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Attorneys for Plaintiff
THE CHAMBERLAIN GROUP, INC.

UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF CALIFORNIA

THE CHAMBERLAIN GROUP, INC.,

Plaintiff,

vs.

NORTEK SECURITY & CONTROL LLC, f/k/a LINEAR LLC

Defendant.

Case No.: '17CV2412 BTM AGS

COMPLAINT FOR PATENT INFRINGEMENT

[DEMAND FOR JURY TRIAL]

COMPLAINT

Plaintiff, The Chamberlain Group, Inc., ("CGI") for its Complaint against Nortek Security & Control LLC ("NSC"), alleges as follows:

THE PARTIES

1. Plaintiff CGI is a Connecticut Corporation with a principal place of business at 300 Windsor Drive, Oak Brook, Illinois 60523.

2. On information and belief, Defendant Nortek Security & Control LLC, formerly known as Linear LLC, is a California Corporation with a principal place of business at 1950 Camino Vida Roble, Carlsbad, CA 92008.

JURISDICTION AND VENUE

3. This Court has jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §§ 1331 and 1338(a) because this action arises under the patent laws of the United States, including 35 U.S.C. § 271 et seq.

4. This Court has personal jurisdiction over Defendant because Defendant is a California Corporation with its principal place of business in Carlsbad, California.

5. On information and belief, Defendant offers to sell, sells, and distributes within this District the Accused Products discussed below, each of which infringes the Asserted Patents (as defined below).

6. On information and belief, Defendant NSC operates out of its headquarters located at 1950 Camino Vida Roble, Carlsbad, CA 92008.

7. Venue is proper in this judicial district pursuant to 28 U.S.C. §§ 1391 and 1400(b). Defendant is incorporated in California, has a regular and established place of business in Carlsbad, California, and has committed acts of infringement in this District.

BACKGROUND AND PATENTS-IN-SUIT

8. CGI is a century-old, global leader in designing and delivering innovative access control devices for both residential and commercial applications. CGI's products protect the majority of garages in America, and thus protect the largest entrance to millions of American homes. CGI is trusted by homeowners and businesses alike to combine the convenience of cutting-edge technology with a commitment to safety and reliability. Some of its best-known offerings include the globally-recognized Chamberlain®, LiftMaster®, Merlin®, and Grifco® brands.

9. CGI has long been at the forefront of developing new technologies in the access control device market. For instance, as early as 2003—years before the era of smartphones and apps we use today—CGI was the first company to invent technology allowing consumers to safely and securely control various entryways to their homes or businesses remotely over a wireless network. Building on these innovations, CGI's pioneering and award-winning technology was the first to empower consumers to view, monitor, open, and close their garage doors when away from home—providing a degree of both convenience and peace of mind not offered by any competitor.

10. CGI's status as an industry-leader in technological development is further reflected in the many patents granted to the company by the United States Patent and Trademark Office. CGI has been granted approximately 435 patents throughout its history and currently holds approximately 250 active patents covering various technologies. These cover CGI's MyQ® remote access technology as well as Chamberlain® and LiftMaster® products.

11. CGI's past and future success as a company rests in its ability to continuously bring new innovations to market in residential garage door openers, commercial door openers, and gate entry systems, and in protecting those innovations, including the innovations claimed in United States Patent Nos.

8,587,404 ("the '404 patent"); 7,755,223 ("the '223 patent"); and 6,741,052 ("the '052 patent") (collectively, "the Asserted Patents").

12. CGI is the owner by assignment of each of the Asserted Patents.

13. Each of the Asserted Patents generally relates to different aspects of access control devices and each contributes to CGI's reputation as the industry leader in access control technology. The Asserted Patents help to protect CGI's significant investment to design and develop innovative solutions for its customers and consumers.

14. The '404 patent, entitled "Movable Barrier Operator and Transmitter with Imminent Barrier Moving Notification," was duly and legally issued on November 19, 2013 to inventor Edward T. Laird. CGI owns the '404 patent by assignment. A true and accurate copy of the '404 patent is attached as **Exhibit 1**.

15. The invention of the '404 patent is directed in general to improving the safe operation of a movable barrier such as a garage door. Garage doors and other movable barriers can be large, heavy, and if not monitored by a user when activated could harm an unaware bystander. This situation can occur when operated wirelessly from a remote location. The '404 patent claims both systems and apparatus for providing safety warning notifications when operated in this circumstance without the annoyance of warning when operated locally.

