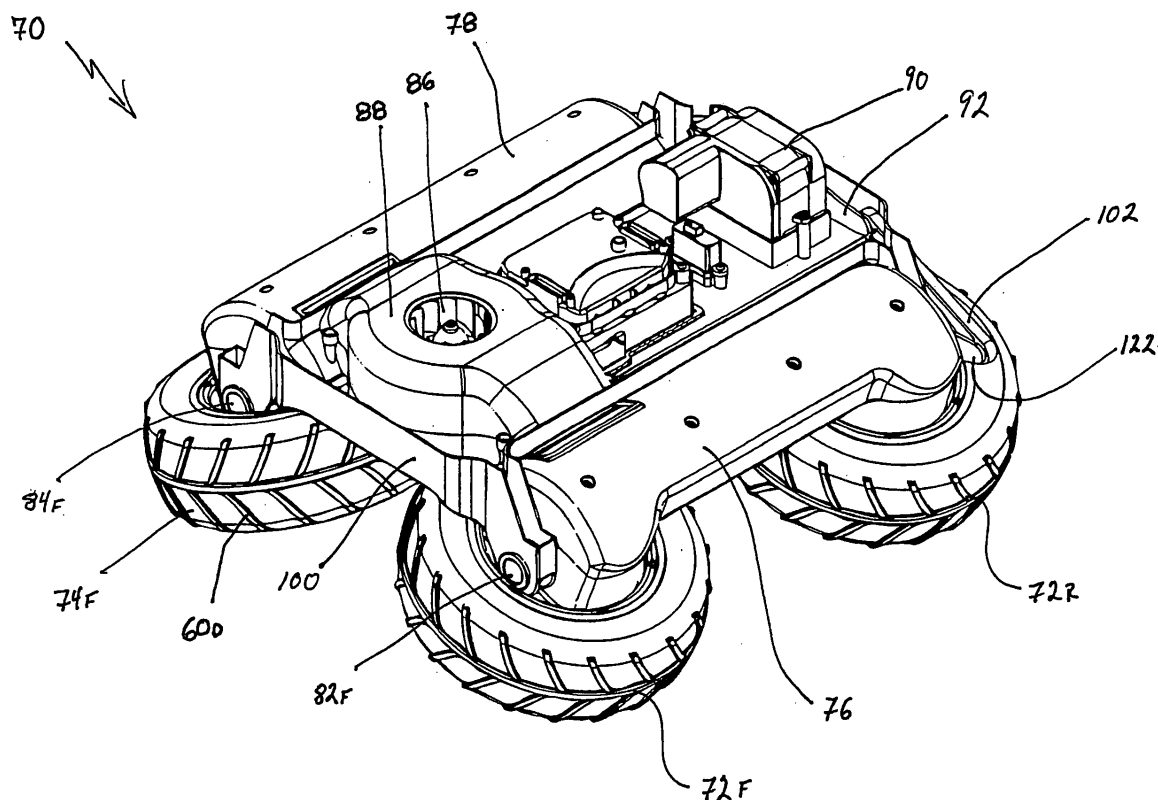


FIG. 7

Description

RELATED APPLICATION DATA

[0001] This application claims priority from U.S. Provisional Application Serial No. 60/761,650 filed on January 24, 2006.

BACKGROUND

Field of the Technology

[0002] The present invention relates to hovering models. More particularly, it relates to a steering and propulsion system for hovering models.

Description of the related art

[0003] Generally, conventional toy models that have a hovering feature produce thrust by one or multiple propellers mounted on the top side of the vehicle. Steering is achieved by one or more rudders placed behind the propulsion fans. In other alternative arrangements, steering can be achieved by reversing the thrust of a single fan versus the opposite fan in a dual fan setup.

[0004] Thrust produced by propeller(s) has proven to be very inefficient for operation, and also drains power from a typical rechargeable battery very quickly. Thus, runtime for the toy is disappointingly short compared to electric powered traditional toy R/C cars with wheels. Rechargeable battery powered toy models that have hovering capability typically do not have sufficient thrust, consequently, acceleration and handling are adversely affected. The ability to move in reverse is severely limited due to even weaker propeller thrust in the reverse direction.

[0005] Conventional models generally have an inflatable air cushion underneath the vehicle that is not capable of climbing even the slightest incline since it can function only as a frictionless air bearing. Additionally, these conventional models with hovering capability require smooth surfaces to operate on so that a pocket of pressurized air can be effectively maintained under the air cushion for air bearing function. As a prior art hovering model gathers speed via propulsion propellers, its ability to steer is greatly reduced since the thrust of the propellers is typically not great enough to overcome the vehicle's momentum. Therefore steering response is slow and as a result, the steering radius is large.

[0006] It becomes apparent that there is a need for a more power efficient hovering model that also includes effective steering and propulsion system.

SUMMARY

[0007] According to one aspect of the present principles, the model with hovering capability includes air cushions that include both an air bearing function and a steering/propulsion system.

ing/propulsion system.

[0008] According to another aspect of the present principles, the model with hovering capability includes air cushions that are exclusively air bearings and other air cushions that include both air bearing and steering/propulsion capability.

[0009] These and other aspects of the model with hovering capability are achieved by a model having at least one front air cushion, at least one rear air cushion, and a propulsion system connected to the at least one front air cushion or the at least one rear air cushion. The propulsion system causing the connected air cushion to tilt in a predetermined manner and rotate in a user selected direction.

[0010] In accordance with one aspect, the tilting in a predetermined manner includes tilting the at least one air cushion from a flat air bearing condition to an angular disposition with respect to a ground running surface the model is being operated on.

[0011] According to another aspect, the at least one front air cushion is fixedly mounted in a horizontal, air bearing position and the propulsion system is connected to the at least one rear air cushion such that the at least one rear air cushion provides steering and propulsion to the model.

[0012] In yet a further aspect of the present principles, the model includes two rear air cushions, and one front air cushion operating exclusively as an air bearing. In this implementation, the propulsion system is connected to the two rear cushions such that rotation of each in opposite directions with respect to each other causes the model to move in a straight direction.

[0013] In a further implementation, the model includes an air compression fan with corresponding ducting configured to provide air to the air cushions, and a shut off mechanism connected to the air cushions connected to the propulsion system for shutting off air flow to the air cushions when the propulsion system is activated and the air cushions are tilted.

[0014] In yet another implementation of the present principles, the model includes a front right and a front left air cushion, and a rear right and a rear left air cushion. A left side gear housing is connected to the front left and rear left air cushions, and is pivotally mounted to a chassis of the model. A right side gear housing is connected to the front right and rear right air cushions, and is pivotally mounted to the chassis of the model. A control means is connected to the left side gear housing and the right side gear housing for independently and selectively pivoting said gearing housings, and thereby the respective air cushions to provide at least two different modes of operation for said air cushions.

[0015] The control means can include, for example, a right side servo having a right side servo horn, a left side servo having a left side servo horn, a right side control arm connected at one end to the right side servo horn and an opposite end connected to the right side gear housing, and a left side control arm connected at one

end to the left side servo horn and an opposite end connected to the left side gear housing. The servos selectively control the operating position of the gear housings in response to user received commands from a radio controller.

[0016] The services are capable of pivoting the gear housings in a range of more than 90 degrees to provide both a 4 wheel operating vehicle in one mode, and the tilted wheel propulsion system for the model in another operating mode.

