

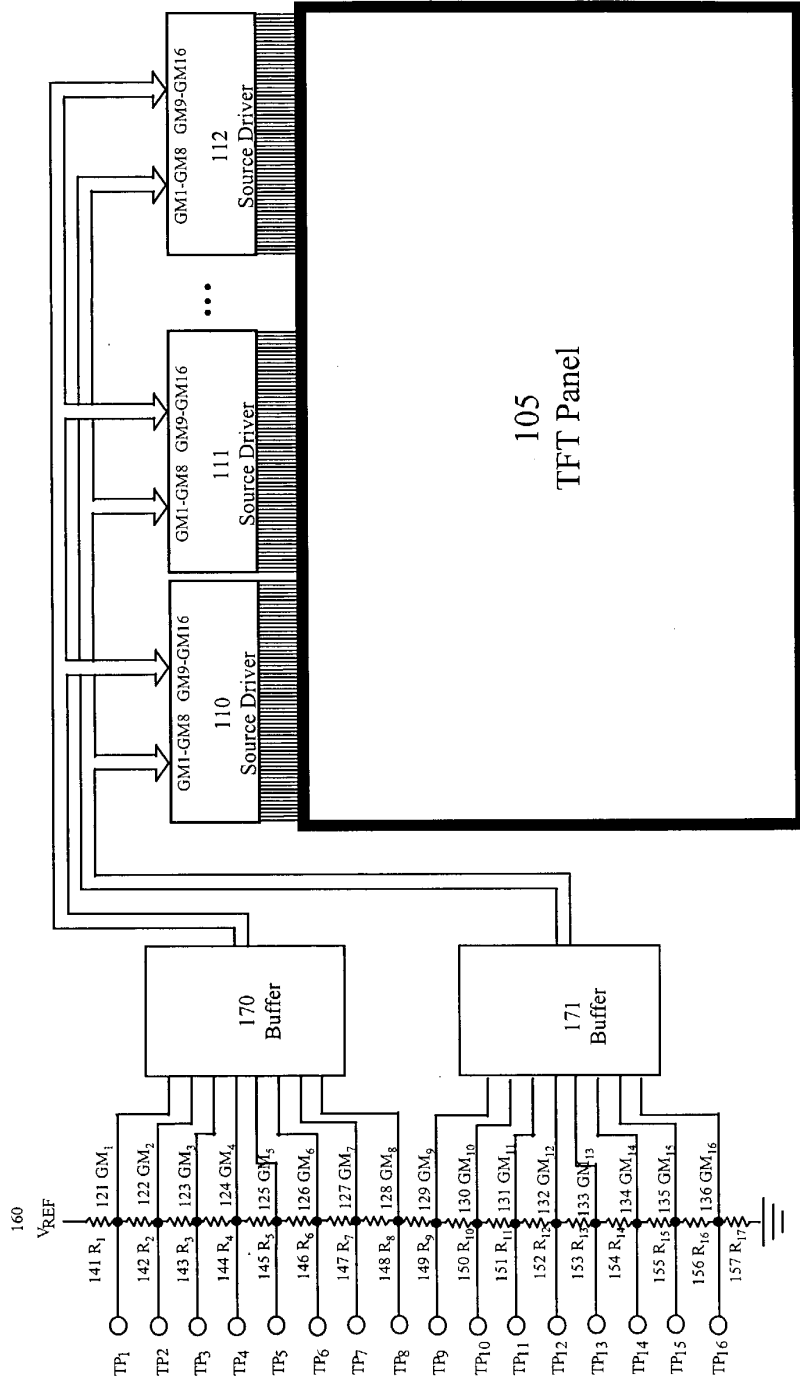


FIG. 1

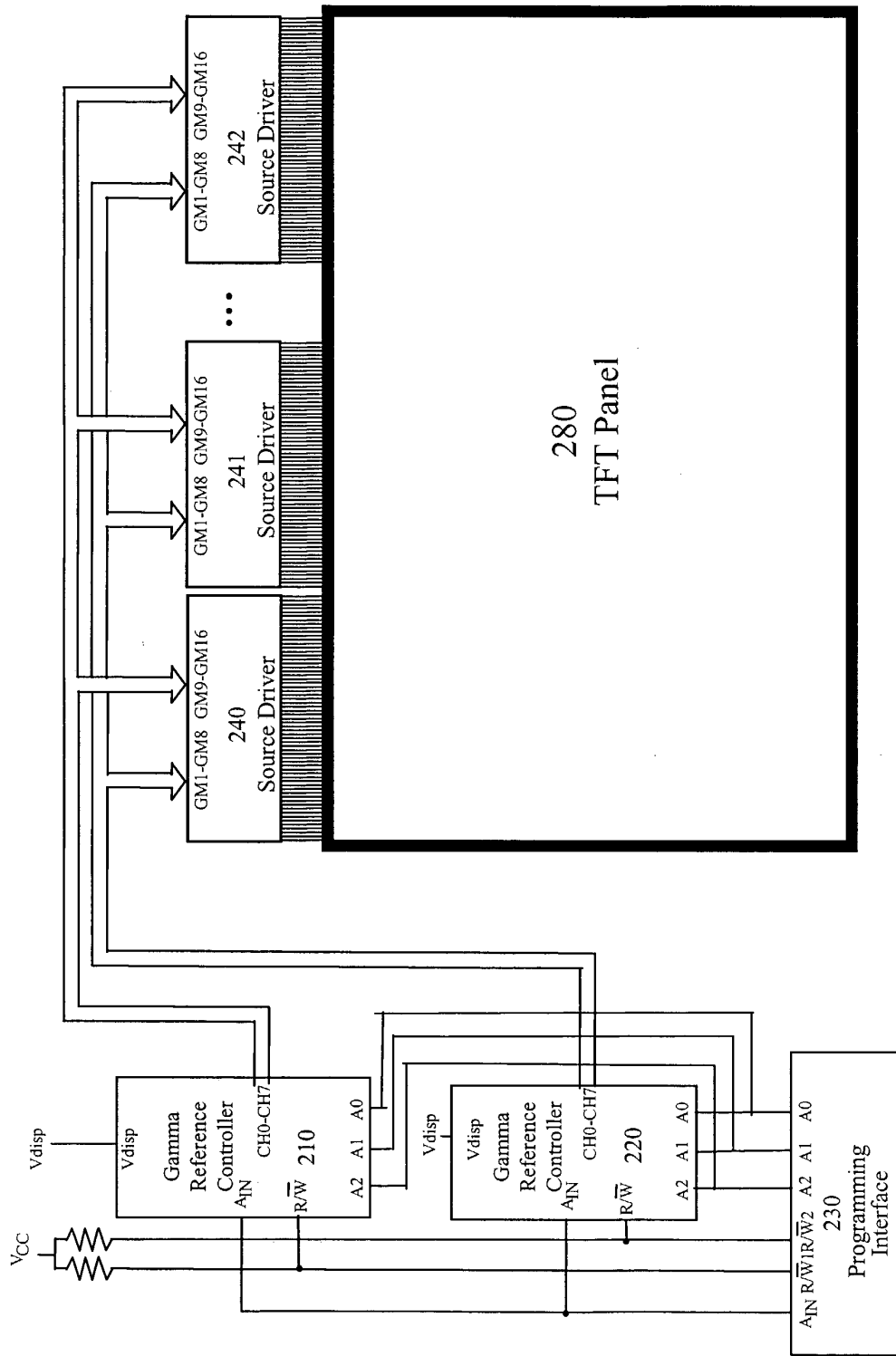