16. Claim 11 of the '404 patent, reproduced below, is representative:

> A movable barrier system with a moving-barrier imminent motion notification, the system comprising:
>
> a movable [barrier] operator connected to control movement of a movable barrier between a first position and a second position;
>
> the movable barrier operator comprising:
>
> a communication connection comprising at least one of the group consisting of: a direct wireless connection to a transmitter, a local wired connection, a system wired connection, a network connection, and a wireless communication system connection; and

a processor configured to determine whether a received command for a closing the movable barrier was received from at least one of the system wired connection, the network connection, and the wireless communication system connection;

the processor configured to effect the closing of the movable barrier in combination with operating a moving barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the system wired connection, the network connection, and the wireless communication system connection;

the processor configured to determine whether the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection;

the processor configured to effect the closing of the movable barrier without operating the moving-barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection.

17. The ’223 patent, entitled “Movable Barrier Operator with Energy Management Control and Corresponding Method,” was duly and legally issued on July 13, 2010 to inventor James J. Fitzgibbon. CGI owns the ’223 patent by assignment. A true and accurate copy of the ’223 patent is attached as **Exhibit 2**.

18. The invention of the ’223 patent is directed in general to an energy-efficient movable barrier system. Conventional movable barrier operators, such as garage door openers, were generally designed to provide full power to all elements of the system at all times. For systems that include features like obstacle detectors, however, keeping the entire system fully powered at all times can be energy-inefficient, as the obstacle-sensing beam does not need to be fully powered when, for example, the garage door is closed. Among other benefits, the inventive apparatus helps reduce energy consumption by providing full power to features like the obstacle detector when they are needed, but switching them into a low-power standby mode when they are not.

19. Claim 1 of the ’223 patent, reproduced below, is representative:

A movable barrier operator apparatus comprising:

a power supply that operably couples to at least one source of alternating current;

an obstacle detector; and

a movable barrier operator which includes a controller, the movable barrier operator operably coupled to the power supply, receives operating power from the power supply and has at least a first and second mode of energy consumption operation and being further configured and arranged to:

selectively open and close a corresponding movable barrier; and

develop an obstacle detector operating mode control signal from the controller as a function of movable barrier operator system state information that indicates whether the barrier is open or closed, the obstacle detector operating mode control signal being operable to directly control the energy usage of the obstacle detector, the control signal from the controller developed as a result of the state information, the state information selected from a group consisting of motor state information, time information, transmission state information, voltage state information, switch state information and combinations thereof,

the obstacle detector operably coupled to the power supply and to the movable barrier operator, receives operating power from the power supply, and has a plurality of operating modes, wherein at least some of the operating modes have different energy usages, and wherein the obstacle detector is directly responsive to the movable barrier operator obstacle detector operating mode control signal such that:

during the first mode of energy consumption operation, the obstacle detector operates using a first energy usage; and

during the second mode of energy consumption operation, the obstacle detector operates using a second energy usage, wherein the operating power used in one of the energy usages is less than the power used by the other energy usage.

20. The ’052 patent, entitled, “Post-Automatically Determined User-Modifiable Activity Performance Limit Apparatus and Method,” was duly and legally issued on May 25, 2004 to inventor James J. Fitzgibbon. CGI owns the ’052 patent by assignment. A true and accurate copy of the ’052 patent is attached as **Exhibit 3**.

21. The ’052 patent is generally directed to systems and methods of automatically determining a safe and effective force threshold for operation of a movable barrier system, and permitting manual adjustment of the force threshold

after the automatic determination. The force used to move a barrier such as a garage door must be calibrated to a level appropriate for a given installation, and then re-calibrated over the lifetime of the system to adjust for a variety of factors including friction, wear, age, temperature, maintenance, and temporary or permanent physical impingements. Without recalibration, barrier movement may become unsafe, as the force used to open the barrier could become insufficient to lift it, or the force used to close the barrier could become excessive such that it no longer reverses direction when it encounters an obstacle. The invention of the '052 patent automatically determines a safe and effective force threshold, but also accommodates manual adjustments over time, which makes the system easier to install and use, more cost-effective, more efficient, and safer.