[0017] Other aspects and features of the present principles will become apparent from the following detailed description considered in conjunction with the accompanying drawings. It is to be understood, however, that the drawings are designed solely for purposes of illustration and not as a definition of the limits of the present principles, for which reference should be made to the appended claims. It should be further understood that the drawings are not necessarily drawn to scale and that, unless otherwise indicated, they are merely intended to conceptually illustrate the structures and procedures described herein.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] In the drawings wherein like reference numerals denote similar components throughout the views:

[0019] Figure 1 is top view of the model with hovering capability according to an embodiment of the present principles;

[0020] Figure 2 is a bottom view of the model with hovering capability according to an embodiment of the present principles;

[0021] Figure 3 is a cross sectional view of the model with hovering capability taken along lines III-III of Figure 1;

[0022] Figure 4 is a cross sectional view of the model with hovering capability showing the steering and propulsion systems according to an embodiment of the present principles

[0023] Figure 5 is a schematic view of the inner workings of the steering and propulsion system in a non-active position according to an embodiment of the present principles;

[0024] Figure 6 is a schematic view of the inner workings of the steering and propulsion system in the active position according to an embodiment of the present principles;

[0025] Figure 7 is a perspective view of a combined model with hovering capability having/4 wheel vehicle with the wheels in a tilted steering/propulsion mode of operation according to an alternative embodiment of the present principles;

[0026] Figure 8 is a perspective view of the combined model with hovering capability /4 wheel vehicle showing all four wheels in a flat air bearing/hovering position; and

[0027] Figure 9 is a perspective view of the model with hovering capability/4wheel vehicle showing the wheels

in a driving position according to an embodiment of the present principles.

[0028] Figure 10 is a perspective view of the model with hovering capability/4 wheel vehicle showing one set of wheels in a driving position, and another set of wheels in an air bearing position, according to an embodiment of the present principles.

DETAILED DESCRIPTION

[0029] The model with hovering capability (e.g., a model hovercraft) of the present principles can possess multiple air cushions in a variety of configurations. In these various configurations, some or all of the cushions can provide steering and propulsion by tilting and rotating. It will become clear from the following that depending on the particular configuration, some air cushions can function exclusively as an air bearing for the model.

[0030] By way of example, the implementation shown in Figures 1-6 show a total of three air cushions 10L, 10R and 12 installed under the vehicle. Air is drawn into the vehicle from an opening 14 at the top of the body. A compressor fan 30 rotates to draw air into the vehicle from the opening at the top opening 14 of the body. Enough compressed air is channeled to the air cushions 10, 12 to both inflate them and to create and maintain high pressure air in centralized voids 32 under the cushions 10, 12. As with standard hovering vehicles, a steady film of air bleeds off from under the air cushion sides at the point of contact 7 with the ground 5 creating the air bearing or hovering effect. The film of air that bleeds off under air cushion operates to substantially reduce any friction between the air cushion and the ground surface 5 the vehicle runs on. The hovering function works best on smooth, uniform surfaces versus rough and irregular since air film bleed off is minimized on smoother surfaces. Therefore, the pressurized air in the voids 32 formed under the air cushions 10, 12 is effectively maintained and not lost due to cracks or voids in a porous surface.

[0031] The exemplary model of Figures 1-6 featuring three air cushions 10L, 10R and 12, can have the equal-sized doughnut shaped cushions in a triangular arrangement, as shown. In other contemplated embodiments, the size of the cushions 10, 12 can be made different, and particularly the size of air cushions 10 can be different than that of air cushion 12.

[0032] In this exemplary implementation, the front or forward mounted cushion 12 functions exclusively as an air bearing and may generally be mounted in a stationary manner. However, it is contemplated herein that the front air bearing cushion 12 could further benefit from a swiveling mount to assist it in tracking over uneven surfaces so as to better maintain the pressurized air in the void 32 under the cushion for sustained air bearing operation. The rear two air cushions 10L and 10R have a dual function as both air bearings and for propulsion and steering.

[0033] The propulsion and steering mechanism will

now be described in connection with reference to Figures 3 - 6. In concept, by tilting one or both of the rear mounted air cushions 10, the air bearing function is lost since the pocket of pressurized air in void 32 bleeds off completely due to the lost uniform ground contact.

[0034] Generally, when the wheels 10 are tilted, the pressurized air would continue to be channeled to the tilted air cushion(s) and wasted, but a unique, mechanical air shutoff system is employed. This can be shown by the angularly disposed and opposing flanges 50 attached to the universal joint linkages 42. When the rear cushions 10L and 10R tilt, the respective flanges 50L and 50R effectively close the air passages 52 which feed air to the rear air cushions. This shut off by the flanges 50 re-directs pressurized air from the compressor fan to the active air bearing cushion(s), in this case front cushion 12. This air shutoff feature ensures that all air is redirected to the air cushions that are not tilted and all other internal ducting remains pressurized for maximum hovering effect. In this example, the forward or front air cushion 12 is the fulltime air bearing with no motorized tilt and rotation features. The rear two air cushions 10L and 10R can be tilted and rotated separately or in combination.

[0035] According to one preferred implementation, the tilting and rotating of the cushions 10L and 10R happen simultaneously. The tilting of the cushions 10 allows the outer edges 11 of the air cushions to make frictional contact with the ground and eliminates the air bearing effect of the air cushions 10, as shown in Figure 4. By enabling the independent selectable rotation direction of the each tilted air cushion 10L and 10R, the model is provided with both propulsion and steering capability while maintaining a hovering attitude with the front air bearing 12. The tilting angle A of the cushions 10L and 10R is preferably greater than zero degrees (0°). In the example shown, A is approximately 20°. However, those of skill in the art will recognize that angle A need only be greater than zero to achieve the added frictional contact necessary for the propulsion aspect of the present principles.

[0036] As a rather unique feature of the model with hovering capability of the present principles, and model vehicles in general, in order to drive the model in a straight position, each tilted air cushion 10L and 10R must rotate in opposite directions with respect to each other.

[0037] By selecting (from a radio transmitter not shown), both rear cushions 10L and 10R to rotate in the same direction to the right or to the left, this would generate a turn to the right or to the left. Sustained rotation in the selected direction would generate a continuous turning effect or a fast 360 degree rotation of the whole vehicle over and over again in a relatively tight radius of operation and almost in place.

[0038] It would also be possible to rotate one of the rear cushions 10L or 10R and cause the toy to rotate about the same. This steering capability of the model with hovering capability of the present principles provides significant recreational and functional advantages over prior art hovercraft toys. Especially when compared to the very

wide turning radii that is standard for conventional hovering modes (e.g., hovercrafts) with standard propulsion propellers on top of the model body. The tilting and rotating air cushions 10L and 10R provide direct contact with the ground for quick and effective turns unlike any conventional model hovercrafts which tend to slide due to the hovering effect.

[0039] As mentioned above, rotating both air cushions in opposite directions (with respect to each other) to the front or to the rear, generates propulsion to the front or to the rear. This propulsion would be instantaneous and have little to no hesitation due to the direct frictional contact 9 with the ground 5 (See Figure 4). This is compared to the conventional hovercraft vehicles where propulsion is based on momentum build up due to the typical propeller fan setup. As a result of the direct ground contact 9, the tilted and rotated air cushions 10L and 10R operate like tires and therefore represent improved steering and acceleration response compared to existing toy hovercrafts. After acceleration is achieved, the air cushions can be allowed to drop to normal air bearing position (using gravity or spring assist); consequently, the rear cushions 10L and 10R now function as air bearings and the vehicle will coast along on a thin cushion of air caused by the air voids 32 and corresponding bleed off. This coasting is a product of any momentum build up experienced by the toy when in the propulsion mode of operation.

[0040] In addition to steering and propulsion, the selective direct ground contact of air cushions 10L and 10R not only enables the toy hovercraft of the present principles to climb up smooth and gradual inclines, but also provides the toy with the ability to go in reverse quite easily. Those of skill in the art will recognize that the frictionless air bearings of conventional hovercraft vehicles provide no ability to climb inclines. As a matter of fact, the climbing ability of the conventional hovercraft vehicle with a frictionless air bearing is entirely based on the fan propulsion capability, which is generally too low, resulting in the vehicle sliding down an incline it is trying to climb. Additionally, conventional hovercraft vehicles have difficulty traveling in reverse due to insufficient propeller thrust in the reverse direction.

