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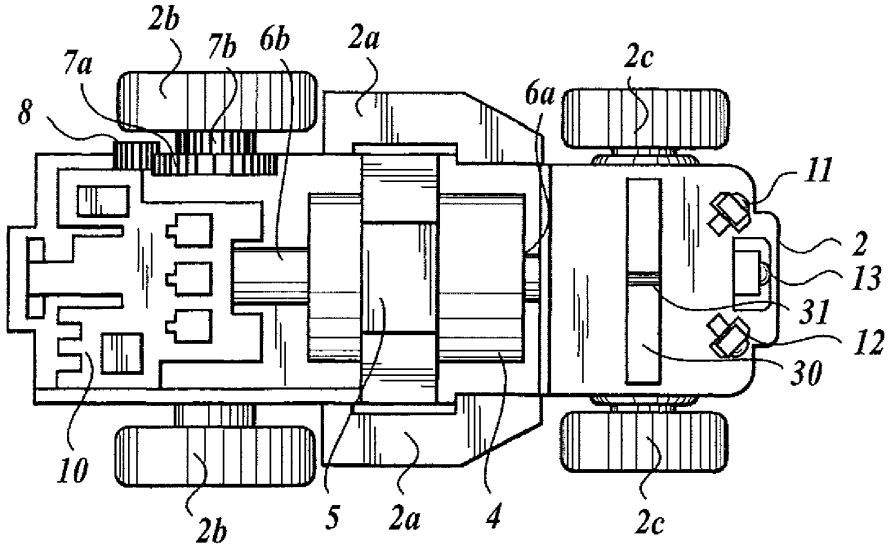
(54) **Steering control device for running toy and running toy**

(57) Disclosed is a steering control device for a running toy including: light emitting sections (11,12) mounted on the running toy to emit different types of infrared rays with different wavelengths in left and right directions diagonally ahead of the running toy, a light receiving section (13) mounted on the running toy to receive the infrared rays emitted from the light emitting sections (11,12) and reflected on an obstacle, and a control section (8) mounted on the running toy to control a steering device of the running toy when the light receiving sections receive an infrared ray with a wavelength matching with at least one of the wavelengths of the infrared rays emitted from the light emitting sections so that the running toy is steered in a direction to avoid collision with the obstacle according to the matching wavelength of the received infrared ray.

FIG.2



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a steering control device for a running toy and a running toy including the steering control device for a running toy.

2. Description of Related Art

[0002] For example, as described in Japanese Patent Application Laid-Open Publication No. 2004-305769, a running toy represented by automobile-type running toy can be steered by wireless operation. Thus, a collision with an obstacle ahead can be avoided by such steering.

[0003] However, with the invention described in Japanese Patent Application Laid-Open Publication No. 2004-305769, the toy itself cannot detect the obstacle, thus when wireless operation is performed with inexperienced operation, a collision with the obstacle due to operating error and the like occurs, resulting in damage of the toy itself.

SUMMARY OF THE INVENTION

[0004] The present invention has been made in consideration of the above situation, and it is one of main objects to provide a steering control device for a running toy so that the running toy can avoid a collision with an obstacle ahead autonomously and a running toy including such steering control device for a running toy.

[0005] According to a first aspect of the present invention, there is provided a steering control device for a running toy comprising:

light emitting sections mounted on the running toy to emit different types of infrared rays with different wavelengths in left and right directions diagonally ahead of the running toy;
a light receiving section mounted on the running toy to receive the infrared rays emitted from the light emitting sections and reflected on an obstacle; and
a control section mounted on the running toy to control a steering device of the running toy when the light receiving sections receive an infrared ray with a wavelength matching with at least one of the wavelengths of the infrared rays emitted from the light emitting sections so that the running toy is steered in a direction to avoid collision with the obstacle according to the matching wavelength of the received infrared ray.

[0006] According to a second aspect of the present invention, there is provided a steering control device for a running toy comprising:

light emitting sections mounted on the running toy to emit an infrared ray at different timing in left and right directions diagonally ahead of the running toy;
a light receiving section mounted on the running toy to receive the infrared ray emitted from the light emitting sections and reflected on an obstacle; and
a control section mounted on the running toy to control a steering device of the running toy so that the running toy is steered in a direction to avoid collision with the obstacle according to the timing the infrared ray is received by the light receiving section.

[0007] According to a third aspect of the present invention, there is provided a steering control device for a running toy which changes a direction of a steering wheel or a relative revolution speed of left and right driving wheels with a steering device, comprising:

light emitting sections to emit different types of infrared rays with different wavelengths in left and right directions diagonally ahead of the running toy;
a light receiving section to receive an infrared ray reflected on an obstacle ahead of the running toy; and
a control section to control the steering device so that the running toy is steered for a predetermined amount of time by changing a direction of the steering wheel or the relative revolution speed of the left and right driving wheels in a direction to avoid collision with the obstacle according to the wavelength of the reflected infrared ray received by the light receiving section.

[0008] According to a fourth aspect of the present invention, there is provided a steering control device for a running toy which changes a direction of a steering wheel or a relative revolution speed of left and right driving wheels with the steering device, comprising:

light emitting sections to emit an infrared ray at different timing in left and right directions diagonally ahead of the running toy;
a light receiving section to receive the infrared ray reflected on an obstacle ahead of the running toy; and
a control section to control the steering device so that the running toy is steered for a predetermined amount of time by changing a direction of the steering wheel or the relative revolution speed of the driving wheel in a direction to avoid collision with the obstacle according to the timing of the reflected infrared ray received by the light receiving section.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The above and other objects, advantages, and features of the present invention will become more fully understood from the detailed description given herein-

below and the appended drawings which are given by way of illustration only, and thus are not intended as a definition of the limits of the present invention, and wherein:

FIG. 1 is an external view showing a running toy and wireless controller of the present embodiment;
FIG. 2 is a plan view showing a chassis of the running toy shown in FIG. 1;
FIG. 3 is a block diagram showing a control circuit of the running toy shown in FIG. 1;
FIG. 4 is a perspective view showing a steering device of the running toy shown in FIG. 1;
FIG. 5 is a plan view showing a steering device of the running toy shown in FIG. 1;
FIG. 6 is a diagram showing a portion of a coil current circuit of the steering device of the running toy shown in FIG. 1;
FIG. 7 is a cross-section view showing a suspension of the running toy shown in FIG. 1 from a front view;
FIG. 8 is a diagram showing a status of running on a curved road surface of the running toy shown in FIG. 1;
FIG. 9 is a diagram showing an example of a course in which the running toy shown in FIG. 1 is used;
FIG. 10A is another example of a course in which the running toy shown in FIG. 1 is used; and
FIG. 10B is another example of a course in which the running toy shown in FIG. 1 is used.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] An embodiment of the present invention will be described below with reference to the drawings.

[0011] FIG. 1 is an external view showing an automobile-type running toy 1 including a steering control device of the present invention and a wireless controller 9 for operating speed of the running toy 1. An outer frame of the running toy 1 includes a chassis 2 shown in FIG. 2 and a body 3. The chassis 2 and the body 3 are configured with plastic, and although not limited, a concave section or hole section (engaging section) is provided on an inner side of the front portion and an inner side of the side portion and the body 3 is fixed to the chassis 2 by elastically engaging the concave section or hole section to the projection section 2a of the chassis 2. The running toy 1 includes a later-described light receiving section 13 for receiving a control signal (for example, an infrared signal) from the wireless controller 9.