FIG. 2

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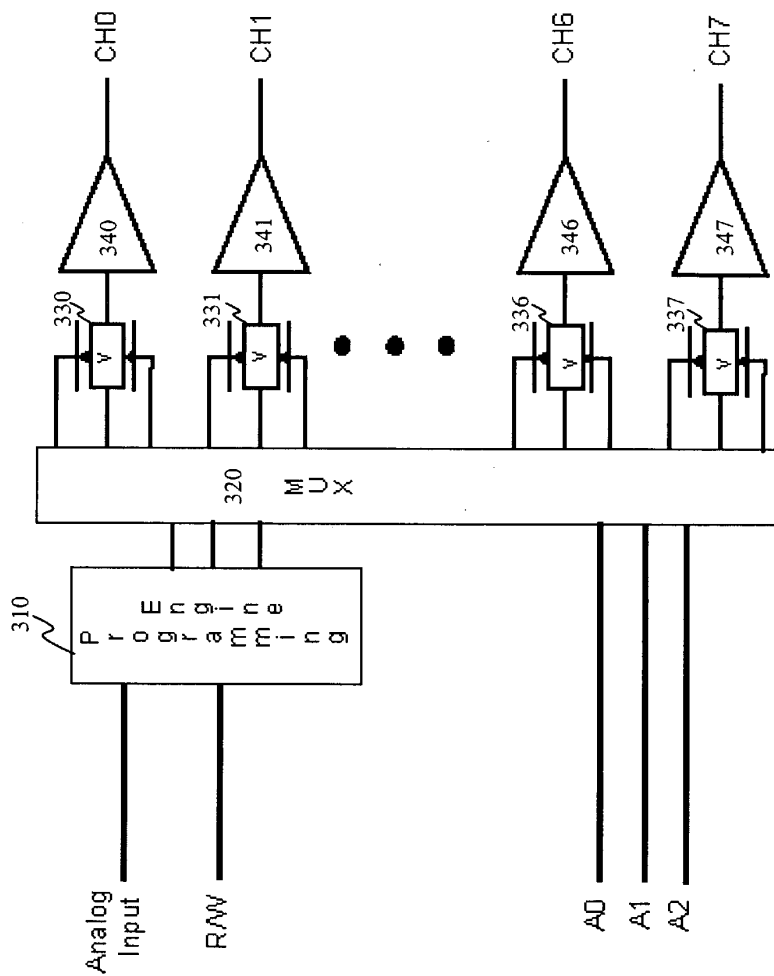


