# United States Patent

**Ryan et al.**

[15] **3,675,925**

[45] **July 11, 1972**


## [54] COLOR RESPONSIVE TOY


[72] Inventors: **John W. Ryan**, Los Angeles; **John G. Tomkinson**, Palos Verdes Peninsula; **Paul R. Wieman**, Hawthorne, all of Calif.

[73] Assignee: **Mattel, Inc.**, Hawthorne, Calif.



[22] Filed: **Feb. 8, 1971**

[21] Appl. No.: **113,478**

[52] **U.S. Cl.** .....**273/101.2**, 46/244 R, 250/226, 356/152

[51] **Int. Cl.** .....**A63f 9/02**

[58] **Field of Search** .....250/203, 202, 215, 226; 46/244 R, 244 C; 273/101.1, 101.2; 356/152



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 3,314,189 | 4/1967 | Carroll | 46/244 C |
| 3,020,793 | 2/1962 | Neubrech et al | 250/226 X |
| 3,171,963 | 3/1965 | Bourguignon | 46/244 C X |
| 3,218,461 | 11/1965 | Saunders et al | 250/215 X |



*Primary Examiner*—Walter Stolwein

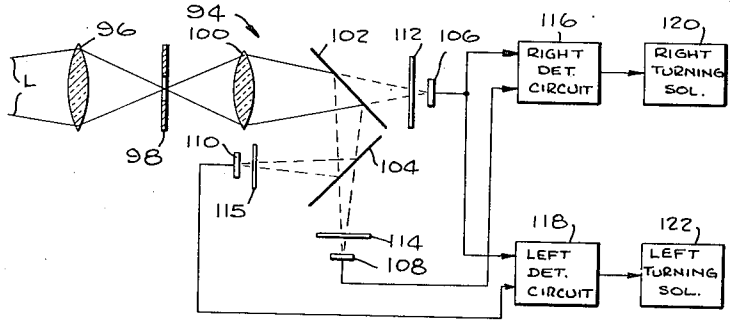
*Attorney*—Seymour A. Scholnick



[57] **ABSTRACT**

A toy which senses the color of a target area to select an appropriate output, one of such toys being a rifle which can be aimed at a target device to register whether a hit has been made. The rifle includes a lens which focuses light from the precise direction in which the rifle is aimed onto two identical photocells. A red filter is placed in front of a first of the cells while a neutral density filter is placed in front of a second cell, so that when the rifle is aimed at a red target the red-filtered cell generates a larger output than the other. A detecting circuit determines when the output from the red-filtered cell is greater than that from the other to ring a bell in the gun that indicates a hit. The detecting circuit is activated only at the instant when a child first depresses a trigger on the gun.