[0012] FIG. 2 is a plan view showing the chassis 2. Although not limited, a chargeable battery (Nickel-Cadmium battery) 4 is provided in a longitudinal state in the central portion of the chassis 2. The battery 4 is attached to a battery storage section (not shown) with an attachment member 5. Conductive strips 6a and 6b electrically connectable to a negative electrode and positive electrode of the battery 4 are provided in front portion and rear portion of the battery storage section. Although not shown, the conductive strips 6a and 6b are partially exposed on the bottom side of the chassis 2 and the battery 4 can be charged by using the exposed portions of the conductive strips 6a and 6b.

[0013] A motor holding plate 10 is provided in a rear portion of the chassis 2, and a motor (not shown) is stored in a bottom portion of the plate. The motor is a DC motor, and exposed positive and negative terminals are electrically connected to the positive and negative electrodes of the battery 4, respectively. A gear 8 is fixedly provided to a motor shaft of the motor. The gear 8 is engaged to a gear 7a, and the gear 7a is engaged to a gear 7b fixedly provided to a rear wheel axle (not shown) connecting rear wheels 2b and 2b. As a result, motor power is transferred from the gear 8 to gears 7a and 7b in order, and the rear wheels 2b and 2b are driven to rotate.

[0014] Two light emitting sections 11 and 12 for emitting infrared rays and a light receiving section 13 for receiving infrared rays are provided in the front portion of the chassis 2. The light emitting sections 11 and 12 are provided in left and right portions of the front of the chassis 2, and although not limited, emit infrared rays centered to 45 degrees diagonally forward to the left and right respectively. The left light emitting section 11 and the right light emitting section 12 each emit infrared rays $\lambda 1$ and $\lambda 2$ with different wavelengths at intervals of, for example 0.5 to 0.7 seconds. The light receiving section 13 is provided at a center of the front of the chassis 2, and receives reflected light of the infrared rays $\lambda 1$ and $\lambda 2$ emitted by the light emitting sections 11 and 12 reflecting off of the obstacle ahead and a control signal from the above-described wireless controller 9. As described above, the light receiving section 13 can receive both infrared rays $\lambda 1$ and $\lambda 2$ and the control signal, thus separate light receiving devices for each purpose is not necessary and the running toy 1 can be made with a compact form.

[0015] The light emitting sections 11 and 12 may emit a plurality of types of infrared rays at different wavelengths to at least two areas in left and right directions. The infrared rays emitted from the light emitting sections 11 and 12 have a predetermined irradiation width and the irradiation directions of the infrared rays from the light emitting sections 11 and 12 are suitably adjusted so that the irradiation widths of the left and right light emitting sections 11 and 12 do not overlap each other nor form a large gap between each other. It is preferable that the irradiation width does not spread excessively wide outward than the width of the automobile toy.

[0016] The light emitting sections 11 and 12 may emit infrared rays $\lambda 1$ and $\lambda 2$ at timing different from each other. In this case, the infrared rays $\lambda 1$ and $\lambda 2$ do not need to be in different wavelengths.

[0017] As shown in FIG. 1, the wireless controller 9 includes a speed button 9a and a turbo button 9b. The speed button 9a can change running speed of the running toy 1 between two stages, normal speed and low speed. The running speed is always at low speed when the running toy 1 is started. When the speed button 9a is pressed

once, the running speed changes to normal speed, and when the button is pressed twice, the running speed returns to low speed. By pressing the turbo button 9b once, the running speed can sharply accelerate temporarily from low speed or normal speed to maximum speed. After maintaining maximum speed for ten seconds, the running speed automatically returns to normal speed.

[0018] FIG. 3 is a block diagram showing a control circuit of the running toy 1, and the running toy 1 includes a control device 16 including a speed control device 17 and a steering control device 18. The speed control device 17 variably controls the running speed of the running toy 1 by, for example Pulse Width Modulation (PWM) control of motor output according to the control signal received with the light receiving section 13. The steering control device 18 includes the light emitting sections 11 and 12 for emitting infrared rays, the light receiving section 13 for receiving the infrared rays reflected on the obstacle ahead, a coil current control section 19 for controlling the steering device 20 by energizing a later-described coil 14 in order to change a direction of the front wheels 2c and 2c for a predetermined amount of time to a direction to avoid the obstacle according to a wavelength of the infrared ray received by the light receiving section 13. In other words, the steering control device 18 detects whether the obstacle is in the area of the left or right direction diagonally ahead by recognizing the wavelength of the reflected light of the infrared ray received by the light receiving section 13 and according to the detected result, allows the coil current control section 19 to control the steering device 20 to steer for a predetermined amount of time in a direction to avoid collision in order to avoid collision with the obstacle. Here, the infrared rays emitted from the above-described light emitting sections 11 and 12 and the control signal (infrared signal) transmitted from the wireless controller 9 have different wavelengths.

[0019] The coil current control section 19 may control the steering device 20 according to wavelength and strength of the infrared rays received by the light receiving section 13. In other words, the steering control device 18 may detect whether the obstacle is in the area of the left or right direction diagonally ahead by recognizing the wavelength and the strength of the reflected light of the infrared light received by the light receiving section 13 and according to the detected result, may allow the coil current control section 19 to control the steering device 20 to steer for a predetermined amount of time in a direction to avoid collision in order to avoid collision with the obstacle. The coil current control section 19 may also perform the speed controlling performed by the speed control device 17. When the coil current control section 19 also performs the speed controlling, space for the speed control device 17 becomes unnecessary and the running toy 1 can be made with a compact form.

[0020] Next, details of the steering device of running toy 1 will be described. As shown in FIG. 4, the steering device 20 of the running toy 1 includes left and right knuckle arms (turning body) 21 attached to the left and right front wheels 2c and 2c respectively, and a tie rod (connecting body) 22 connecting the left and right knuckle arms 21 to each other.

[0021] Here, front wheel axles 21a are attached to each knuckle arm 21 and front wheels 2c and 2c are attached to the front wheel axles 21a so as to be able to spin freely. As shown in FIG. 5, the left and right knuckle arms 21 are supported by the chassis 2 so as to be rotatable around the left and right shafts 21b, respectively. As shown in FIG. 7, upper end portion and lower end portion of the left and right shafts 21b are in hole sections of the lower chassis 2e and the upper chassis 2f, respectively. The hole section where the top end section of the shaft 21b is inserted into penetrates the upper chassis 2f vertically and the left and right knuckle arms 21 can move slightly vertically between the lower chassis 2e and upper chassis 2f. On the other hand, as shown in FIG. 5, the tie rods 22 form turning pairs with the free ends of the knuckle arms 21 at areas of shafts 21c of both end portions. As a result, when the tie rods 22 oscillate left and right, the left and right knuckle arms 21 rotate around shafts 21b and the direction of the left and right front wheels 2c and 2c are changed.

[0022] A trim 25 is placed behind the tie rod 22. The trim 25 includes a cylindrical shaft 23 and the trim 25 can turn around a center axis of the cylinder. The shaft 23 has magnetic force and with magnetic attractive force of a later-described permanent magnet 24, holds the tie rod 22 in a position which is not biased to left or right (neutral position). Turning a lever 25b exposed from the bottom side of the chassis 2 left and right around the center axis of the shaft 23 allows fine adjustment of the neutral position of the tie rod 22.

[0023] The permanent magnet 24 is provided in a center portion of the tie rod 22. The permanent magnet 24 is in a disk shape, and is provided so that each end face faces upward or downward. One end face of the permanent magnet is an S pole, and the other end face is an N pole. Left and right coils 14 are provided in front of the tie rod 22. The coils 14 are round air core coils, which are coils without cores, one end portion of each coil 14 faces the end face of the permanent magnet 24 provided in the tie rod 22. Here, the disk shaped permanent magnet and round air core coil are used in order to make the entire toy smaller and lighter by not using a core in the coil. The generation of magnetic force of the coil in a round air core coil is weak, however this is not a problem when the above-described shaft 23 used has very weak magnetic force.