FIG. 3

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5

Application

For

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United States Provisional Utility Patent

Title:

Haptic Targeting Device

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Inventor:

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citizen of United States of America.**

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HAPTIC TARGETING DEVICE

BACKGROUND

Field

Invention relates haptic devices, and in particular to a targeting device providing haptic feedback to the user.

Related Art

Haptic feedback has been applied to computer mice activities. For example, studies have shown that haptic feedback can reduce the time necessary for a computer mouse user to click a target and can reduce the number of targeting errors. Haptic feedback has also been applied to robots controlled by a user in a separate location. Studies have shown that haptic feedback improves the ability of the user to place pegs in holes via the remote robot.

However, whereas haptic feedback has been applied to targeting operations for virtual environments, computers, and video game controllers, for example in guns for gaming systems to simulate the feel of the recoil of a firearm, haptic feedback has not been applied to non-telepresence, real-world targeting operations, including pointing activities, wherein a pointing activity is herein defined as the act of physically aligning a tool or object with a separate entity with the intent of aiming the tool or object at the separate entity.

SUMMARY

The invention allows the user to feel, through haptic feedback, when the tool the user is employing is pointed at a target. As a result, invention reduces the time necessary for the user to determine if he/she has pointed at a target and/or increases the success of the targeting activity.

Invention applies haptic feedback to non-telepresence, real-world targeting operations. Possible application areas include, but are not limited to, firearms, surgery, and photography.

One of the advantages of this device is that it alerts the user in a discrete fashion without alerting others because only the user can feel the feedback. In addition, the response time of the operator is faster than with conventional targeting devices because the user only has to make a binary decision – either the tool is correctly aimed or it is not.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a diagram illustrating a paintball gun with the haptic targeting device attached, according to one embodiment of the present invention.

Figure 2 is a diagram illustrating the main components of the haptic targeting device, according to one embodiment of the present invention.

Figure 3 is a diagram illustrating lengthwise cross section of the infrared detecting system, according to one embodiment of the present invention.

Figure 4 is a diagram illustrating a control system of the invention, according to one embodiment of the present invention.

Figure 5 is a diagram illustrating the braces, according to one embodiment of the present invention.

5 Figure 6 is a diagram illustrating a motor with an eccentric mass, according to one embodiment of the present invention.

Figure 7 is a diagram illustrating a system for correcting operator-aiming errors, according to one embodiment of the present invention.

DETAILED DESCRIPTION

Figure 1 is a diagram illustrating a paintball gun with the haptic targeting device attached, according to one embodiment of the present invention. Whereas current aiming systems can be time consuming and inaccurate in situations where the user must act quickly, present invention employs haptic feedback to allow the paintball gun user to rapidly feel and determine if and/or when the paintball gun is pointed at a target.

The following example illustrates one embodiment of the present invention, enabling a user to feel when the paintball gun, or other device that fires a projectile, is pointed at a target. Other embodiments are possible for determining when the paintball gun is pointed at a target and for displaying the haptic feedback to the user.

One embodiment includes an infrared scope that is used to determine if the paintball gun is pointed at a target. Two methods can be used to distinguish between target and non-target areas. In the first method, any object within a certain temperature range would be considered a target. The second method uses vision recognition software to identify targets.