**7 Claims, 7 Drawing Figures**



PATENTED JUL 11 1972

3,675,925

SHEET 1 OF 2

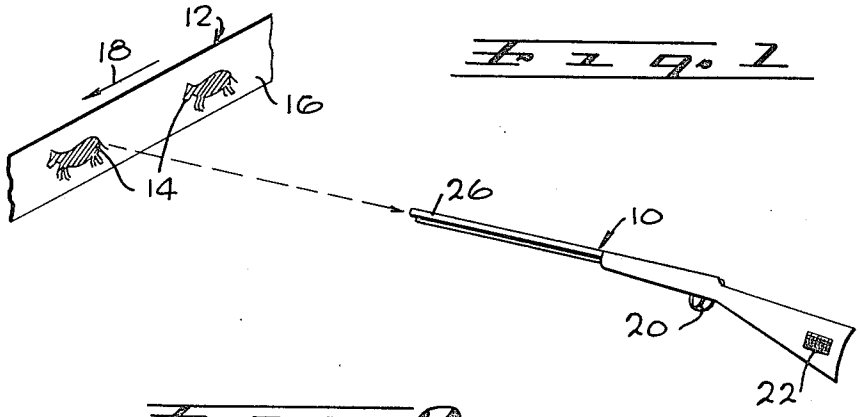



FIG. 1

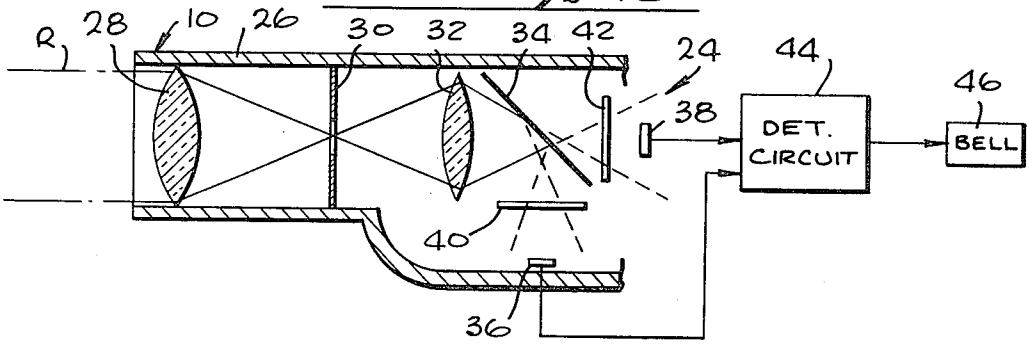



FIG. 2

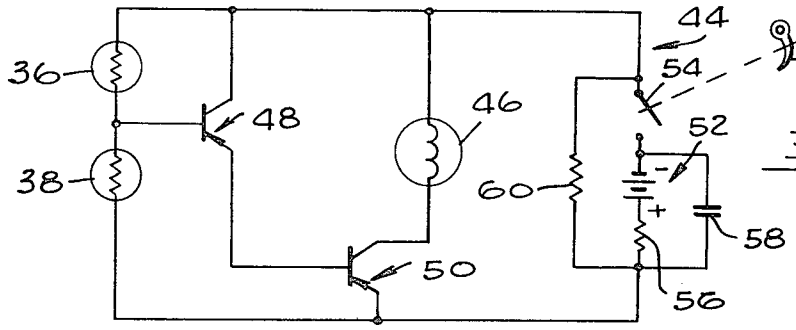



FIG. 3

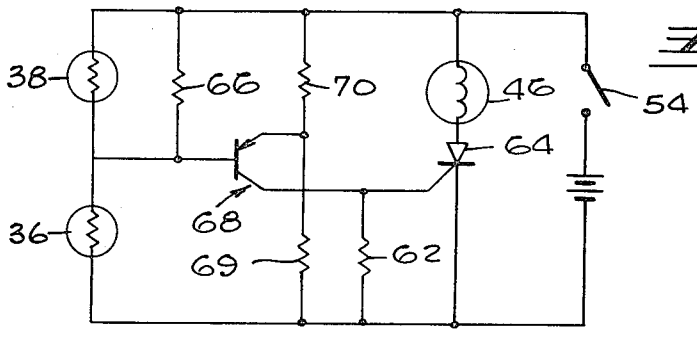



FIG. 4

INVENTORS
JOHN W. RYAN
JOHN G. TOMKINSON
BY PAUL R. WEIMAN
Mark E. Shirk
ATTORNEY

Fig. 5

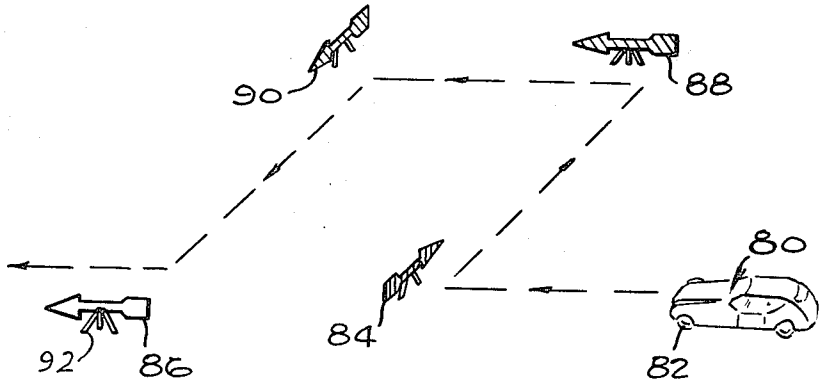



Fig. 6

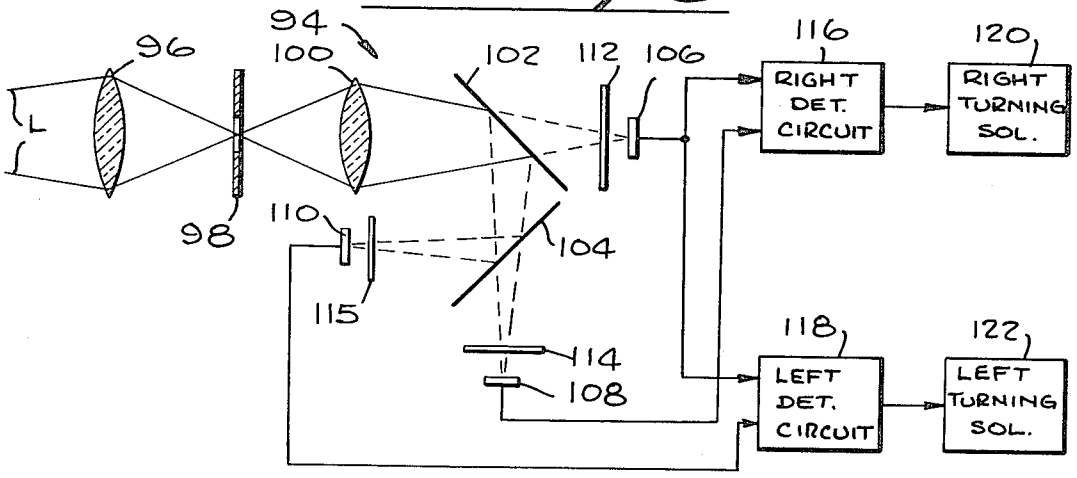
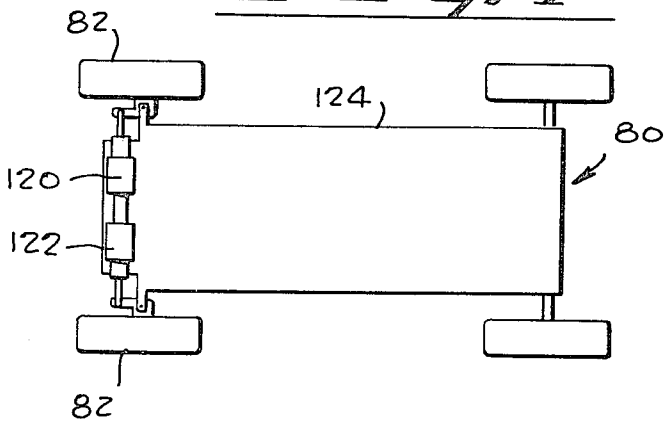



Fig. 7




JOHN W. RYAN
JOHN G. TOMKINSON
PAUL R. WIEMAN
INVENTORS

BY Mat E. Shirk

ATTORNEY

# COLOR RESPONSIVE TOY

## BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to action toys.

2. Description of the Prior Art

Various toys have been devised to detect a target device by sensing the light from it. Typically, the target device produces a strong beam of light which the toy can distinguish from the much dimmer surroundings. In many cases, it would be desirable to enable a toy to detect a passive target by sensing the different amount of light from it as compared to the surroundings, as where the target is white and the surroundings are black. However, the great variation in ambient light intensity makes it difficult to provide a toy that can accurately distinguish between bright and dark areas that are illuminated only by ambient light. A toy which could distinguish passive target areas illuminated by ordinary room light or sunlight would simplify the construction and use of toys. For example, a toy rifle that could distinguish whether it had been accurately aimed at a target at the moment when the trigger was pulled, without the necessity for an elaborate target with photocells or lamps at the targets, would simplify the toy targets and allow a variety of different targets to be supplied at low cost.