[0024] FIG. 6 shows a portion of the coil current circuit. The energizing of the coil current circuit is controlled by the coil current control section and in the coil current circuit, the left and right coils 14 are energized at the same time, so that when the left and right coils 14 are energized at the same time, the polarity of the side facing the end face of the permanent magnet 24 is the same pole (N pole or S pole) in both left and right coils 14. Therefore,

when the left and right coils 14 are energized, attractive force is produced between one coil 14 and the permanent magnet 24, and repulsive force is produced between the other coil 14 and the permanent magnet 24. With this, the tie rod 22 oscillates by resisting to the attractive force between the shaft 23 and the permanent magnet 24. The coil current control section changes the direction of the flow of the current of the coil 14 to change the oscillating direction of the tie rod 22.

[0025] The left and right coils 14 may alternatively be energized and the tie rod 22 may be oscillated by the attractive force or the repulsive force produced between the energized coil 14 and the permanent magnet 24.

[0026] The steering device 20 is not limited to the above-described structure, and a mechanism including a combination of, for example, a rack and a pinion may be used.

[0027] The steering device may perform steering by relatively changing the number of revolutions of left and right steering wheels whose direction do not change or relatively changing the speed of revolution of the left and right driving wheels. For example, steering the driving toy 1 may be performed by revolving the left and right driving wheels in the opposite direction or by revolving only one driving wheel.

[0028] Steering may be performed after temporarily stopping the running of the running toy 1.

[0029] FIG. 7 shows a suspension of the automobile toy. The suspension includes a leaf spring 30. The leaf spring 30 is provided in the upper chassis 2f. The middle of the leaf spring 30 is curved in a U-shape and the curved portion is lightly pressed by a shaft 31 provided in the upper chassis 2f. Left and right end portions of the leaf spring 30 are placed on the hole sections where the upper end portions of the shafts 21b are inserted into, and abuts the top ends of the shafts 21b. With this, the leaf spring 30 absorbs the impact received by the front wheels 2c and 2c of the running toy 1 from the road surface according to the ups and downs of a running surface.

[0030] Next, the operation of the running toy 1 when running on a curved road surface will be described.

[0031] The running toy 1 is mainly used in a course as shown in FIG. 9 which is exclusive for the running toy 1. On the course, the user can place a starting gate as shown in the bottom portion of the figure and also place obstacles such as tires or drum cans according to the user's preference. When the running toy 1 reaches a left bending curve as shown in FIG. 8 while running on the course, the running toy 1 can autonomously avoid collision with the course wall of the curve by the following operation.

[0032] First, infrared ray λ2 is emitted from the right light emitting section 12 of the running toy 1. The infrared ray λ2 is reflected on the course wall of the curve ahead to the right of the running toy 1 and received by the light receiving section 13. When the light receiving section 13 receives the infrared ray λ2, the coil current control section 19 energizes the coil 14 so that the direction of the front wheels 2c and 2c are changed in a predetermined direction to the left to avoid collision with the course wall. A moving direction of the running toy 1 is changed to a direction to which the front wheels 2c and 2c are changed (arrow A of FIG. 8). Then, after a predetermined amount of time passes, the coil current control section 19 returns the direction of the front wheels 2c and 2c to a straight direction. As described above, the running toy 1 can autonomously avoid collision with the course wall ahead.

[0033] In the above-described description, the operation of when the running toy 1 avoids one obstacle is described, however, since the light emitting sections 11 and 12 and the light receiving section 13 intermittently or successively emit and receive light, for example when there are a plurality of intermittent obstacles ahead to the left and right, the running toy 1 can avoid collisions with these obstacles and continue running. The obstacle to be avoided is not limited to a stationary body, and for example, in a case where a similar automobile toy is running ahead, when the automobile toy running ahead is within the irradiation range of the infrared ray, the automobile toy can be detected and operation to avoid the automobile toy can be performed.

[0034] When the light emitting sections 11 and 12 emit infrared rays λ1 and λ2 at separate timing, even if the infrared rays λ1 and λ2 do not have different wavelengths, the light receiving section 13 can identify which infrared ray λ1 or λ2 is received by the timing the light is received. The steering control device 18 detects whether the obstacle is in a left or right area diagonally ahead according to the timing the infrared rays λ1 and λ2 are received.

[0035] Since the light emitting sections 11 and 12 are provided in the left and right of the front of the running toy 1 and the light receiving section 13 is provided in the center of the front portion of the running toy 1, the path of the infrared rays λ1 and λ2 from being emitted from the light emitting sections 11 and 12 to being received by the light receiving section 13 is short, and consequently, attenuation of the infrared rays λ1 and λ2 can be reduced to keep the sensitivity of the light receiving section 13 high, and the obstacle can be detected faster.

[0036] When the light emitting sections 11 and 12 emit a plurality of types of infrared rays at different wavelengths to two or more areas in the left and right direction, a position of the obstacle can be detected more accurately and a collision with the obstacle can be avoided with less amount of avoidance.

[0037] When the coil current control section 19 can control the steering device 20 according to the wavelength and strength of the infrared rays received by the light receiving section 13, the distance to the obstacle can be detected by the strength of the infrared rays. When the distance to the obstacle can be detected, when for example, an obstacle suddenly appears ahead due to the change in running direction as described above, a collision with the obstacle can be avoided more reliably. When the speed and timing of changing the direction of

the front wheels 2c and 2c can be controlled, the collision with the obstacle can be avoided even more reliably. The same can be said for when the light emitting sections 11 and 12 emit infrared rays at separate timing and the coil current control section 19 can control the steering device 20 according to the timing and strength of the infrared ray received by the light receiving section 13.

[0038] Other than the course as shown in FIG. 9, the running toy 1 can be used in a course representing an urban street as shown in FIG. 10A, or a course representing a street under construction as shown in FIG. 10B, and running while avoiding obstacles can be enjoyed.

[0039] As described above, according to the running toy 1 including the steering control device 18 of the present invention, since the steering control device 18 includes light emitting sections 11 and 12 for emitting infrared rays $\lambda 1$ and $\lambda 2$ at different wavelengths, a light receiving section 13 for receiving infrared rays $\lambda 1$ and $\lambda 2$ reflected on obstacles and a coil current control section 19 for controlling the steering device 20 in order to change a direction of the front wheels 2c and 2c for a predetermined amount of time to a direction to avoid the obstacle according to the wavelength of the infrared ray received by the light receiving section 13, the position of the obstacle ahead can be detected by recognizing the wavelength of the infrared ray received by the light receiving section and collision with the obstacle can be autonomously avoided.

[0040] The present invention is not limited to the embodiment described above, and can be suitably modified.

[0041] For example, in the above-described embodiment, collision is avoided by steering, however when the left and right light receiving sections receives infrared rays almost at the same time, then it may be determined that there is an obstacle which cannot be avoided and the running toy can be stopped or steered to temporarily move backwards.

[0042] According to a first aspect of the preferred embodiments, there is provided a steering device for a running toy comprising:

> light emitting sections mounted on the running toy to emit different types of infrared rays with different wavelengths in left and right directions diagonally ahead of the running toy;
> a light receiving section mounted on the running toy to receive the infrared rays emitted from the light emitting sections and reflected on an obstacle; and
> a control section mounted on the running toy to control a steering device of the running toy when the light receiving sections receive an infrared ray with a wavelength matching with at least one of the wavelengths of the infrared rays emitted from the light emitting sections so that the running toy is steered in a direction to avoid collision with the obstacle according to the matching wavelength of the received infrared ray.