Haptic feedback is employed to alert the user when the paintball gun is pointed at a target. In one embodiment, vibration feedback continuously alerts the operator whenever the paintball gun is pointed at the target. The vibration feedback is created by

a motor with an eccentric mass attached to the motor's rotating shaft. This approach literally allows the user to feel when the paintball gun is pointed at a target.

Figure 2 is a diagram illustrating the main components of the haptic targeting device, according to one embodiment of the present invention. An infrared detecting system 1 is attached with two braces 2, 3 below the barrel 4 of the paintball gun 5. When infrared light that corresponds to wavelengths typically emitted by humans is detected by the infrared detecting system 1, a motor with an eccentric mass 6 is activated. The motor with an eccentric mass 6 causes a vibration that alerts the operator that the paintball gun is pointed at a target.

The infrared detecting system 1 is aligned with the barrel 4 of the paintball gun 5. As a result, the infrared detecting system 1 only detects infrared light that originates along the line of fire of the paintball gun 5. As a result, the infrared detecting system 1 only detects targets in the line of fire of the paintball gun 5. The line of fire is defined as a straight line that runs down the center of the barrel, out the open end of the barrel, and to infinity.

Figure 3 is a diagram illustrating lengthwise cross section of the infrared detecting system, according to one embodiment of the present invention. Infrared light enters the window 7 of the infrared detecting system 1. Of note, the window 7 is designed to absorb as little infrared energy as possible. The infrared light reflects off the large concave mirror 8, which focuses the infrared light onto the small concave mirror 9, which

focuses the infrared light onto the infrared detector 10. Humans radiate the most infrared light at about ten microns so the infrared detector 10 is sensitive to infrared wavelengths of approximately eight to twelve microns.

The infrared detector 10 is connected to the control system 11. Control system 11 governs switch 12. Switch 12 opens and closes the circuit between the battery 13 and the motor with an eccentric mass 6. More specifically, positive lead 14 and negative lead 15 connect to the motor with an eccentric mass 6.

Figure 4 is a diagram illustrating a control system of the invention, according to

Figure 1. Lengthwise cross section of the infrared detecting system 1 (see figure 2)

one embodiment of the present invention. The control system 11 is comprised of two main components – the signal conditioner 16 and the comparator 17. The signal conditioner 16 filters the signal from the infrared detector 10 to reduce unwanted signal noise. The signal conditioner 16 also amplifies the signal from the infrared detector 10. The comparator 17 compares the signal from the signal conditioner 16 to a predetermined high value and low value. The high value and low value are set by the range input 18. If the signal from the signal conditioner 16 is between the predetermined high value and low value, the comparator 17 activates the switch 12. Of note, the switch 12 is normally open. When the comparator 17 activates the switch 12, the switch 12 closes the circuit between the battery 13 and the motor with an eccentric mass 6. Switch 12 stays closed as

long as the signal from the signal conditioner 16 is between the predetermined high value and low value as determined by the comparator 17.

Figure 5 is a diagram illustrating the braces, according to one embodiment of the present invention. The infrared detecting system 1 is attached to the barrel 4 of the paintball gun 5 with two braces 2, 3. A brace consists of a brace side A 19 and a brace side B 20. Brace side A 19 and brace side B 20 are attached with two brace screws 21. Of note, the two holes in brace side B 20 for the brace screws 21 are tapped to provide threads to hold the brace screws 21.

The primary diameter 22 of brace side A 19 and brace side B 20 is equal to the outside diameter of the infrared detecting system 1. Similarly, the secondary diameter 23 of brace side A 19 and brace side B 20 is equal to the outside diameter of the barrel 4.

Figure 6 is a diagram illustrating a motor with an eccentric mass, according to one embodiment of the present invention. The haptic feedback in this embodiment is provided by a motor with an eccentric mass 6. Other embodiments will be presented subsequently. The negative lead 14 is attached to motor terminal A 24. The positive lead 15 is attached to motor terminal B 25. When switch 12 is closed, the rotating shaft 26 spins. The eccentric mass 27 is attached to the rotating shaft 26. When the rotating shaft 26 spins, the eccentric mass 27 causes the motor with an eccentric mass 6 to vibrate. Another embodiment features a braking system for the motor with an eccentric mass 6

to reduce the time necessary for the rotating shaft 26 to stop rotating after switch 12 is deactivated.

The vibration from the motor with an eccentric mass 6 is felt by the paintball gun operator. When the paintball gun operator feels the vibration, he/she knows the paintball
5 gun 5 is pointed at a target.