22. Claim 1 of the '052 patent, reproduced below, is representative.

> An apparatus for use with a movable barrier comprising:
>
> at least one motor operably coupleable to the movable barrier;
>
> a barrier movement control unit operably coupled to the at least one motor, which barrier movement control unit includes:
>
> a processor operably coupled to receive information regarding at least some forces acting upon the movable barrier when the movable barrier is moving and being arranged and configured to automatically determine at least one force threshold during a first mode of operation for use by the barrier movement control unit when controlling the motor in a second mode of operation; and
>
> a user manipulable force threshold modification control having an output that provides force threshold modification information for use by the barrier movement control unit when controlling the motor in the second mode of operation.

NSC AND THE PRIOR LITIGATION

23. Defendant NSC is a competitor of CGI in the United States market for garage door openers, and a repeat infringer of CGI's patents.

24. On July 9, 2014, CGI commenced a prior patent infringement action in the Northern District of Illinois against NSC, then-known as Linear LLC. *See*

The Chamberlain Group, Inc. v. Linear LLC and Nortek Security & Control, LLC, Civil Action No.: 14-cv-5197 (N.D. Ill. 2014) (St. Eve, J.).

25. CGI initiated the suit because NSC's activities infringed one or more claims of five CGI patents not at issue here, United States Patent Nos. 6,998,977; 7,852,212; 8,144,011; 7,876,218; and 7,482,923 (collectively, the "Licensed Patents"). Together, those patents claim inventions for, *inter alia*, monitoring, interacting with, and controlling the operation of a movable barrier (*e.g.*, a garage door, or gate) over a network, including through a smartphone.

26. On July 7, 2015, the District Court denied NSC's Motion to Dismiss the prior complaint and concluded that each of the patents asserted in the prior litigation was directed to patent-eligible subject matter under 35 U.S.C. § 101. *See* No. 14-cv-5197, Dkt. 67 (N.D. Ill. 2014).

27. The parties subsequently negotiated a settlement whereby NSC and its parent, Nortek, Inc. ("Nortek"), took a license to the CGI patents asserted in the prior litigation (the "Agreement").

28. The Agreement was bargained-for by the parties and supported by sufficient consideration. It has remained valid and enforceable since its execution. CGI has fulfilled and performed all obligations under the Agreement to date, including prejudicial dismissal of its otherwise viable infringement suit.

29. In early 2017, however, CGI learned that Nortek had elected to manufacture Smart Wi-Fi Garage Door Openers for Amarr, one of CGI's customers for Smart Wi-Fi Garage Door Openers, including CGI's MyQ® Smart Garage Door products.

30. The products Nortek manufactures for Amarr, specifically the Amarr 860 and Amarr 840, are sold under Amarr's brand and compete with CGI's products, including with CGI's MyQ® Smart Garage Door products, in violation of the Agreement.

31. On May 24, 2017, CGI provided Nortek notice that Nortek's manufacture of the Amarr 860 and Amarr 840 violated the Agreement. CGI asked that Nortek halt manufacturing and delivery of the Amarr 860 and Amarr 840, and reserved all rights with respect to whether NSC was in violation of other CGI intellectual property rights not covered by the Agreement.

32. NSC responded on June 7, 2017 and again on July 28, 2017, but did not contest the elements of its breach. Instead, it raised an improper defense that was itself expressly prohibited by the Agreement.

33. NSC also acknowledged that it was aware of CGI patents beyond the Licensed Patents, and CGI's patent infringement lawsuits against other companies with competing "smart" Wi-Fi garage door systems.

34. On November 22, 2017, CGI filed suit against NSC in the Northern District of Illinois for breach of contract, based on NSC's willful breach of the Agreement. *See The Chamberlain Group, Inc. v. Nortek, Inc., et al.*, No. 17-cv-8505, Dkt. 1 (N.D. Ill. 2017).

35. CGI now files this suit to protect additional intellectual property rights that NSC is violating with its own products, including the Linear LDCO850 and Linear LDCO852 Smart Wi-Fi Garage Door Openers, and the products NSC manufactures for Amarr, including the Amarr 860 and Amarr 840 products and related accessories.

OVERVIEW OF THE INFRINGING PRODUCTS

36. On information and belief, Defendant manufactures, sells, and offers for sale the Linear LDCO850 and Linear LDCO852 Smart Wi-Fi Garage Door Openers under the Linear brand ("the Linear Products").

37. On information and belief, Defendant also manufactures, sells, and offers for sale Smart Wi-Fi Garage Door Openers sold under the brand name

Amarr, including without limitation, the Amarr 860 and Amarr 840 products ("the Amarr Products") and related accessories.