[0043] According to the first aspect, the running toy can perform suitable steering to avoid an obstacle according to whether the obstacle is in the area to the left or to the right diagonally ahead based on the received wavelength of the reflected light.

[0044] Preferably, in the steering control device for the running toy, when the wavelength of the infrared ray received by the light receiving section matches with at least one of the wavelengths of the infrared rays emitted from the light emitting sections, the control section controls the steering device of the running toy so that the running toy is steered in a direction to avoid collision with the obstacle according to the matching wavelength and strength of the received infrared ray.

[0045] Consequently, the control section can control the steering device to steer the running toy in a direction to avoid collision with the obstacle according to the wavelength and the strength of the reflected light received by the light receiving section, and collision with the obstacle can be avoided accurately.

[0046] According to a second aspect of the preferred embodiments, there is provided a steering control device for a running toy comprising:

> light emitting sections mounted on the running toy to emit an infrared ray at different timing in left and right directions diagonally ahead of the running toy;
> a light receiving section mounted on the running toy to receive the infrared ray emitted from the light emitting sections and reflected on an obstacle; and
> a control section mounted on the running toy to control a steering device of the running toy so that the running toy is steered in a direction to avoid collision with the obstacle according to the timing the infrared ray is received by the light receiving section.

[0047] According to the second aspect, the running toy can perform suitable steering to avoid the obstacle according to whether the obstacle is in the area to the left or right diagonally ahead by recognizing the timing of receiving the reflected light.

[0048] Preferably, in the steering control device for the running toy, the control section controls the steering device of the running toy so that the running toy is steered in a direction to avoid collision with the obstacle according to the timing and strength of the infrared ray received by the light receiving section.

[0049] Consequently, since the control section controls the steering device to steer the running toy in the direction to avoid collision with the obstacle according to the timing and strength of the reflected light received by the light receiving section, the running toy can accurately avoid collision with the obstacle.

[0050] According to a third aspect of the preferred embodiments, there is provided a steering control device for a running toy which changes a direction of a steering wheel or a relative revolution speed of left and right driving wheels with a steering device, comprising:

light emitting sections to emit different types of infrared rays with different wavelengths in left and right directions diagonally ahead of the running toy;
a light receiving section to receive an infrared ray reflected on an obstacle ahead of the running toy; and
a control section to control the steering device so that the running toy is steered for a predetermined amount of time by changing a direction of the steering wheel or the relative revolution speed of the left and right driving wheels in a direction to avoid collision with the obstacle according to the wavelength of the reflected infrared ray received by the light receiving section.

[0051] According to the third aspect, since the steering control device for the running toy includes, a light emitting section to emit different types of infrared rays with different wavelengths in a left and right direction diagonally ahead of the running toy, a light receiving section to receive the infrared ray reflected on an obstacle ahead of the running toy, and a control section to control the steering device so that the running toy is steered for a predetermined amount of time in a direction to avoid collision with the obstacle according to the wavelength of the reflected light received by the light receiving section, the steering control device can detect whether the obstacle is in the left or right area diagonally ahead and the running toy can be steered for a predetermined amount of time in the direction to avoid the collision with the obstacle. Therefore, the running toy can autonomously avoid the obstacle ahead.

[0052] Preferably, in the steering control device for the running toy, the control section controls the steering device of the running toy so that the running toy is steered for a predetermined amount of time by changing a direction of the steering wheel or the relative revolution speed of the driving wheel in a direction to avoid collision with the obstacle according to the wavelength and strength of the reflected infrared ray received by the light receiving section.

[0053] Consequently, since the control section controls the steering device so that the running toy is steered in the direction to avoid collision with the obstacle according to the wavelength and the strength of the reflected light received by the light receiving section, the collision with the obstacle can be accurately avoided.

[0054] According to a fourth aspect of the preferred embodiments, there is provided a steering control device for a running toy which changes a direction of a steering wheel or a relative revolution speed of left and right driving wheels with the steering device, comprising:

light emitting sections to emit an infrared ray at different timing in left and right directions diagonally ahead of the running toy;
a light receiving section to receive the infrared ray reflected on an obstacle ahead of the running toy; and
a control section to control the steering device so that the running toy is steered for a predetermined amount of time by changing a direction of the steering wheel or the relative revolution speed of the driving wheel in a direction to avoid collision with the obstacle according to the timing of the reflected infrared ray received by the light receiving section.

[0055] According to the fourth aspect, since the steering control device for the running toy includes a light emitting section to emit infrared rays at different timing in a left and right direction diagonally ahead of the running toy, a light receiving section to receive the infrared ray reflected on an obstacle ahead of the running toy, and a control section to control the steering device so that the running toy is steered for a predetermined amount of time in a direction to avoid collision with the obstacle according to the timing of the reflected light received by the light receiving section, the steering control device can detect whether the obstacle is in the left or right direction diagonally ahead by recognizing the timing of the received light, and the running toy can be steered for a predetermined amount of time in the direction to avoid collision with the obstacle in order to avoid collision with the obstacle. Therefore, the running toy can autonomously avoid collision with the obstacle ahead.

[0056] Preferably, in the steering control device for the running toy, the control section controls the steering device of the running toy so that the running toy is steered for a predetermined amount of time by changing a direction of the steering wheel or the relative revolution speed of the driving wheel in a direction to avoid collision with the obstacle according to the timing and strength of the reflected infrared ray received by the light receiving section.

[0057] Consequently, since the control section controls the steering device so that the running toy is steered in the direction to avoid collision with the obstacle according to the timing and the strength of the reflected light received by the light receiving section, the collision with the obstacle can be accurately avoided.

[0058] Preferably, in the steering control device for the running toy, the light emitting sections are provided on left and right of a front of the running toy and the light receiving section is provided on a center of the front of the running toy.

[0059] Consequently, since the light emitting sections are provided on the left and right of the front of the running toy and the light receiving section is provided on the center of the front of the running toy, the path of the infrared ray from the light emitting section where the light is emitted to the light receiving section where the light is received can be made short. Therefore, attenuation of the infrared rays can be reduced to keep the sensitivity of the light receiving section high, and the obstacle can be detected faster.

[0060] Preferably, a running toy comprises the steer-

ing control device for the running toy.

[0061] Preferably the running toy further comprises:

a wireless controller emitting a type of infrared ray different from the infrared ray, wherein
the control section controls speed according to the infrared ray from the wireless controller.

[0062] Consequently, since the running toy includes the wireless controller emitting a type of infrared ray different from the infrared ray for detecting the obstacle, and the control section controls speed according to the infrared ray from the wireless controller, the player can change the running speed by wireless operation. Also, a control section for controlling speed does not need to be newly provided, therefore, the running toy itself can be made with a compact form.

[0063] Preferably, in the running toy, the light receiving section receives the infrared ray from the wireless controller.

[0064] Consequently, since the infrared ray from the wireless controller is received by the light receiving section for detecting the obstacle, a new light receiving device for receiving the infrared ray from the wireless controller does not need to be provided, therefore, the running toy itself can be made with a compact form.

[0065] Although various exemplary embodiments have been shown and described, the invention is not limited to the embodiments shown. Therefore, the scope of the invention is intended to be limited solely by the scope of the claims that follow.

Claims

1. A steering control device for a running toy comprising:

   light emitting sections mounted on the running toy to emit different types of infrared rays with different wavelengths in left and right directions diagonally ahead of the running toy;
   a light receiving section mounted on the running toy to receive the infrared rays emitted from the light emitting sections and reflected on an obstacle; and
   a control section mounted on the running toy to control a steering device of the running toy when the light receiving sections receive an infrared ray with a wavelength matching with at least one of the wavelengths of the infrared rays emitted from the light emitting sections so that the running toy is steered in a direction to avoid collision with the obstacle according to the matching wavelength of the received infrared ray.