[0041] In accordance with one preferred implementation of the present principles, the tilting action of rear cushions 10L and 10R can be achieved with motor and gear transmission assemblies. Referring to Figures 4-6, servo motors 38L and 38R and corresponding servo gearing 56 contained in a servo box 54 operate to tilt the respective cushion 10L and 10R.

[0042] Rotation or drive function of air cushions 10L and 10R can also be achieved by motor and gear transmission and universal-jointed linkages. As shown, motors 36L and 36R with corresponding gearing 40L and 40R, respectively. The gearing 40L and 40R are linked to the universal jointed linkages 42L and 42R, respectively. When rotation of the cushions 10L and 10R is actuated by the respective motors 36, servo motors 38 are

actuated causing the servo gearing to rotate a servo horn 58. The servo horn 58 is connected to the cushion mechanism without interfering with the rotation thereof, and causes the same to tilt in its predetermined direction. The servo horn 58 may be directly connected to the flapper flange 50 causing the same to close and thereby disabling the air flow to the respective cushion (as described above). In other embodiments, the servo horn 58 is spring biased by a spring 60 in the propulsion/steering tilted mode. Thus, when the operator of the toy does not actuate the drive functions, the servo motors 38 respond by dropping the cushions 10 to their non-tilted air-bearing position.

[0043] Thus, the model with hovering capability of the present principles as shown and described in Figure 3 and 6 includes a total five motors in this three air cushion embodiment. One motor 34 powers the air compression fan 30, two motors 38L and 38R power the tilt function on each of the respective rear air cushions 10L and 10R, and two other motors 36L (not shown) and 36R would drive each of the rear air cushions 10L and 10R. The drive motors 36L and 36R are preferably a larger capacity motor compared to the tilting motors 38 and the air compression motor 34.

[0044] In one embodiment, the hovering can be controlled by a third radio channel on the radio control transmitter (not shown) which enables the selective turning on and off of the compression fan motor 34. The tilt and rotate feature are also controlled from the remote controller (not shown) for steering, forward and reverse functions. Those of ordinary skill in the art will recognize that by shutting of the compression fan 30 and disabling or discontinuing the "hovering" or "air bearing" mode of the front air cushion 12, it will act as a brake for the vehicle. The model vehicle with hovering capability 1 according to the present principles is adapted to float and operate on water similarly as on dry land. When one or more than one of the air cushions are tilted, the tilted air cushion grips the water with the top of the cushion located away from water. The tilted and rotated air cushion can produce thrust and steering even when on the water. The style, configuration and depth of the air cushion treads 60 can have an increased effect on the vehicles ability to drive through the water or other rougher terrains. Figures 1 and 2 show one type of tread design 60a, Figures 3 and 4 show yet another tread design 60b, and Figures 5 and 6 show a more water friendly tread design 60c. Those of skill in the art will recognize that the style, configuration and depth of the tread 60 can be changed or reconfigured for many various applications (e.g., terrains) without departing from the spirit of the present principles. For example, the treads can be an off-road tread, a water tread, a track tread and/or an all season tread that is essentially designed to handle multiple different road conditions.

[0045] Packed snow and ice are other operable surfaces for the model of the present principles. The tilt/rotate feature of the present principles also allows operation on low pile carpeting. This porous type of surface

would usually slow a toy hovercraft down to a standstill by depleting all or most of the pressurized air under the air cushion causing insurmountable surface friction.

[0046] Although shown in an exemplary implementation with 3 air cushions, the tilt/rotate mechanism of the present principles is not limited in any way to 3 air cushions. For example, the tilt/rotate mechanism of the present principles can be applied to all four air cushions in a four cushion vehicle setup. Tilting all four air cushions to 90 degrees would yield a high ground clearance automobile-like four wheeled vehicle. Essentially a transformation from a model with hovering capability to a model vehicle that runs on wheels is possible with this proprietary propulsion/steering mechanism. Ultimately, two or more air cushions can be employed on this type of model vehicle. Some or all air cushions can feature tilting and rotating to provide a variety of operating mode capabilities.

[0047] Figures 7-9 show the model 70 with hovering capability according to a further implementation of the present principles. As shown, this model has four wheels 72F, 72R, 74F, and 74R. The left side front and rear wheels 72F and 72R, respectively, are connected to each other via a gear housing 76, while the right side wheels 74F and 74R are connected to each other via a gear housing 78. In this implementation, the gear housings 76 and 78 are pivotally mounted to the chassis 100 at pivot points 82 and 84, respectively. The front 82F, 84F and rear pivot points 82R and 84R are axially aligned with their respective opposite. Thus, when the gear housings 76, 78 pivot about their respective pivot points 82 and 84, the wheels essentially are pivoted about the same pivot points.

[0048] The selective control of the gear housings 76, 78 provide this model vehicle with steering and propulsion control, while maintaining the capability to either operate in a hovering mode or in a true 4 wheel drive mode. Referring to Figure 7, there is shown the model 70 with all four wheels 72F, 72R, 82F and 82R in the steering/propulsion mode of operation. As shown, the wheels are tilted such that the treads of the same contact the ground in the same manner as that described above with reference to the implementation shown Figures 1-6.

[0049] In one preferred implementation, each side set of wheels 72 and 74 are independently controlled by a user from the radio remote controller (not shown). This independent control allows the user to select a set of wheels (e.g., either left side wheels 72, right side wheels 74 or both sides) which will be used for driving, steering, hovering, etc. The user's radio remote controller (not shown) is configured to control the servos contained in housing 90 that is responsible for the operating mode of the model. In the embodiment shown, there are two servos contained in housing 90, each connected to a servo horn 92 and 94. The servo horns 92 and 94 are fixedly connected to controller arms 102 and 104, respectively. The controller arm 102 is connected to the gear housing 76 via a fixed connection point 122. The controller arm

104 is connected to the gear housing 78 via a fixed connection point, not shown. As will be apparent from the figures, the position of the servo horns 92 and 94, and thereby the controller arms 102 and 104 dictate the operating mode of gear housing 76 and 78, and thereby the corresponding wheels 72 and 74, respectively.

[0050] As shown in Figure 7, the servo horns 92 and 94 (not shown) are in one extreme position away from each other such that the controller arms 102 and 104 essentially push the wheels 72 and 74 into their tilted propulsion/steering mode of operation. By independently driving wheels 72 and 74, the user can steer the model using a differential, tank like steering approach. Although the implementation shown in figure 7 shows both gear housings and corresponding wheels tilted, those of skill in the art will recognize that by providing independent user control of the servos controller servo horns 92 and 94, the user will be able to selectively tilt one set of wheels (e.g., 72 or 74), while the other set can be maintained in a air bearing mode (e.g., see Figure 10).

[0051] Figure 8 shows the model 80 with all four wheels 72 and 74 in an air bearing mode of operation. As can be seen in this figure, the position of the servo horns 92 and 94 are more intermediate than the extreme shown in Figure 7 for the propulsion/steering mode. As explained in detail above with respect to the implementation shown in Figures 1-6, when the wheels 72 and 74 are flat against the surface on which it is riding, the wheels act as air bearings to provide the hovering capability of the model. In this mode, the compression fan 86 and corresponding ducts 88 provide air to all four wheels now operating as air bearings. As described above, when the wheels are tilted for propulsion/steering (See Figures 7 and 10), the air flow to those wheels is terminated by a flapper mechanism or other mechanical, or electromechanical means.

[0052] The radio control electronics 80 include all the electronics necessary to operate the model. In addition, the electronics will also include the various channels (and corresponding crystals) required to operate the compression fan, the independent tilting of the wheels 72 and/or 74, and/or independent driving of wheels 72 and/or 74.