## OBJECTS AND SUMMARY OF THE INVENTION

An object of the present invention is to provide a toy which can select an output in accordance with the color seen in a predetermined direction.

Another object is to provide a toy rifle which can be used with a passive target to indicate whether the marksman has fired directly at the target when he pulls the trigger.

In accordance with one embodiment of the present invention, a rifle is provided which can be used with a passive target device containing targets of a red color surrounded by areas of a white color to automatically indicate whether the marksman has hit the target. The rifle includes a pair of identical photodetector cells, one covered by a red filter and the other by a filter that blocks at least a part of the red light projected thereagainst. A lens system focuses light received from the precise direction in which the rifle is aimed onto the two cells. A circuit coupled to the two cells determines when the output from the cell covered by the red filter is greater than the output from the other cell to ring a bell in the gun that indicates a hit. The circuit is activated only at the instant when a trigger on the gun is initially pulled.

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 side view of a color sensitive rifle and target constructed in accordance with one embodiment of the present invention;

FIG. 2 is a partially diagrammatic view of the rifle of FIG. 1;

FIG. 3 is a schematic diagram of the detecting circuit of FIG. 2;

FIG. 4 is a schematic diagram of another form of detecting circuit;

FIG. 5 is a view of a steerable toy vehicle and sign arrangement constructed in accordance with another embodiment of the invention;

FIG. 6 is a partially diagramatic view of the vehicle of FIG. 5; and

FIG. 7 is a partial plan view of the chassis of the vehicle of FIG. 5.



## DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. 1 illustrates a gun 10, constructed in accordance with the invention, which is designed to be "fired" at a target device 12 which includes target areas 14 of a bright red color that are surrounded by areas 16 of a white color. The target device is in the form of a strip that moves in the direction of arrow 18 to make the apparatus more interesting. When a child pulls a trigger 20 on the gun, sensing apparatus in the gun detects whether the gun was aimed accurately at one of the targets 14. If the aiming was accurately on a target, a bell sound is produced which issues from a speaker grill 22 in the stock of the gun. If the aiming was improper, no bell sound is produced.

FIG. 2 illustrates a detecting system 24 located within the gun housing 26, which determines whether a "hit" should be registered. The system includes a first lens 28 which focuses light rays R originating from a distant target. A stop 30 located at the focal plane of the lens 28 prevents the passage of all light except that which originates within a narrow angle around the direction in which the gun is aimed. Light passing through the small aperture at the center of the stop 30 is converged by a second lens 32.

A semi-reflecting mirror 34 positioned behind the second lens 32 reflects half of the light incident on itself towards a first photodetector cell 36 and allows the other half of the light to pass through itself towards a second photodetector cell 38. A red filter 40 is placed between the mirror 34 and first photocell 36 to allow only red light to reach photocell 36. A neutral density filter 42 is positioned in front of the second photocell 38 to block a portion of all colors of light incident thereon, so that only portions of all colors of light reach the photocell 38. It may be noted that lens 32 does not form a sharp image of the target on the photocells 36 and 38, but only a very blurred and out of focus "image." This is to prevent inequality in the photocell illumination arising from misalignment of optical elements, which might occur when the gun is aimed at the border between a black and white areas. Instead, the field lens 32 is positioned to focus an image of the objective lens 28 on the photocells.

If the target device 12 is illuminated by white light and the gun is aimed precisely towards one of the red targets 14, then the rays R received by the gun and which can pass through the stop 30 will be red in color. One-half of these rays will be reflected by the mirror 34, will pass through the filter 40, and will reach the first photodetector 36. The other half of the red light will pass through the mirror 34 and be partially absorbed by the neutral density filter 42, so that only perhaps one-fourth of the received light will reach the second photocell 38 instead of one-half. The photocells 36 and 38 are identical and are constructed to provide an output proportional to the intensity of light thereon, so that the first cell 36 will provide a greater output than the second cell 38. A detector circuit 44 compares the outputs of the two cells 36 and 38. If the output from the first cell 36 exceeds the output from the second cell 38, the detector circuit 44 provides an output to a bell 46 which is located behind the grill 22 in the stock of the gun. When the bell 46 rings, it indicates that the gun has been aimed precisely at one of the red targets 14.

If the gun is aimed at the white area 16 surrounding the targets 14, then the rays from the direction in which the gun is aimed will represent white light. The one-half portion of this light which is reflected towards the first photocell 36 will be partially blocked by the red filter 40 so that the first cell 36 will have a low output. The one half portion of white light which passes through the mirror 34 will be only partially absorbed by the neutral density filter 42 so that perhaps one-fourth of the total lights will reach the second photocell 38. The photocell 38 will therefore provide a substantial output. The detector circuit 44 will then determine, by the fact of the greater output from second photocell 38, that the target has not been hit. Accordingly, it will not supply a signal to the bell 46 and no sound will be produced thereby. It should be noted

the reason why two cells **36** and **38** are used is to provide an accurate determination as to whether the target has been hit or missed, regardless of the intensity of ambient light which illuminates the target device **12**. The second cell **38** essentially adjusts the sensitivity of the detector circuit in accordance with the ambient light level at the target. Of course, a minimum illumination level is required for the apparatus to function properly.

FIG. **3** is a simplified circuit diagram of the detector circuit **44**. The photocells **36**, **38** represent resistors whose resistances decrease as the incident illumination increases so that the outputs of the cells are essentially the voltages across themselves. The circuit is of the Darlington type, including a transistor **48**. The transistor **48** is turned on when the first photocell **36** is strongly illuminated and therefore its resistance drops, so that the voltage at the base of transistor **48** becomes more negative and the transistor conducts. When the transistor **48** conducts, its emitter current flows through the base of a second transistor **50** so that the second transistor **50** conducts and allows current to flow through the bell output device **46** to produce a bell sound. A battery **52** which powers the device is coupled to the circuit through a switch **54** that is closed only when the trigger **20** on the gun is depressed, so that the circuit can operate to ring the bell only when a child has pulled the trigger.