2. The steering control device for the running toy according to claim 1, wherein when the wavelength of the infrared ray received by the light receiving section matches with at least one of the wavelengths of the infrared rays emitted from the light emitting sections, the control section controls the steering device of the running toy so that the running toy is steered in a direction to avoid collision with the obstacle according to the matching wavelength and strength of the received infrared ray.

3. A steering control device for a running toy comprising:

   light emitting sections mounted on the running toy to emit an infrared ray at different timing in left and right directions diagonally ahead of the running toy;
   a light receiving section mounted on the running toy to receive the infrared ray emitted from the light emitting sections and reflected on an obstacle; and
   a control section mounted on the running toy to control a steering device of the running toy so that the running toy is steered in a direction to avoid collision with the obstacle according to the timing the infrared ray is received by the light receiving section.

4. The steering control device for the running toy according to claim 3, wherein the control section controls the steering device of the running toy so that the running toy is steered in a direction to avoid collision with the obstacle according to the timing and strength of the infrared ray received by the light receiving section.

5. A steering control device for a running toy which changes a direction of a steering wheel or a relative revolution speed of left and right driving wheels with a steering device, comprising:

   light emitting sections to emit different types of infrared rays with different wavelengths in left and right directions diagonally ahead of the running toy;
   a light receiving section to receive an infrared ray reflected on an obstacle ahead of the running toy; and
   a control section to control the steering device so that the running toy is steered for a predetermined amount of time by changing a direction of the steering wheel or the relative revolution speed of the left and right driving wheels in a direction to avoid collision with the obstacle according to the wavelength of the reflected infrared ray received by the light receiving section.

6. The steering control device for the running toy according to claim 5, wherein the control section con-

trols the steering device of the running toy so that the running toy is steered for a predetermined amount of time by changing a direction of the steering wheel or the relative revolution speed of the driving wheel in a direction to avoid collision with the obstacle according to the wavelength and strength of the reflected infrared ray received by the light receiving section.

7. A steering control device for a running toy which changes a direction of a steering wheel or a relative revolution speed of left and right driving wheels with the steering device, comprising:

light emitting sections to emit an infrared ray at different timing in left and right directions diagonally ahead of the running toy;
a light receiving section to receive the infrared ray reflected on an obstacle ahead of the running toy; and
a control section to control the steering device so that the running toy is steered for a predetermined amount of time by changing a direction of the steering wheel or the relative revolution speed of the driving wheel in a direction to avoid collision with the obstacle according to the timing of the reflected infrared ray received by the light receiving section.

8. The steering control device for the running toy according to claim 7, wherein the control section controls the steering device of the running toy so that the running toy is steered for a predetermined amount of time by changing a direction of the steering wheel or the relative revolution speed of the driving wheel in a direction to avoid collision with the obstacle according to the timing and strength of the reflected infrared ray received by the light receiving section.

9. The steering control device for the running toy according to any one of claims 1 to 8, wherein the light emitting sections are provided on left and right of a front of the running toy and the light receiving section is provided on a center of the front of the running toy.

10. A running toy comprising the steering control device for the running toy according to any one of claims 1 to 8.

11. A running toy according to claim 10, further comprising:

a wireless controller emitting a type of infrared ray different from the infrared ray, wherein
the control section controls speed according to the infrared ray from the wireless controller.

12. A running toy according to claim 11, wherein the light receiving section receives the infrared ray from the wireless controller.