[0053] Figure 9 shows the model 70 in 4 wheel drive mode, where the wheels 72 and 74 now function as wheels where intended. By providing the user with independent control of wheels 72 from wheels 74, the user can steer the vehicle using a differential-like steering approach. In order to enter this mode of operation, the servo horns 92 and 94 move into the other extreme position (i.e., inward toward each other) such that control arms 102 and 104 cause gear housings 76 and 78 to rotate inward thus causing wheels 72 and 74 to be disposed in their vertical running position.

[0054] Figure 10 shows an alternative mode of operation for the model 70, where the left side wheels 72 are tilted in a propulsion mode, and right side wheels 74 are in a flat, air bearing mode of operation. In this mode, the model will be provided with propulsion by wheels 72,

which, due to their configuration, will result in unique sideways and angular sideways movements of the toy. Since the user can selectively and independently activate the wheel groups 72 and/or 74 to operated in air bearing, propulsion or driving mode, the possibilities for unique stunt movements and action of the model are significantly increased beyond that of all currently known models having hovering capability.

[0055] While there have been shown, described and pointed out fundamental novel features of the present principles, it will be understood that various omissions, substitutions and changes in the form and details of the methods described and devices illustrated, and in their operation, may be made by those skilled in the art without departing from the spirit of the same. For example, it is expressly intended that all combinations of those elements and/or method steps which perform substantially the same function in substantially the same way to achieve the same results are within the scope of the present principles. Moreover, it should be recognized that structures and/or elements and/or method steps shown and/or described in connection with any disclosed form or implementation of the present principles may be incorporated in any other disclosed, described or suggested form or implementation as a general matter of design choice. It is the intention, therefore, to be limited only as indicated by the scope of the claims appended hereto.

Claims

1. A model comprising:

at least one front air cushion;
at least one rear air cushion; and
a propulsion system connected to said at least one front air cushion or said at least one rear air cushion, said propulsion system causing the connected air cushion to tilt in a predetermined manner and rotate in a user selected direction.

2. The model of claim 1, wherein said tilting in a predetermined manner comprises tilting said at least one air cushion from a flat air bearing condition to an angular disposition with respect to a ground running surface the model is being operated on.

3. The model of claim 1, wherein said at least one front air cushion is fixedly mounted in a horizontal, air bearing position and said propulsion system is connected to said at least one rear air cushion such that said at least one rear air cushion provides steering and propulsion to the model.

4. The model of claim 2, wherein said angular disposition comprises tilting said rear air cushion at an angle greater than zero degrees with respect to running surface of the model.

5. The model of claim 1, wherein the air cushion connected to the propulsion system further comprises a tread having a predetermined configuration.
6. The model of claim 5, wherein the predetermined configuration of the air cushion tread comprises one selected from a group consisting of off-road tread, water tread, track tread and an all season tread.
7. The model of claim 1, further comprising:
 two rear air cushions; and
 one front air cushion operating exclusively as an air bearing;
 wherein said propulsion system is connected to said two rear cushions such that rotation of each of said rear air cushions in opposite directions with respect to each other causes said model to move in a straight direction.
8. The model of claim 1, further comprising:
 an air compression fan with corresponding ducting configured to provide air to said air cushions;
 and
 a shut off mechanism connected to the air cushions connected to said propulsion system for shutting off air flow to the air cushions connected to the propulsion system when said propulsion system is activated and the air cushions are tilted.
9. The model of claim 1, further comprising:
 a front right and a front left air cushion;
 a rear right and a rear left air cushion;
 a left side gear housing connecting said front left and said rear left air cushions, said left side gear housing pivotally mounted to a chassis of the model;
 a right side gear housing connecting said front right and said rear right air cushions, said right side gear housing pivotally mounted to the chassis of the model; and
 control means connected to said left side gear housing and said right side gear housing for independently and selectively pivoting said gearing housings, and thereby the respective air cushions to provide at least two different modes of operation for said air cushions.
10. The model of claim 9, wherein said control means comprises:
 a right side servo having a right side servo horn;
 a left side servo having a left side servo horn;
 a right side control arm connected at one end to the right side servo horn and an opposite end connected to the right side gear housing;
 a left side control arm connected at one end to the left side servo horn and an opposite end connected to the left side gear housing;
 wherein said servos selectively control the operating position of said gear housings in response to user received commands from a radio controller.
11. The model of claim 10, wherein said servos are capable of pivoting said gear housings in a range of more than 90 degrees to provide both a 4 wheel operating vehicle in one mode, and the tilted wheel propulsion system for the model in another operating mode.