The invention described above through the explanation of one possible embodiment is not limited to paintball gun applications. The invention is applicable to all devices that fire a projectile. One embodiment of this invention is for firearms capable of being carried by one person. Yet another embodiment is for larger firearms.

10 Another embodiment features piezoelectric crystals to create the vibration that the user feels. Yet another embodiment features a solenoid that is activated when a target is detected. Another embodiment utilizes a voice coil to create the vibration.

Another embodiment uses objects that protrude from the targeting device to alert the user. The objects that protrude can be pins.

15 Another embodiment stores mechanical energy in a coil spring from the cocking of a firearm. Yet another embodiment stores mechanical energy in a spring from the recoil of a firearm. The potential energy in the spring is later released to drive the haptic feedback.

Advantageously, present invention applies haptic feedback to firearms to alert the user when his/her firearm is pointed at a target. Several specific haptic approaches can be used for this application.

5 In the paintball gun example, the haptic feedback originates in the butt of the gun and is felt by the operator's hand. In another embodiment the haptic feedback originates on the surface of the butt of the gun from piezoelectric bender discs. This embodiment allows a small vibration to be easily felt by the operator.

In another embodiment, the haptic feedback takes place in the trigger of the gun. More specifically, the trigger vibrates when the gun is pointed at a target. In another 10 embodiment, the haptic feedback originates in the area immediately surrounding the trigger.

In yet another embodiment, the haptic feedback takes place in the area of the user's non-trigger hand. For example, with a rifle the haptic feedback would take place in the stock of the firearm where the user supports the rifle with the non-trigger hand.

15 The haptic feedback originates in the infrared detecting system 1 in another embodiment. This embodiment does not require wires from the infrared detecting system 1 to another part of the gun.

In another embodiment, the user feels the haptic feedback in a location completely separate from the gun. The separate location could be, for example, the chest, upper arm, or head.

Using infrared technology to identify targets is a common method. Infrared
5 technology is simply one of many potential methods to enable the firearm to determine when the gun is pointed at a target. Another embodiment uses image recognition software to analyze digital pictures to determine the position of targets.

The paintball gun example uses a threshold method to identify targets. Another embodiment also uses infrared technology but requires image recognition software to
10 analyze the infrared image. Image recognition software enables the system to identify targets more selectively. For example, only objects with military style helmets would be considered targets.

Another embodiment utilizes an infrared scope currently used the by military. The operator can look through the scope to identify targets just like with a normal
15 infrared scope. In addition, the same scope is used in conjunction with image recognition software to identify targets.

A position sensitive detector (commonly known as PSD) that is sensitive to infrared light is utilized in another embodiment to determine the position of targets relative to the line of fire. The PSD returns two analog signals proportional to the

difference in the location of the centroid of the target to the line of fire. The two analog signals correspond to X and Y positions in a plane perpendicular to the line of fire that includes the target. This embodiment allows the invention to not only tell the user if the detector is pointed at the target but to also tell the user how to alter the aim of the
5 targeting device so the target is in the line of fire.

The invention described in this document can be used in conjunction with traditional methods. In other words, non-haptic feedback could also be employed with this invention. Other embodiments include visual feedback. For example, when the gun is pointed at a target a blinking light alerts the operator. Laser pointers can also be used
10 with the invention.

Audible alerts can also be used with this invention. For example, the infrared detecting system could emit a high frequency tone from a voice coil when the gun is pointed at a target.

Based on the data from the position sensitive detector explained previously,
15 another embodiment automatically corrects the aim of the firearm so the firearm is pointed at a target. This embodiment utilizes two motors inside the firearm. The first motor, called the Y aim corrector 28 (see figure 7), moves the line of fire in the Y direction. The second motor, called the X aim corrector 29 moves the line of fire in the X direction.

A wheel is connected to the rotating shaft of each motor. By accelerating the wheel, an equal and opposite force is applied to the base of the motor. The base of the motor is mounted inside the gun so the force applied to the base of the motor is translated to the gun. This force pushes the barrel of the gun in the direction of the target.

5 The most common targeting system used by our nation's police force and by the military in urban combat situations requires the firearm operator to align two points. The two points are located at either end of the barrel of the firearm. The operator must align the two points with his/her line of sight and determine if the intended target is in the line of fire.

10 This operation demands a significant cognitive load and can be time consuming. In addition, this targeting method can be inaccurate when the operator is forced by the situation to make a quick decision.