FIG.1

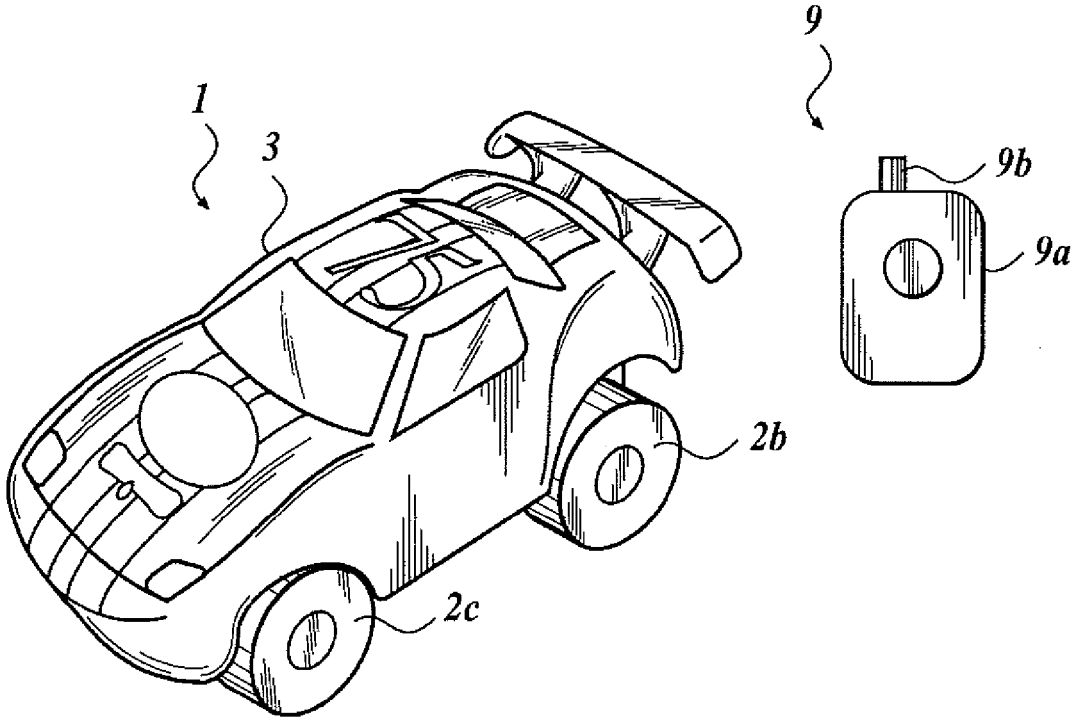


FIG.2

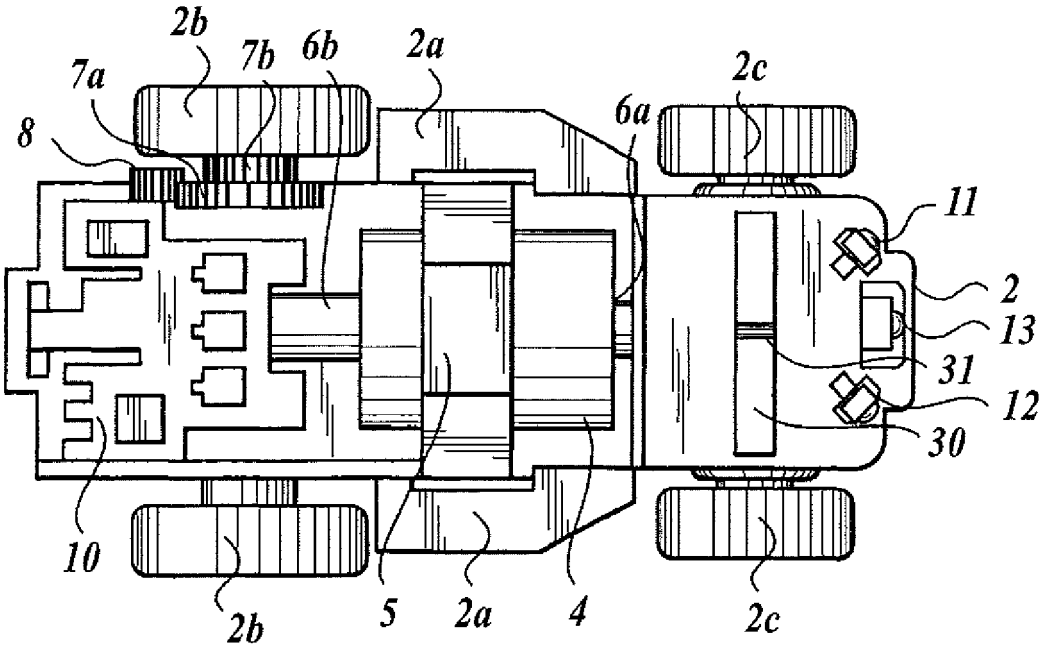


FIG.3

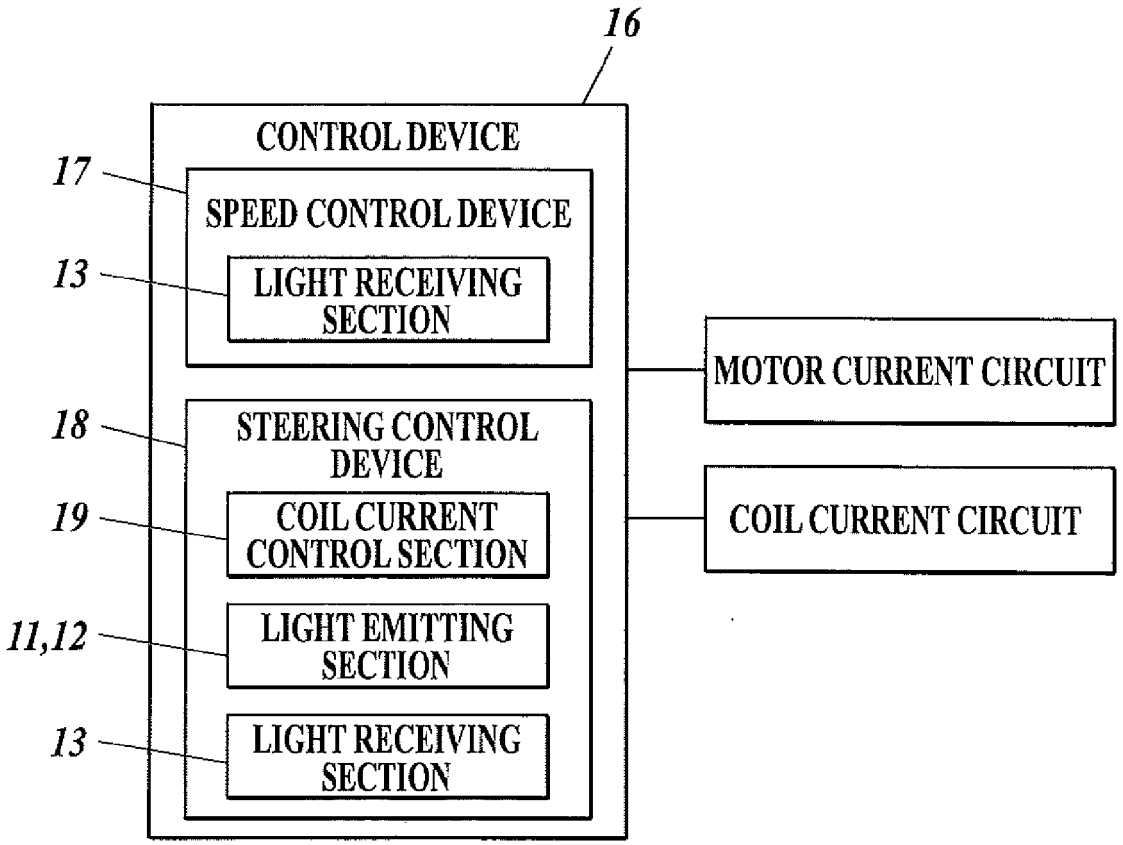

16
CONTROL DEVICE
17
SPEED CONTROL DEVICE
13
LIGHT RECEIVING SECTION
18
STEERING CONTROL DEVICE
19
COIL CURRENT CONTROL SECTION
11,12
LIGHT EMITTING SECTION
13
LIGHT RECEIVING SECTION
MOTOR CURRENT CIRCUIT
COIL CURRENT CIRCUIT