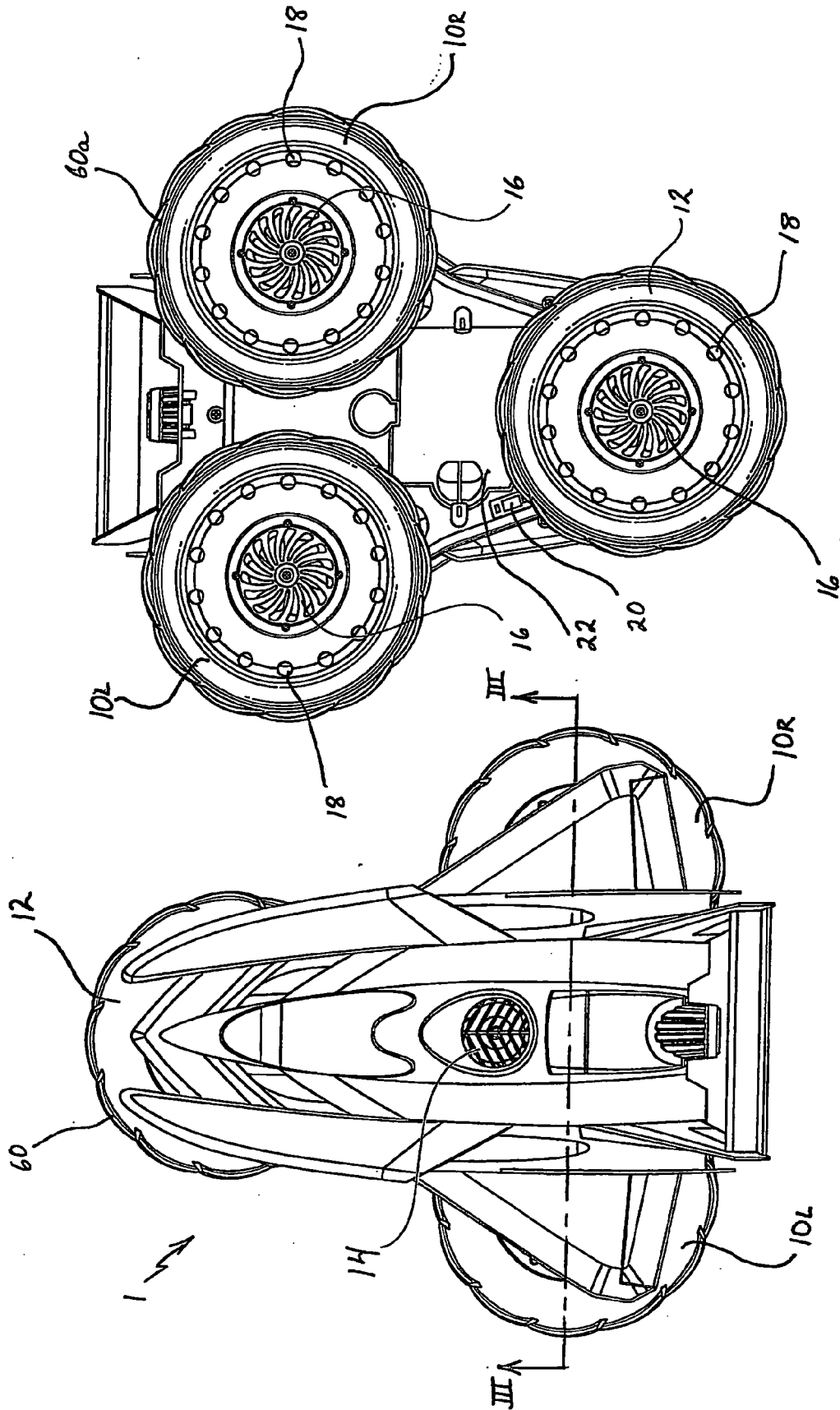


FIG. 1

FIG. 2

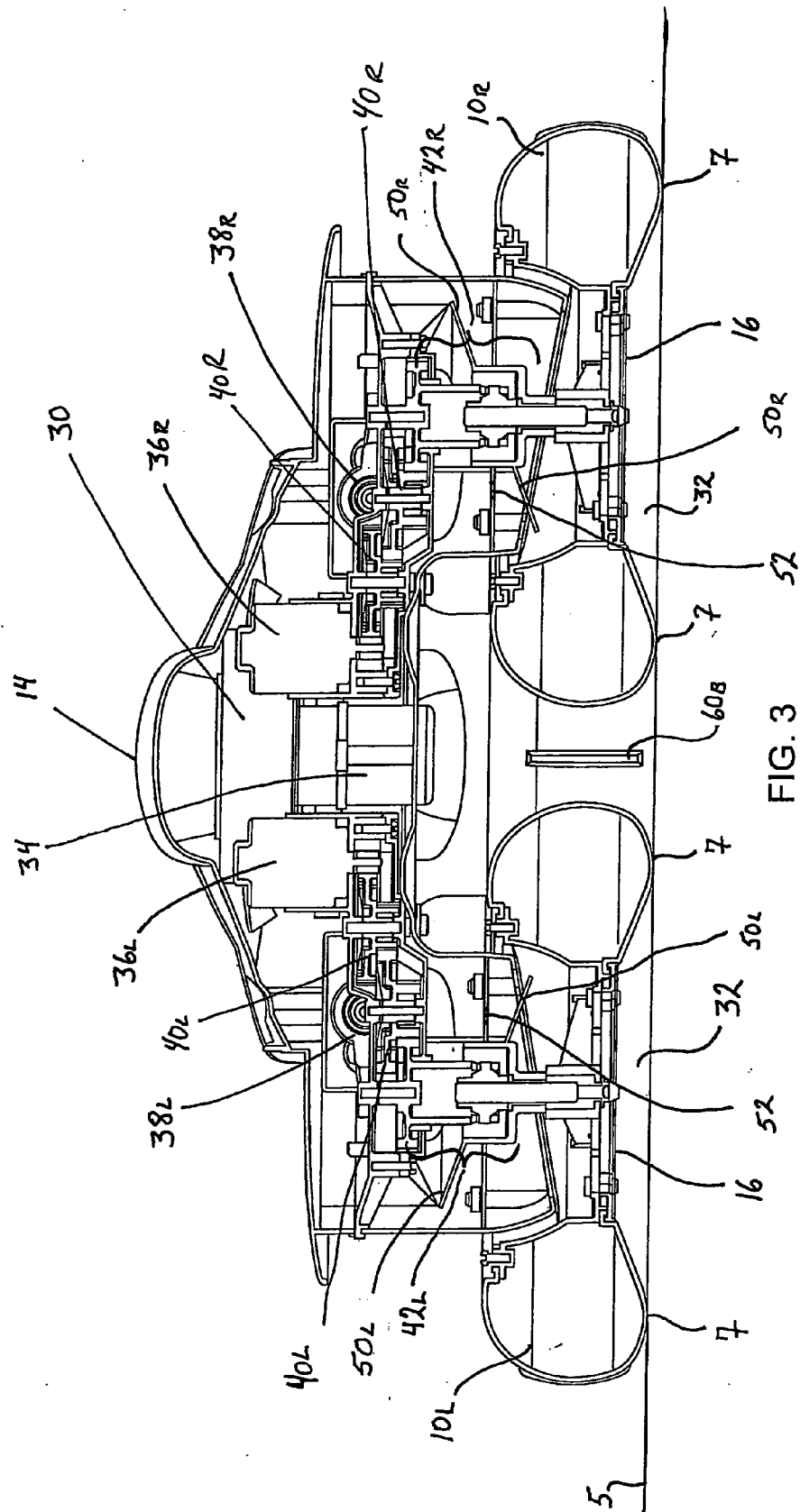
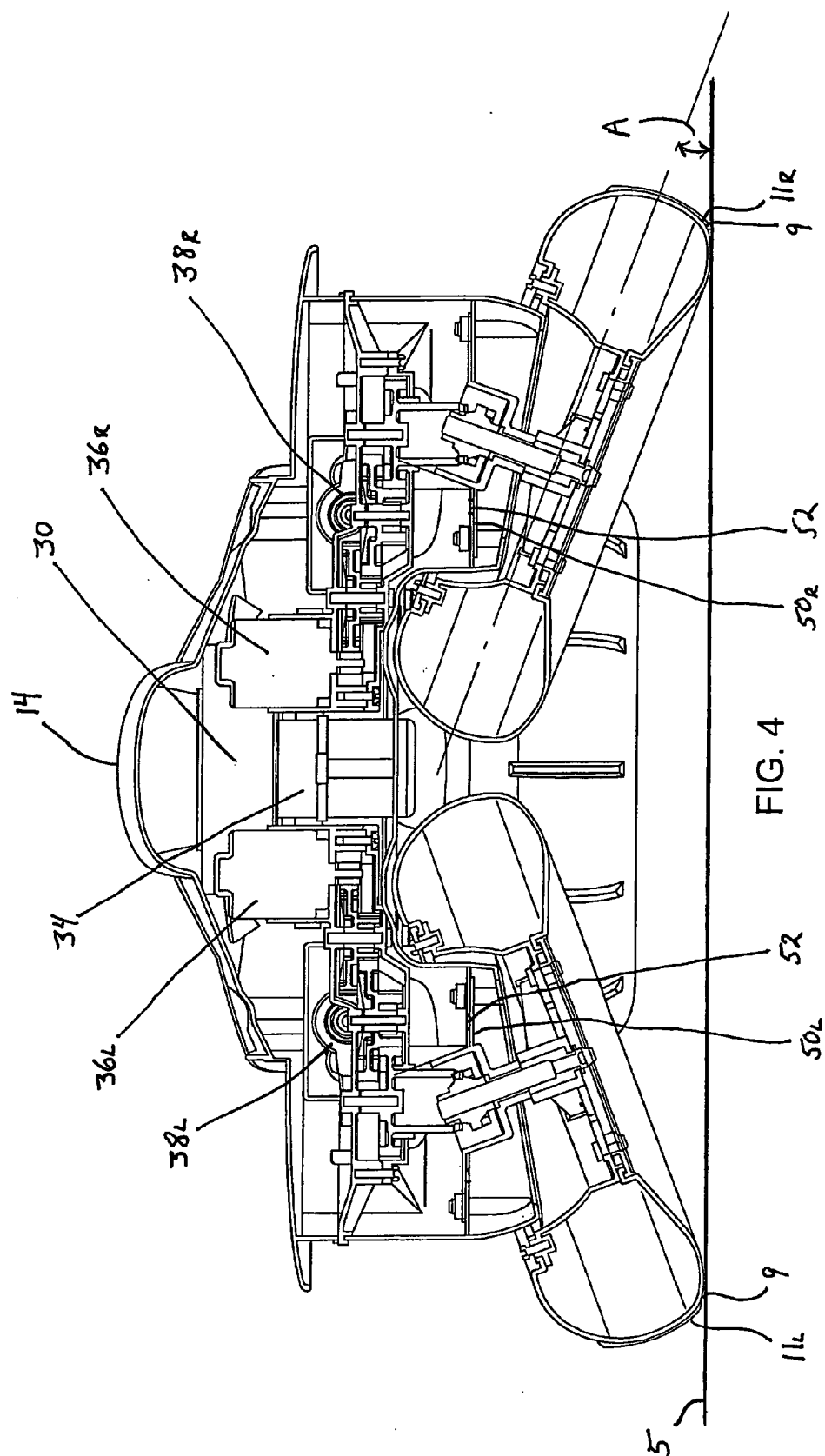