38. On information and belief, the Linear Products and the Amarr Products all have functionally the same logic board, Wi-Fi wall control, and obstacle detector, and are the same in all respects material to the Asserted Patents. The Linear Products, Amarr Products, and any other NSC product that has the same structure, function, and operation as the Linear Products and/or Amarr Products are collectively referred to below as the "Accused Products."

39. On information and belief, the Accused Products are long-term equipment that, once installed, is not removed for decades. Given the expected lifetime of the Accused Products, such harm is effectively irreparable.

Linear LDCO850 / LDCO852

40. The following are images of the Linear LDCO850 product and accessories, which show elements of the Accused Products.


LDCO850
Smart Garage Door Operator
Wi-Fi Connectivity
Reliable Power
LDCO850
NEW PRODUCT
Smart · Quiet · Strong
spott
Smart Just Got Smarter
• spott™ allows control and monitoring of the LDCO850 garage door operator via mobile device with the Linear PRO Access app
• spott™ offers up to ten authorized users passive/ hands-free opening and closing of the LDCO850 garage door
• Free app can be used with most smartphones and tablets
Download on the App Store
GET IT ON Google Play
Linear
Ultra-Quiet, Efficient Design, Smart
Wi-Fi connectivity with spott™ and the Linear PRO Access mobile app
Ultra-smooth, quiet performance thanks to variable speed operation
Dimmable LED light panel, 100W equivalent, energy efficient
Integrated battery backup included for peace of mind
Self-diagnostic system continually checks for proper operation
Compatible with Amazon Alexa, Google Assistant, IFTTT and HomeLink
American engineering and quality assurance
amazon alexa
works with the Google Assistant
Works with IFTTT
HomeLink COMPATIBLE
Linear PRO ACCESS

LDCO850 Smart Garage Door Operator

*The **LDCO850** includes the **MTR3** narrow-band 3-button remote and the **WWS850** multi-function Wi-Fi wall station.*

One Operator, Many Applications
Belt drive or chain drive, 7' or 8' T-rail or I-rail

Secure. Responsive Remote Control
Linear remote controls operate over a long range and employ high-security technology.

Easy Door Release
Release the operator's quick-disconnect trolley to open or close the garage door manually.

Self-Diagnostic System
The LDCO850's self-diagnostic system continually checks and confirms proper operation. In the unlikely event of a problem, it pinpoints the trouble and alerts users by flashing the courtesy light.

Options and Accessories
Your Linear PRO Access dealer is the source for everything from additional transmitters (miniature key ring or multi-button visor) to wireless keypads and advanced access systems.

Model LDCO850 — UNIT SPECIFICATIONS

DIMENSIONS (with 7' rail)
Installed Length: 124.5"
Maximum Door Opening: 7' 6"
Maximum Door Height (with optional rails): 8'
Headroom Clearance Required: 1.5"

CARTONS

Carton 1 - Operator Head
Contents:
- Garage Door Operator Head
- Integrated battery backup included, 12V, 5.4AH
- WWS850 Wi-Fi Wall Station (w/ 27' wire)
- MTR3 Remote Control
- Obstacle-sensing beams (w/ 35' of wire)
- Mounting hardware

Dimension: 17" x 14.75" x 10"
Shipping Weight: 23.7 lbs.

Carton 2 - Operator Rail
Contents:
- Pre-assembled, pre-tensioned 7' or 8' T-rail or I-rail, belt drive or chain drive

spott™
Wireless monitoring and control of LDCO850 operator and lighting
Utilized via free, downloadable Apple and/or Android mobile device app
Compatible with Amazon Alexa, HomeLink, Google Assistant and/or IFTTT
Accommodates up to ten authorized users
Wi-Fi connection required

CONVENIENCE AND SAFETY
- Obstacle-sensing beams
- Emergency quick release
- Auto trolley reconnect
- Ventilation/pet positioning
- Down safety reverse
- Up safety stop
- Door park on down direction

CODING SYSTEM
- MegaCode®
- Factory-coded transmitter
- Learning receiver with learn button
- Keypad codes and individually-removable transmitters
- LED indication of RF activity

Transmitter buttons, keypad codes: 40
Frequency: 318 MHz
Operating Range (line of sight): 150' (approx.)
Operating Temperature: -31°F to 158°F
Remote Control: MTR3 narrow-band 3-button remote control (1)
Batteries: 3V 2032 Lithium (1)
HomeLink® Compatible: Yes

ELECTRICAL SPECIFICATIONS

Power
Line Power: 120 VAC 60 Hz
Current rating (including lights): 2.5 Amp
UL 325 listed and compliant
Length of Power Cord (3 prong): 6 foot
Logic type: Solid-state microcontroller with built-in surge suppression
Battery backup: 12V, 5.4AH

Lighting
LED, 100W equivalent, dimmable
Length of light delay: 4.5 min.