In contrast, a targeting system with haptic feedback would instantly alert the operator when the firearm is correctly aimed; thereby reducing the deliberation time the operator spends attempting to determine if the firearm is aimed at the target. The haptic system simply requires the user to make a binary decision – either the firearm is aimed at the target or it is not. Moreover, the number of targeting errors would be reduced because the operator would know before shooting if the bullet would hit the target.

15

Another embodiment of this concept relates to photography. The digital camera determines if the focal point is at the same location as a person. Once the camera determines the camera is targeted on a person, one of the previously described haptic cues is sent to the operator.

5 Another embodiment sends a haptic signal to alert the car operator when a target is detected. Targets include pedestrians and other cars. In addition, if a red light is detected and the operator does not appear to be slowing down, a haptic alert would be felt by the user.

The invention could also be applied to video game and virtual reality systems.

10 In situations where the patient is conscious, audible alerts can cause the patient unnecessary anxiety. This anxiety could be avoided by communicating the alert to the doctor or nurse but not to the patient. This invention's haptic alert could be designed so only the doctor or nurse would receive the feedback. This invention also applies to medical device targeting activities. One embodiment is a blood vessel locator. When the
15 device locates the blood vessel, the nurse receives a haptic cue. This way, the nurse is able to locate the blood vessel without the patient knowing when the shot is about to be administered.

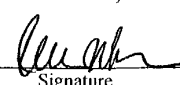
The invention described in this document could also be used for hunting. The range input 18 would simply be adjusted to target a particular type of animal.

The invention could also be a safety device. For example, the gun could vibrate to alert the user that the gun was pointed at a human, thereby warning the operator. Conversely, the invention could be set to only vibrate at infrared wavelengths commonly associated with animals and to never vibrate at wavelengths associated with human
5 temperatures.

Foregoing described embodiments of the invention are provided as illustrations and descriptions. They are not intended to limit the invention to precise form described. Other variations and embodiments are possible in light of above teachings, and it is thus intended that the scope of invention not be limited by this Detailed Description, but rather
10 by Claims following.

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Docket No.: ALTA-P007

APPLICATION TRANSMITTAL LETTER

Commissioner of Patents
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Alexandria 22313-1450

ATTN: MAIL STOP PATENT APPLICATION

Sir:

Transmitted herewith for filing is the patent application of

Inventor(s): **ORLANDO, et al.**

Entitled: **"GAMMA TRIMSTER AND METHOD FOR GAMMA REFERENCE VOLTAGE GENERATION FOR DISPLAYS"**

10 No. pages of specification, including title page, claims and abstract

3 No. sheets of X informal, formal drawings

Also enclosed are:

- X Provisional Application for Patent Cover Sheet
- Executed Combined Declaration and Power of Attorney for Patent Application
- An Original Executed Assignment of the Application
- Form PTO-1595 (Recordation Cover Sheet for Assignment)
- Request and Certification Form PTO/SB/35 (11-00)
- X Application Data Sheet (4 sheets)
- An Information Disclosure Statement (Form PTO/SB/08A and Form PTO/SB/08B)
- A copy of References cited in Information Disclosure: documents

FEES DUE

X Applicant Claims Small Entity Status (37 CFR 1.27)

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The full fee due in connection with this communication is \$ 80.00
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This application is filed pursuant to 37 C.F.R. 1.53 in the name of the above-identified Inventor(s).

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

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☐ Additional inventors are being named on the _____ separately numbered sheets attached hereto					
TITLE OF THE INVENTION (500 characters max)					
Gamma Transfer And Method For Gamma Reference Voltage Generation For Displays					
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☒ Specification Number of Pages		10		☐ CD(s), Number	
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☒ Application Data Sheet. See 37 CFR 1.76				Check # 0934 \$80.	
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☒ Applicant claims small entity status. See 37 CFR 1.27.				FILING FEE AMOUNT (\$)	
☒ A check or money order is enclosed to cover the filing fees				\$80.00	
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The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.					
☒ No.					
☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____					

Respectfully submitted,

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6/11/03

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43,939

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USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the complete provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

ABSTRACT

Haptic feedback alerts user when a tool employed by user, such as firearm, surgical equipment or photographic equipment, is pointed at a target, reducing the time necessary for user to determine whether tool is pointed at target and increasing targeting success. Haptic feedback alert is provided in discrete fashion without alerting others. User response time is improved over conventional targeting devices because user only has to make a binary decision corresponding to whether the tool is correctly aimed or not.