FIG. 3



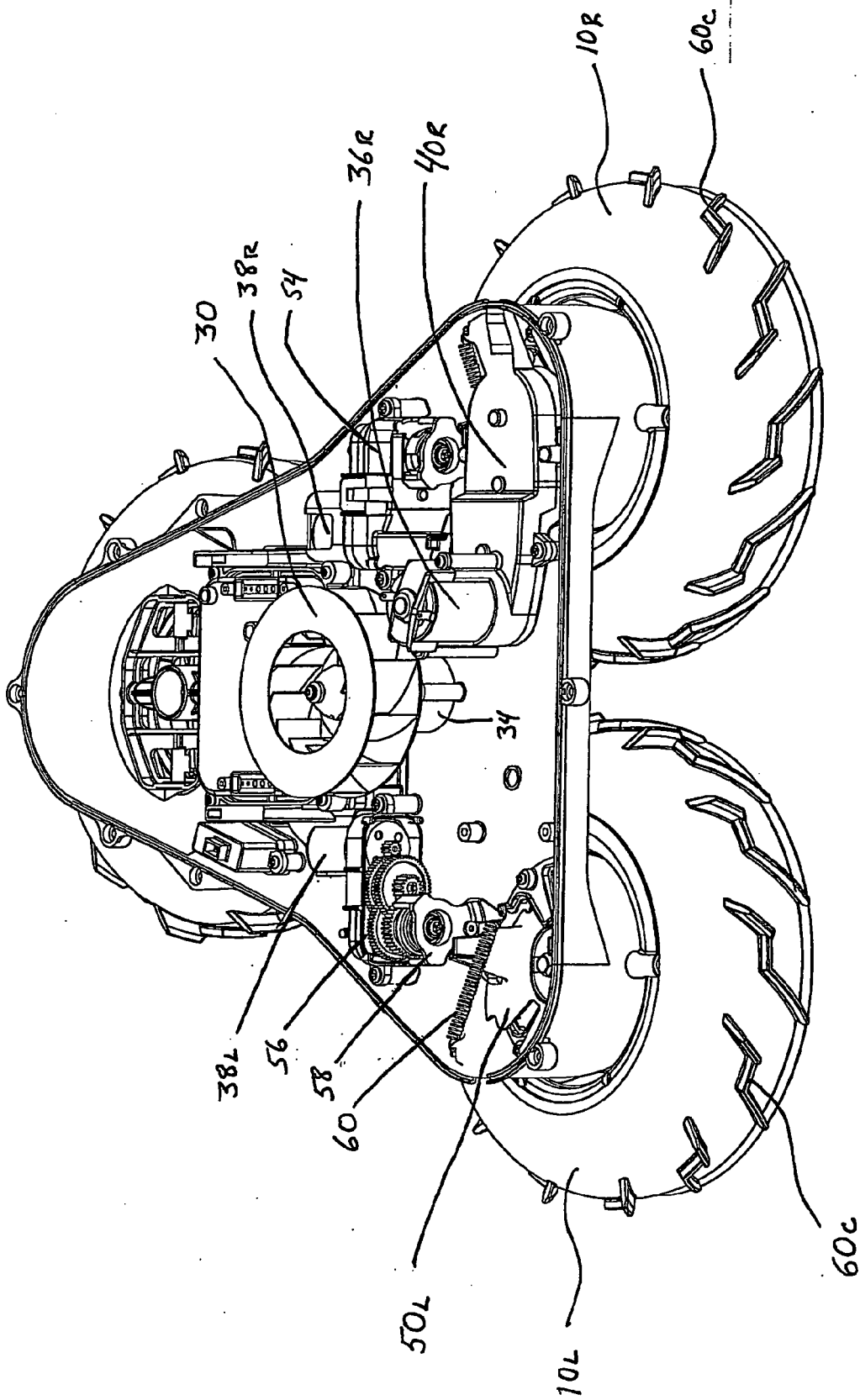


FIG. 5

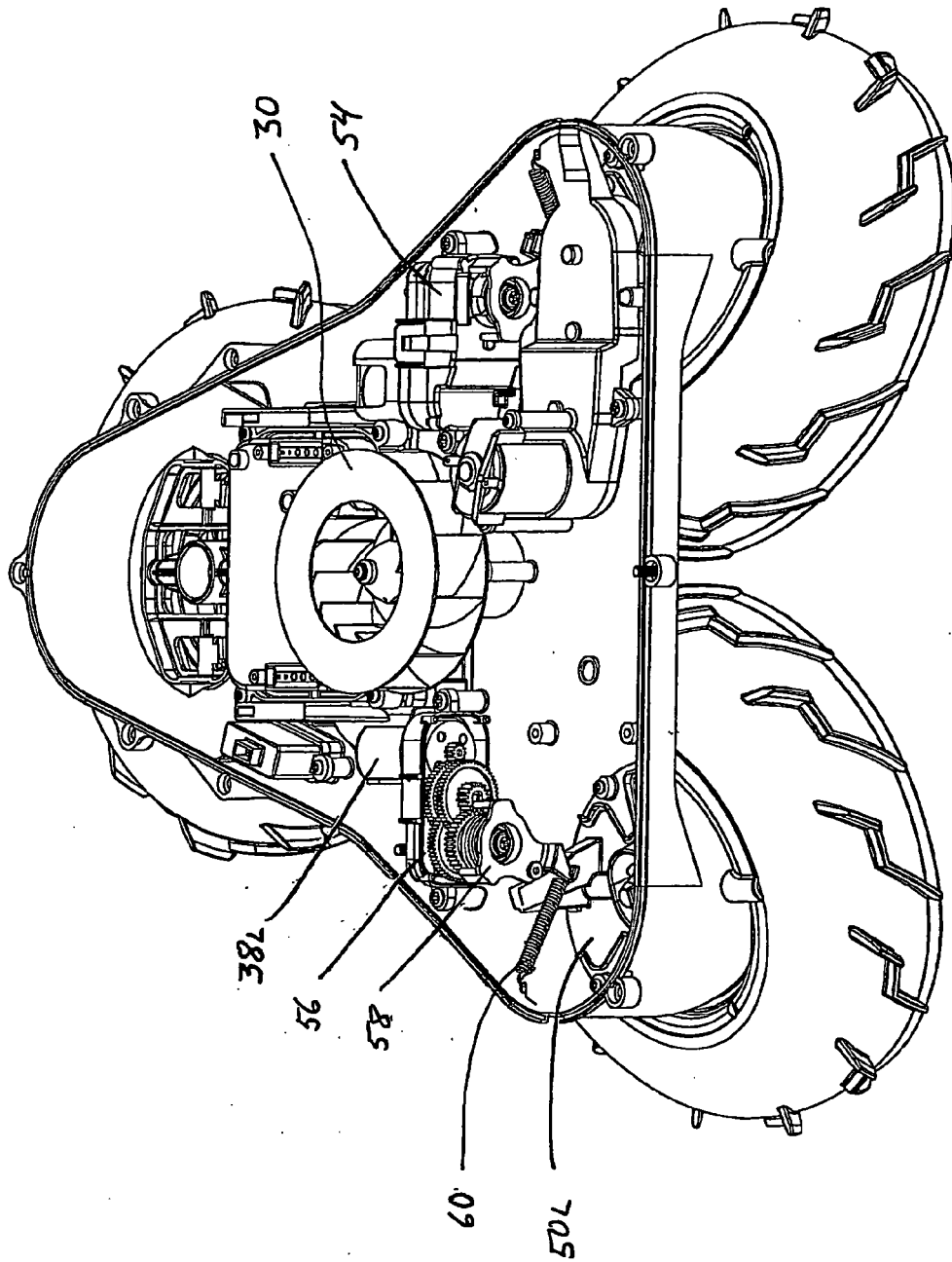


FIG. 6

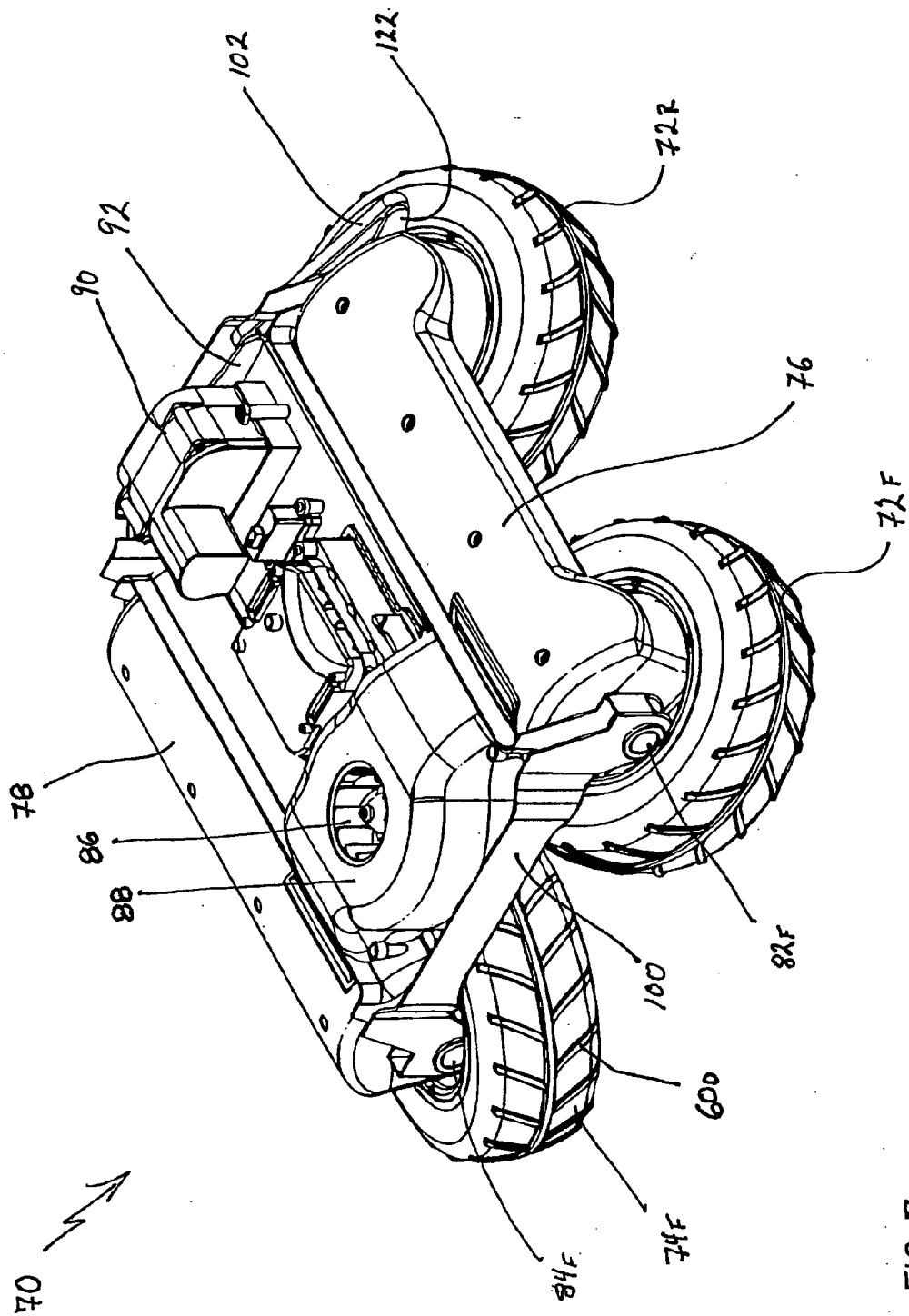


FIG. 7