MECHANICAL SPECIFICATIONS

Motor
Power: 800 Newtons
RPM: 100
Lubrication: Permanent

Drive Mechanism
Drive Means: Full #410 roller chain or steel-reinforced drive belt
Reduction means: Motor integrated worm/helical gear reduction, 30:1 ratio
Door Linkage: Adjustable door arm

Adjustments
Force: Electronic auto setting, auto adjusting, with optional manual modification
Limit: Electronic, internal

Travel Rate
Approx. 7" per second

Materials
Chassis: Electrogalvanized Steel
Rail: Electrogalvanized Steel
Trolley: Lubrication-free Delrin®

WARRANTY
Motor: Lifetime
Belt: Lifetime
Chain: 5 year
Mechanical: 5 year
Electronic: 1 year

linearproaccess.com
800-543-4283 / 3121 Hartsfield Rd., Tallahassee, FL 32303
10016787_d

Linear PRO ACCESS™

See https://www.linearproaccess.com/wp-content/uploads/LDCO850-LDCO852-spott.pdf.

41. The following are images of the LDCO852 product and accessories, which show elements of the Accused Products.

LDCO852 Smart Garage Door Operator

*The **LDCO852** includes the **MTR3** narrow-band 3-button remote and the **LPWWS** multi-function Wi-Fi wall station.*

One Operator, Many Applications
Belt drive or chain drive, 7' or 8' T-rail or I-rail

Secure. Responsive Remote Control
Linear remote controls operate over a long range and employ high-security technology.

Easy Door Release
Release the operator's quick-disconnect trolley to open or close the garage door manually.

Self-Diagnostic System
The LDCO852's self-diagnostic system continually checks and confirms proper operation. In the unlikely event of a problem, it pinpoints the trouble and alerts users by flashing the courtesy lights.

Options and Accessories
Your Linear PRO Access dealer is the source for everything from additional transmitters (miniature key ring or multi-button visor) to wireless keypads and advanced access systems.

Model LDCO852 — UNIT SPECIFICATIONS

DIMENSIONS (with 7' rail)
Installed Length: 124.5"
Maximum Door Opening: 7' 6"
Maximum Door Height (with optional rails): 8'
Headroom Clearance Required: 1.5"

CARTONS
Carton 1 - Operator Head
Contents:
- Garage Door Operator Head
- Integrated battery backup included, 12V, 5.4AH
- LPWWS Wi-Fi Wall Station (w/ 27' wire)
- MTR3 Remote Control
- Obstacle-sensing beams (w/ 35' of wire)
- Mounting hardware

Dimension: 12.3" x 12" x 6.1"
Shipping Weight: 20 lbs

Carton 2 - Operator Rail
Contents:
- Pre-assembled, pre-tensioned 7' or 8' T-rail or I-rail, belt drive or chain drive

spott™
Wireless monitoring and control of LDCO852 operator and lighting
Utilized via free, downloadable Apple and/or Android mobile device app
Compatible with Amazon Alexa, IFTTT, HomeLink and/or Google Home
Accommodates up to ten authorized users
Wi-Fi connection required

CONVENIENCE AND SAFETY
- Obstacle-sensing beams
- Emergency quick release
- Auto trolley reconnect
- Ventilation/pet positioning
- Down safety reverse
- Up safety stop
- Door park on down direction

CODING SYSTEM
- MegaCode®
- Factory-coded transmitter
- Learning receiver with learn button
- Keypad codes and individually-removable transmitters
- LED indication of RF activity

Transmitter buttons, keypad codes: 40
Frequency: 318 MHz
Operating Range (line of sight): 150' (approx.)
Operating Temperature: -31°F to 158°F
Remote Control: MTR3 narrow-band 3-button remote control (1)
Batteries: 3V 2032 Lithium (1)
HomeLink® Compatible: Yes

ELECTRICAL SPECIFICATIONS
Power
Line Power: 120 VAC 60 Hz
Current rating (including lights): 2.5 Amp
UL 325 listed and compliant
Length of Power Cord (3 prong): 6 foot
Logic type: Solid-state microcontroller with built-in surge suppression
Battery backup: 12V, 5.4AH

Lighting
LED, 200W equivalent, dimmable
Length of light delay: 4.5 min.