In order to prevent a child from maintaining the trigger **20** in a depressed state to ring the bell every time the gun line of sight drifts over a target, a resistor **56** is connected in series with the battery **52** and a capacitor **58** is connected across the combination of the battery **52** and resistor **56**. The resistor **56** is large enough so that not enough current can flow directly through the battery to operate the circuit in a manner to ring the bell. When a child depresses the trigger **20** to close switch **54**, the charge on the capacitor **58** is applied to the circuit to operate it.

A dissipating resistor **60** is provided which dissipates the charge on the capacitor during a short period such as one-half second after the switch **54** is closed. However, before the charge is dissipated through resistor **60**, the charge is sufficient to operate the circuit and ring the bell **46**. Thus, if the gun is on a target when the switch is closed, or up to one-half second thereafter, the bell will ring. Otherwise, the bell will not ring unless the child releases the trigger to allow the capacitor to recharge for a second or two.

FIG. **4** is a schematic diagram of another circuit which can be employed to detect when the first photocell **36** is more intensely illuminated than the second one **38**. When the trigger-operated switch **54** is closed, resistor **62** holds the SCR **64** off and resistor **66** holds the transistor **68** off. If more light is incident upon the second photocell **38** than on the first one **36**, the voltage at the base of transistor **68** will be more positive than the voltage at the emitter thereof, transistor **68** will be held off, and the SCR **64** will not be triggered on. If more light becomes incident upon the first photocell **36** than the other **38**, transistor **68** turns on and supplies current to the gate of the SCR **64** to trigger it on. Resistors **69** and **70** supply a reference voltage for the emitter of transistor **68** and provide current limiting through the transistor **68** and through the gate of the SCR **64**.

The resistor **66** assures that transistor **64** will be held off when the circuit is subjected to very low light levels. Resistor **62** collects leakage current from the collector of transistor **68** and the gate of SCR **64**, and also keeps the SCR **64** from firing as power is applied, which might occur because of a high anode to gate capacitance in SCR **64**. A variety of electrical or mechanical devices can be utilized to prevent the circuit of FIG. **4** from supplying current to the load **46** except at the instant when the gun trigger is first pulled.

In the detection system **24** of FIG. **2**, a neutral density filter **42** is shown. Instead of utilizing such a filter, the mirror **34** can be constructed to pass less than 50 percent of incident light towards the second photocell **38**, and the neutral density filter **42** can be eliminated. Another alternative is to utilize photodetectors **36** and **38** which are not identical, but which, instead, are of different size or which have different sensitivity characteristics. It is also possible to utilize a green filter instead of the neutral density filter **42**, so that red light does not pass to the cell **38** but the green component of white light does pass thereto. Of course, a variety of other variations can be resorted to, including the use of two lens systems or the positioning of two smalls photocells side-by-side and covered with different small color filters to eliminate the need for a light-splitting mirror. In any case, the detecting circuit coupled to the two cells is constructed to operate the hit-indicating device when the output from one cell exceeds a predetermined multiple (which may be one or any fraction which is less or more than one) of the output from the other cell.

FIG. **5** illustrates another type of toy in the form of a self-propelled vehicle **80** with steerable wheels **82** that can turn to the left, to the right, or remain directed straight ahead. The vehicle is used in conjunction with right turn signs **84**, **86** and left turn signs **88** and **90** that command the vehicle to turn to the left or right. Right turn signs **84** and **86** have a red color while left turn signs **88** and **90** have a green color, all the signs being positioned on stands **92**. The vehicle **80** has a detection system **94** shown in FIG. **6**, which detects the presence of a red or green sign immediately in front of the vehicle. This system includes a lens **96** which focuses light rays L originating from a short distance such as several inches in front of the vehicle, at the plane of a stop **98**. Light passing through the stop **98** is concentrated by a lens **100**. A semi-reflecting mirror **102** positioned behind the lens passes one-third of the light and reflects two-thirds of it towards a second semi-reflecting mirror **104**. The second mirror **104** is constructed to pass one-half of the light and reflect one-half of it. Three photocells **106**, **108**, and **110** are positioned to receive the light, with one-third of the light being directed towards each of the three cells. A neutral density filter **112** is positioned in front of the first cell **106**, a red filter **114** is positioned in front of the second cell **108**, and a green filter **115** is positioned in front of the third cell **110**.