FIG.4

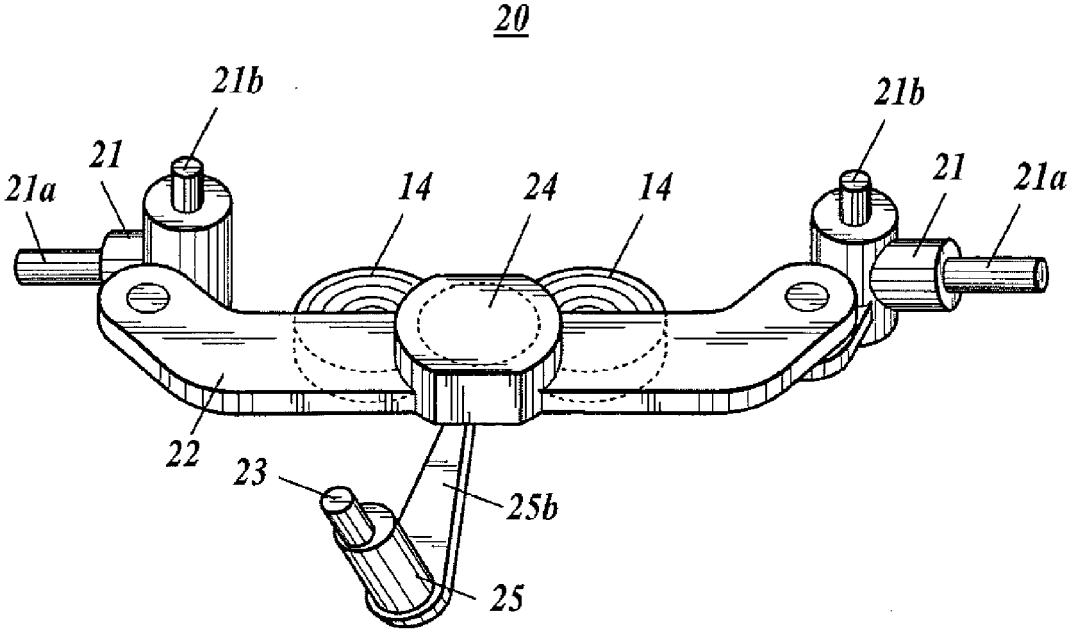


FIG. 5

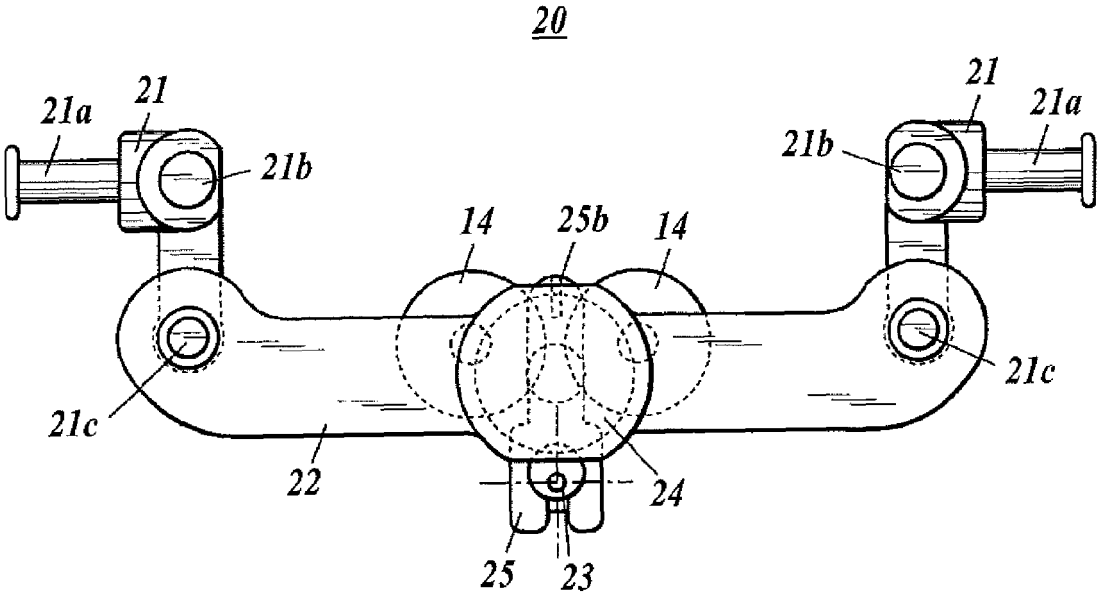


FIG.6

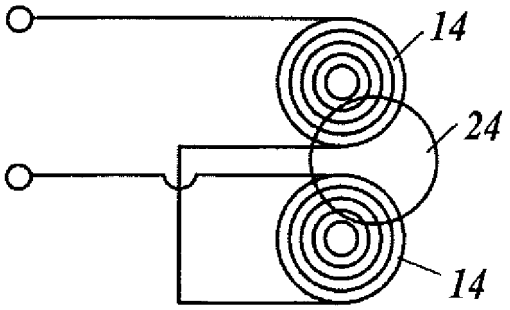


FIG. 7

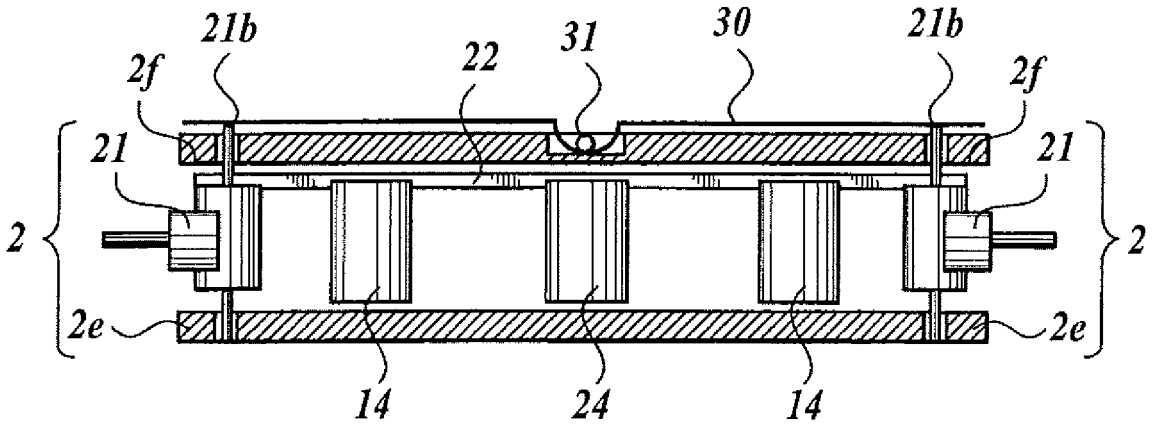


FIG.8

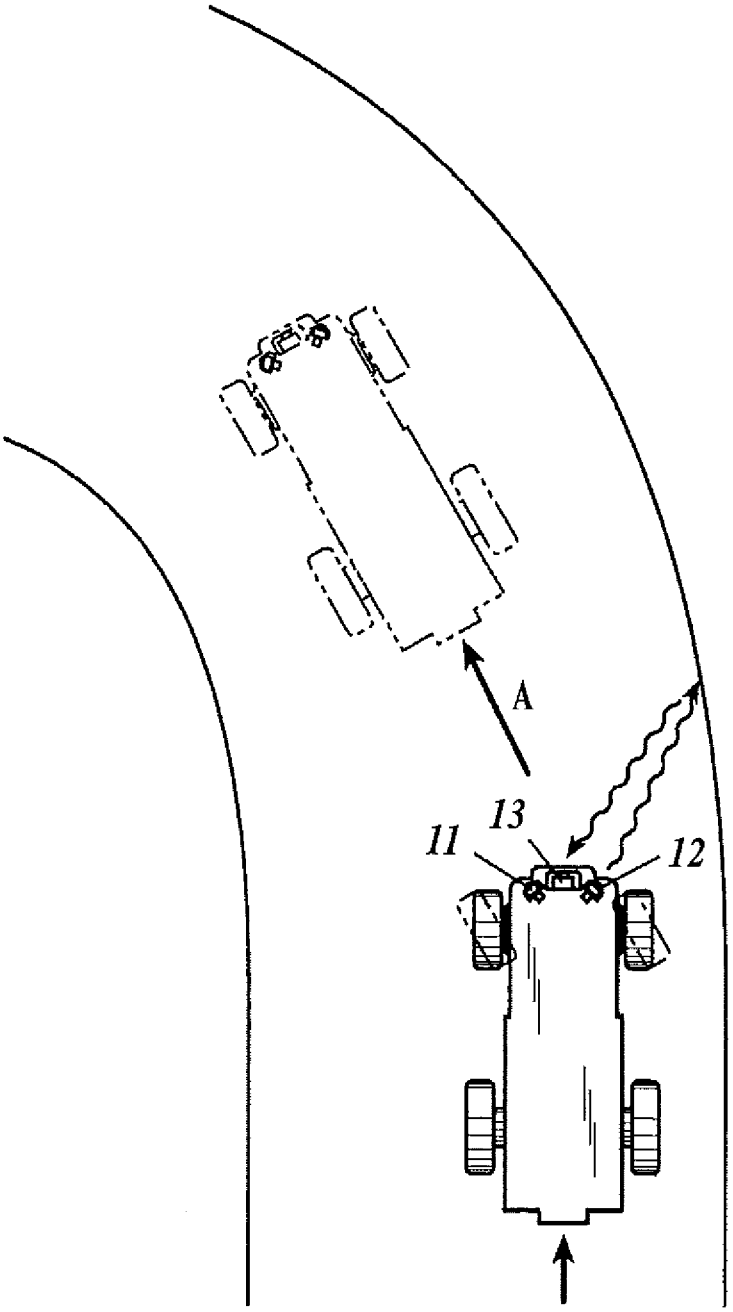


FIG.9

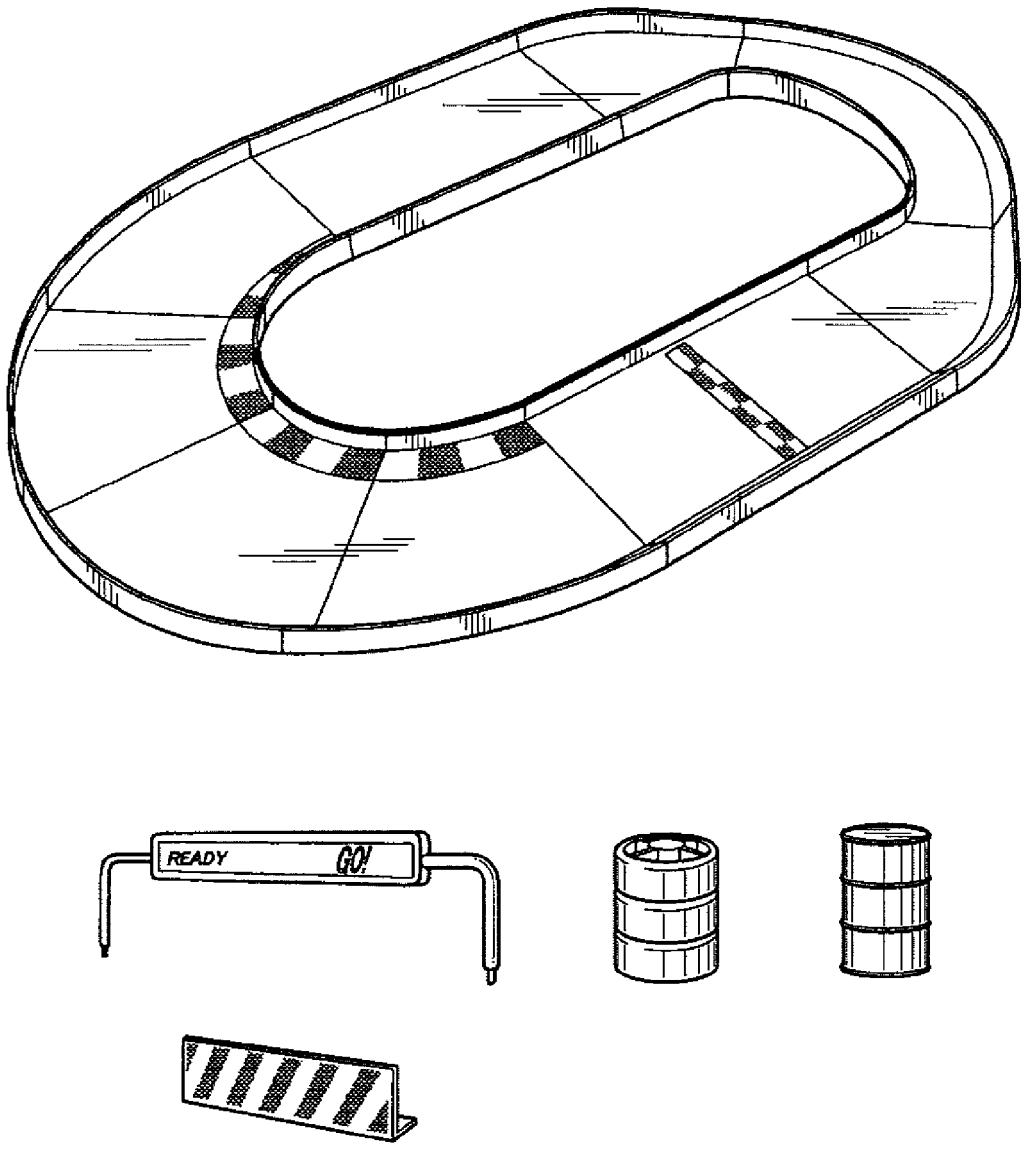


FIG.10A

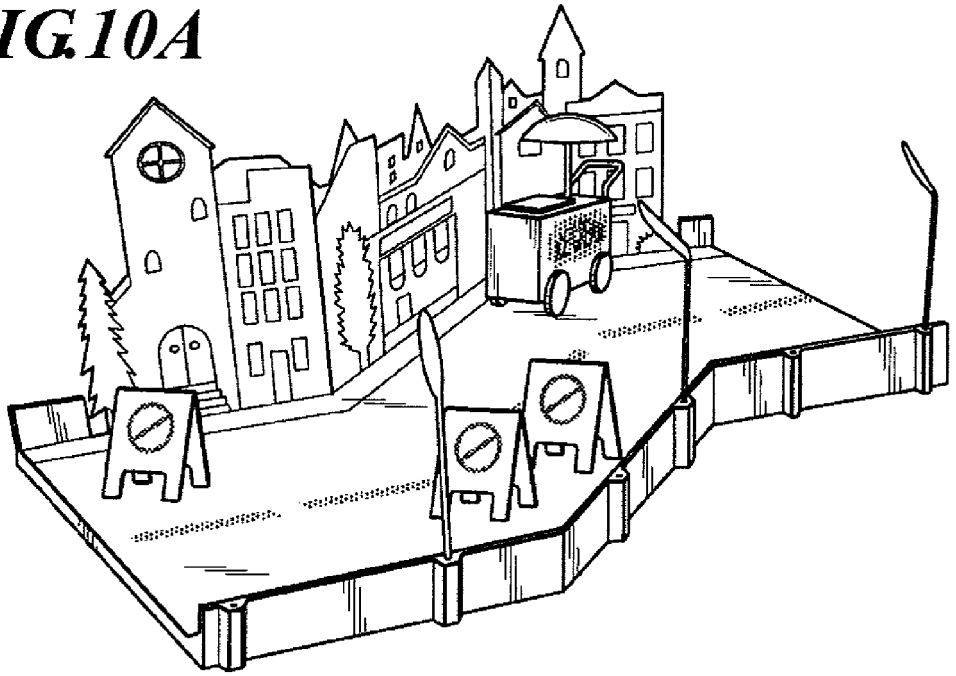
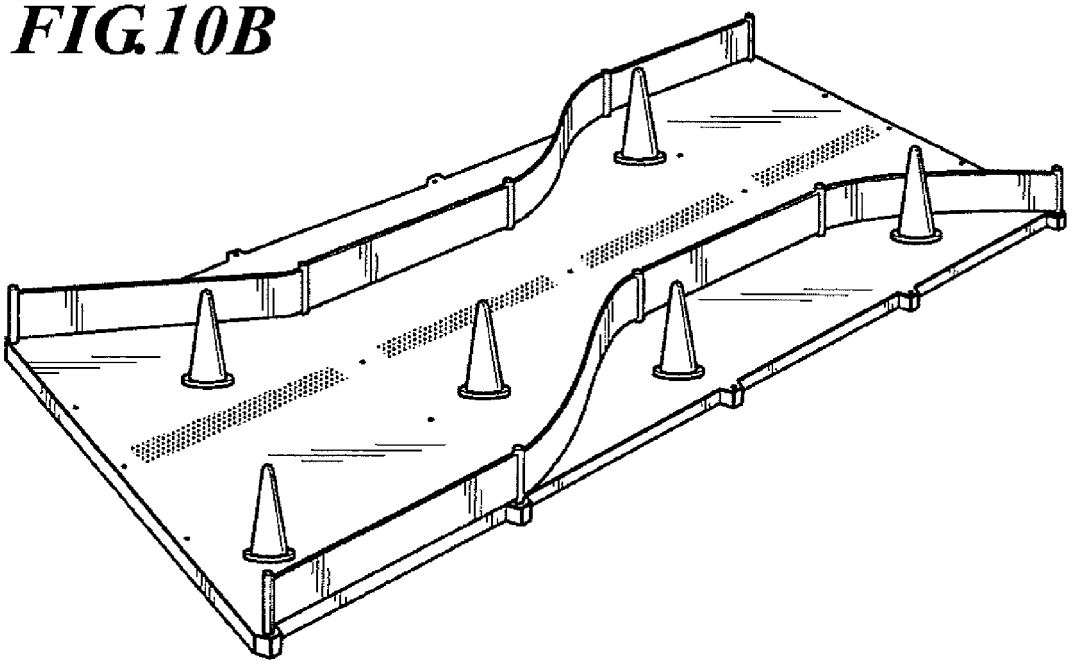


FIG.10B



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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 5436

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2002/102910 A1 (DONAHUE KEVIN GERARD [US] ET AL) 1 August 2002 (2002-08-01) * the whole document *	1,3,5,7	INV. A63H17/40
A	GB 2 361 438 A (TSOU HSIEN CHIH [TW]) 24 October 2001 (2001-10-24) * the whole document *	1,3,5,7	

TECHNICAL FIELDS SEARCHED (IPC)

A63H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 January 2009	Turmo, Robert

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13-01-2009

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