MECHANICAL SPECIFICATIONS
Motor
Power: 800 Newtons
RPM: 100
Lubrication: Permanent

Drive Mechanism
Drive Means: Full #410 roller chain or steel-reinforced drive belt
Reduction means: Motor integrated worm/helical gear reduction, 30:1 ratio
Door Linkage: Adjustable door arm

Adjustments
Force: Electronic auto setting, auto adjusting, with optional manual modification
Limit: Electronic, internal

Travel Rate
Approx. 7" per second

Materials
Chassis: Electrogalvanized Steel
Rail: Electrogalvanized Steel
Trolley: Lubrication-free Delrin®

WARRANTY
Motor: Lifetime
Belt: Lifetime
Chain: 5 year
Mechanical: 5 year
Electronic: 1 year

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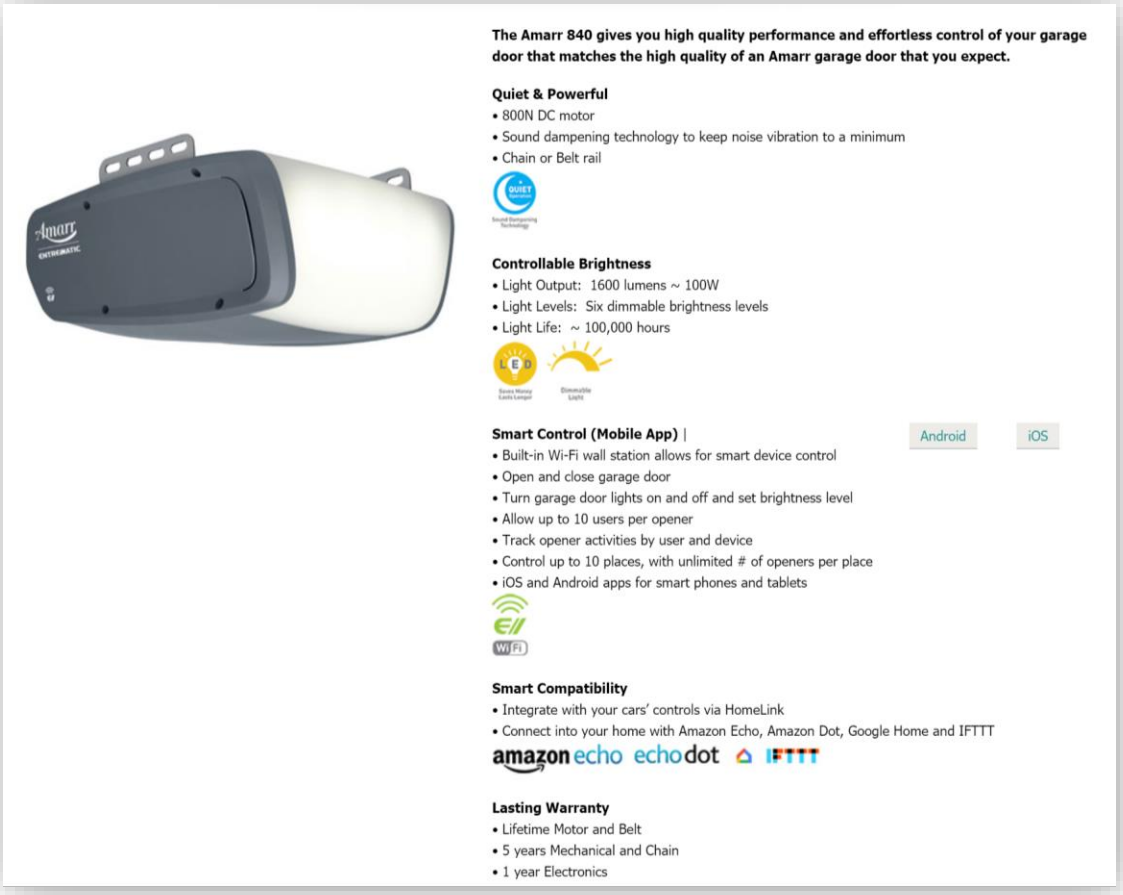
Linear PRO ACCESS™

See https://www.linearproaccess.com/wp-content/uploads/LDCO850-LDCO852-spott.pdf.