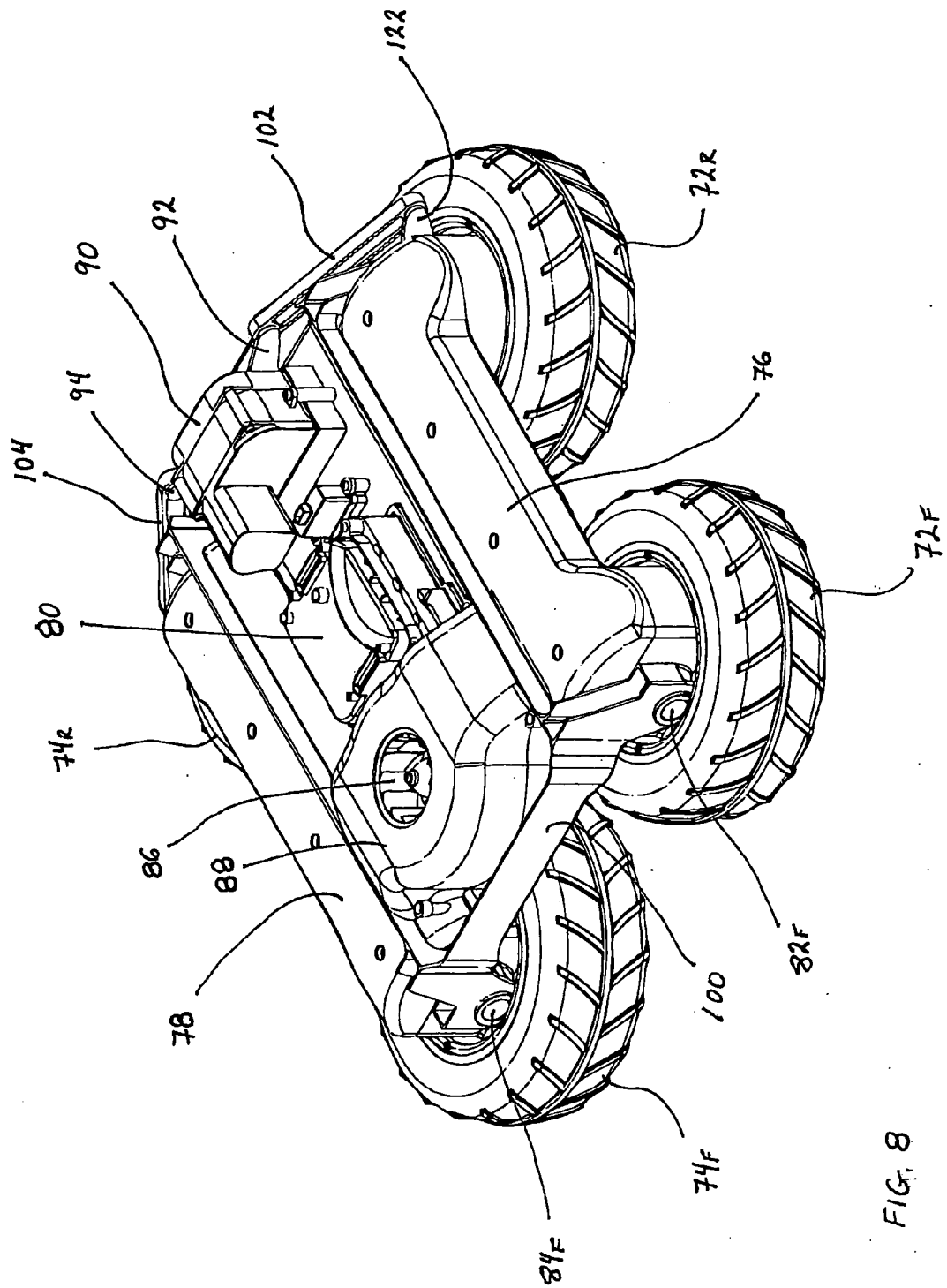


FIG. 8

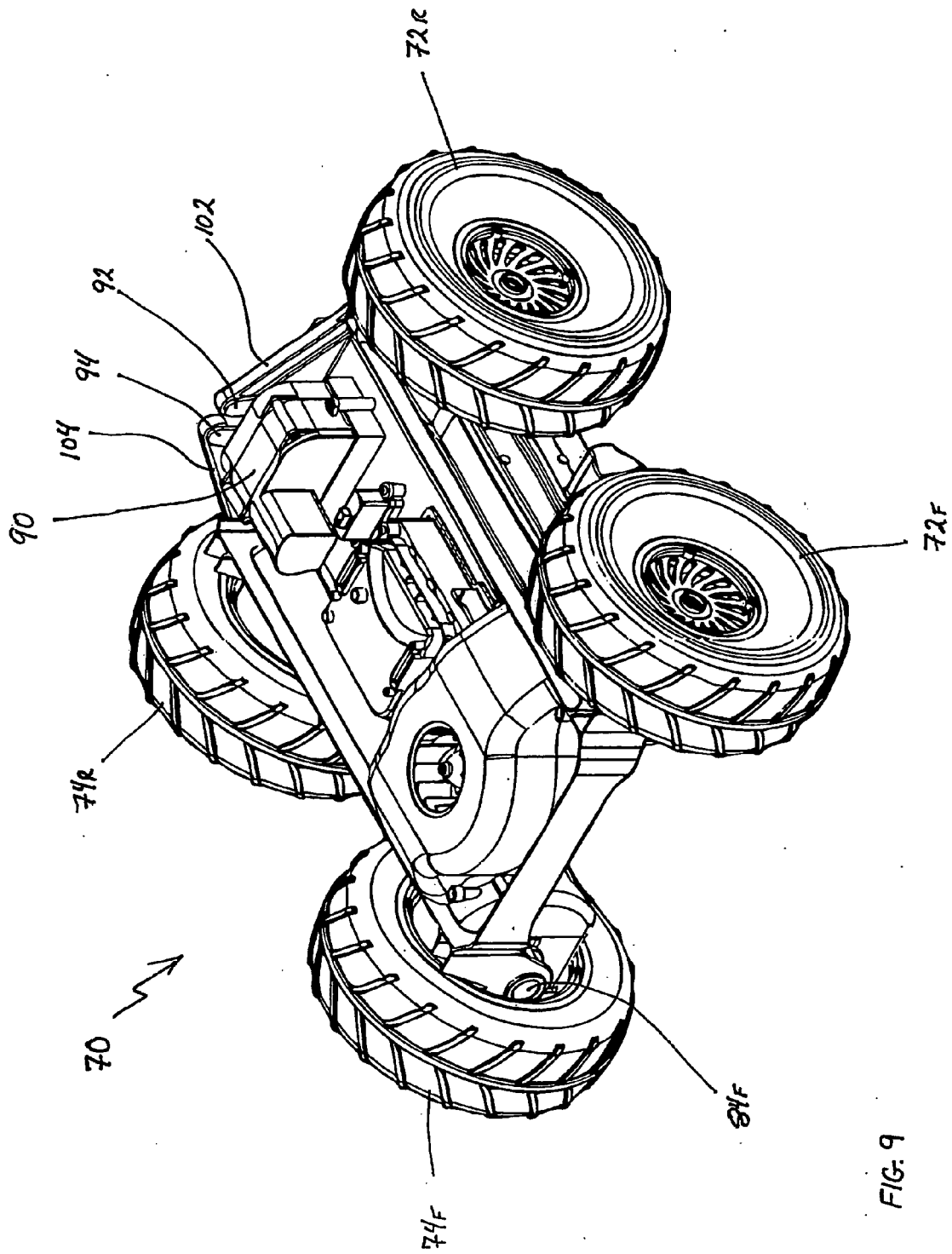
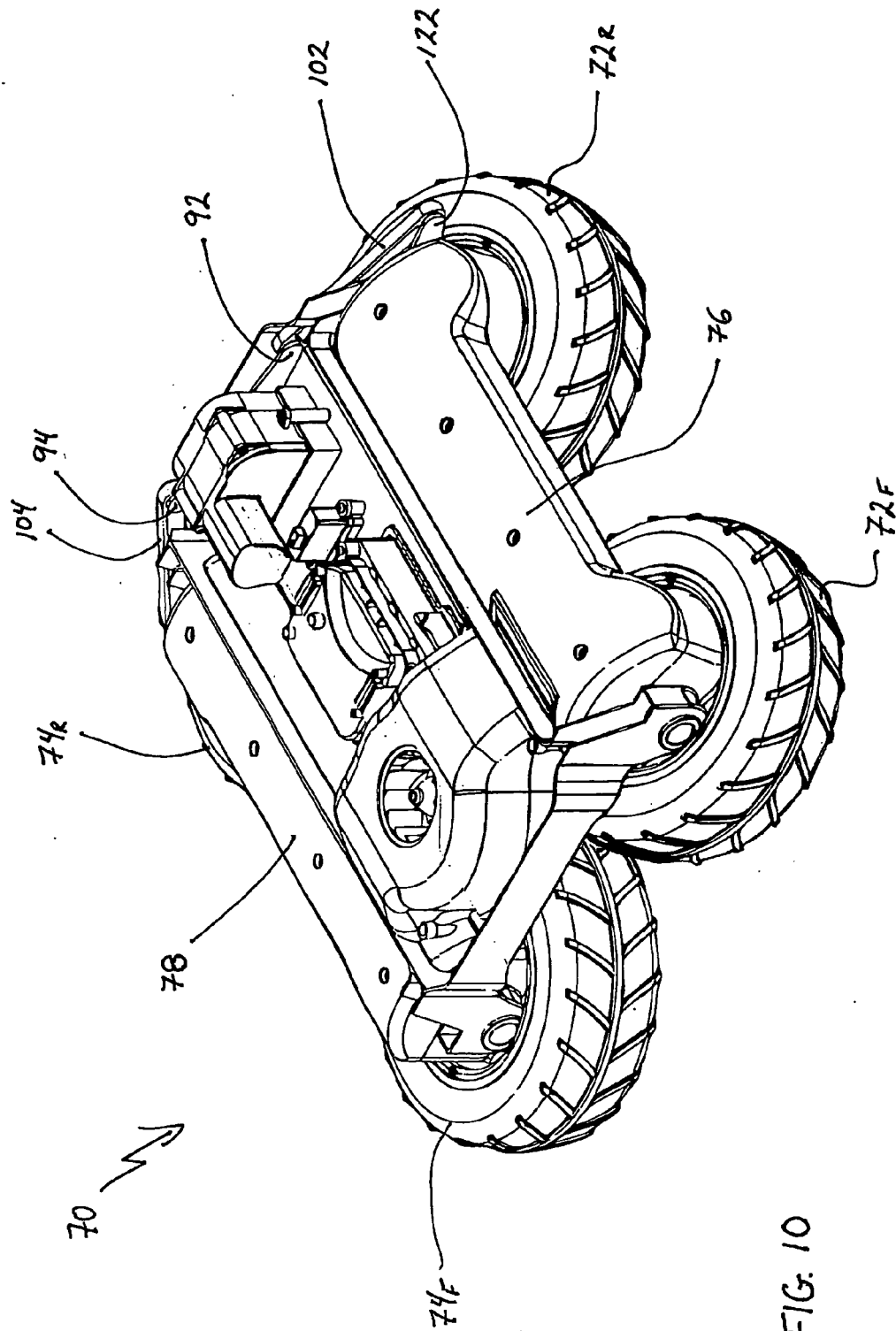


FIG. 9





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 07 5064

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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