The system includes a right detection circuit **116** for detecting the presence of a red, or right-indicating sign, and a left detection circuit **118** for detecting the presence of a green, or left-indicating sign in front of the vehicle. The output of the first cell **106** is coupled to the right and left detection circuits **116** and **118**. The output of the second cell **108** is coupled to the right detection circuit **116** while the output of the third cell **110** is coupled to the left detection circuit **118**. When the right circuit **116** senses that the second cell **108** is generating a larger output than the first cell **106**, it delivers a pulse to a right turning solenoid **120** that turns the vehicle to the right. When the left detection circuit **118** determines that the third cell **110** has a larger output than the first cell **106**, it has sensed the presence of a green sign and it delivers a pulse to a left turning solenoid **122** which turns the vehicle to the left. FIG. **7** illustrates a chassis **124** of the vehicle and the solenoids **120**, **122** for turning the steerable wheels **82** of the chassis. The mechanism of FIG. **7** is highly simplified, and various devices can be utilized to assure that the vehicle will turn a predetermined amount, such as 90°, when a left or right turning sign is detected. Each of the circuits **116**, **118** can be of the type shown in FIGS. **3** and **4**. A child can arrange the red and green signs on a table top to control the path of the vehicle **80** so that it moves along a predetermined route.

Thus, the invention provides toys that are responsive to the color of objects at a predetermined direction with respect to the toy, and which control a toy output in accordance with the color detected thereat. A variety of toy outputs can be provided, such as the ringing of a bell to indicate that a rifle has been properly aimed at a target or the control of a robot vehicle. A wide variety of other types of toys can be constructed to sense the color of objects illuminated by ambient light, and a variety of detection systems can be utilized for detecting the color.

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 and consequently it is intended that the claims be interpreted to cover such modifications and equivalents.

What is claimed is:

1. A light responsive toy comprising:
at least first and second photodetectors for generating output signals of an amplitude dependent upon the amplitude of light incident thereon;
objects of predetermined color positionable at selected locations relative to said toy;
light directing means for directing light reflected from said objects when an object is at only a predetermined direction fixed relative to said toy, onto each of said photodetectors;
color filter means for blocking the passage of light directed towards said first photodetector means, to pass substantially only light of a predetermined color thereto;
detector circuit means coupled to said first and second photodetectors, for detecting a predetermined relationship in their outputs; and
toy output means responsive to said detector circuit means for initiating an output activity, whereby to provide a preselected output activity upon the presence of an object of said predetermined color at said predetermined direction, for a wide range of ambient light levels.

2. The toy described in claim 1 including:
a housing in the form of a gun containing said light directing means, to direct onto said photodetectors only light received from the direction in which said gun is pointing; and wherein
said toy output means includes manually depressable trigger means mounted on said housing and means coupled to said trigger means for providing an indication of a hit only at the moment when said trigger initially reaches a predetermined state of depression.

3. The toy described in claim 1 including;
a substantially neutral density filter positioned in front of said second photodetector means.

4. The toy described in claim 1 including:
a vehicle housing containing said light directing means, said photodetectors, said color filter, and said detector circuit means; and
wheels rotatably mounted on said vehicle to support it, at least one of said wheels mounted to steer in a plurality of directions; and wherein
said toy output means comprises means for steering said at least one wheel.

5. The toy described in claim 1 including: second toy output means;
a third photodetector;
second color filter means for selectively blocking the passage of light directed towards said third photodetector by said light directing means to pass substantially only light of a second predetermined color thereto; and
said detector circuit being is constructed to operate said second toy output means when it detects a predetermined relationship in the relative magnitudes of outputs from said second and third photodetectors.

6. In combination with a toy target device having a target area of a predetermined color surrounded by an area of different color, a toy gun for firing at said target device comprising:
an aimable gun housing;
first and second photodetector cells mounted in said housing for producing output signals of a magnitude dependent upon the intensity of light incident thereon;
lens means mounted in said housing for directing light received only from the direction in which said gun housing is aimed onto said first and second photodetector cells;
color filter means for blocking the passage of light to said first photodetector cell except for light of substantially the predetermined color of said target area;
manually operable trigger means mounted on said gun housing;
means for indicating a hit; and
detector circuit means coupled to said first and second cells for detecting a predetermined relationship in their outputs and for operating said hit-indicating means only when light directed thereto from said target device produces an output from said first cell which exceeds a predetermined multiple of the output of said second cell.

7. The toy gun described in claim 6 wherein: said means for indicating a hit comprises apparatus mounted on said housing for producing a predetermined sound.

* * * * *