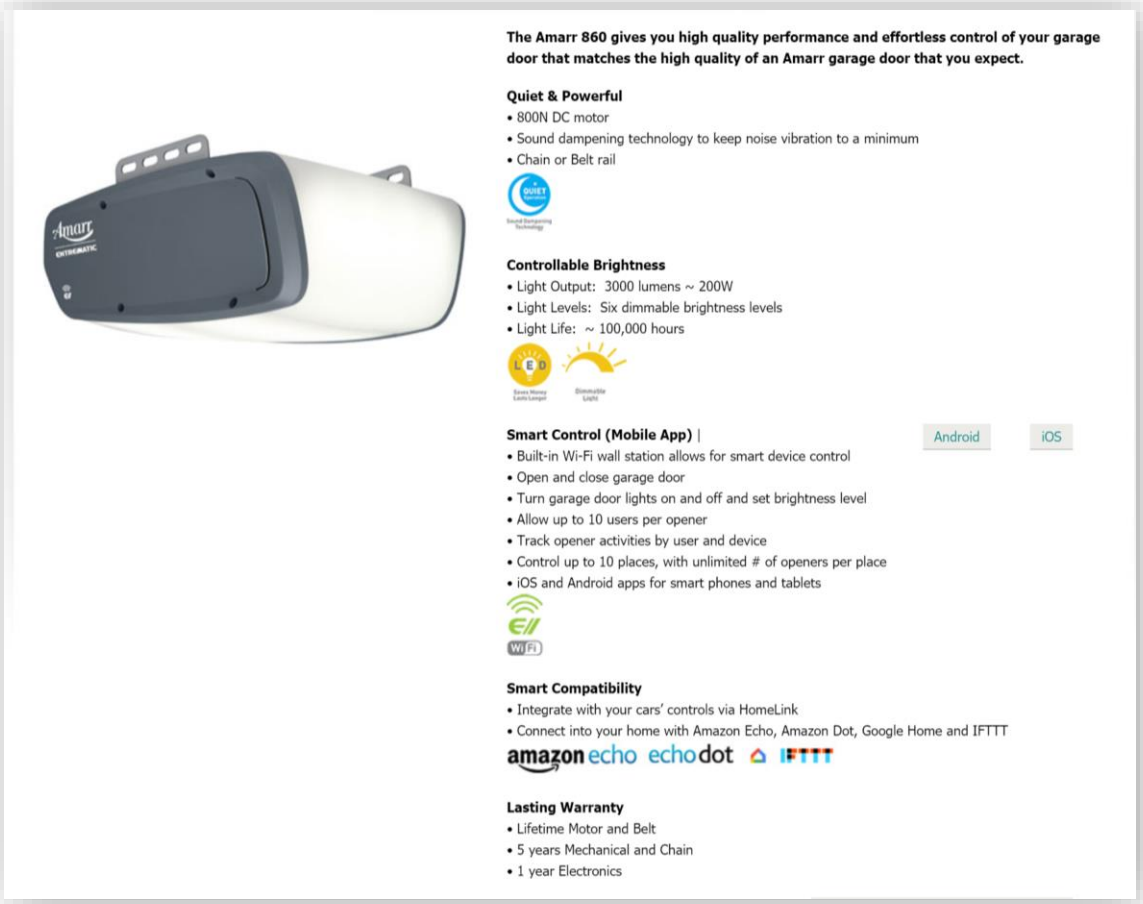
Amarr 840 / Amarr 860

42. The following is an image of the Amarr 840, which shows elements of the Accused Products.



See http://www.amarr.com/residential/product_detail/840.

43. The following is an image of the Amarr 860, which shows elements of the Accused Products.



See http://www.amarr.com/residential/product_detail/860.

COUNT 1 – INFRINGEMENT OF THE '404 PATENT

44. CGI realleges and incorporates by reference each of the preceding paragraphs.

45. On information and belief, Defendant, directly or through the actions of its employees, divisions, and/or subsidiaries, has infringed and continues to infringe at least claim 11 of the '404 patent directly, literally, and/or by equivalents under 35 U.S.C. § 271(a) by, among other things, importing the Accused Products and making, using, offering for sale, and selling the Accused Products in the United States.

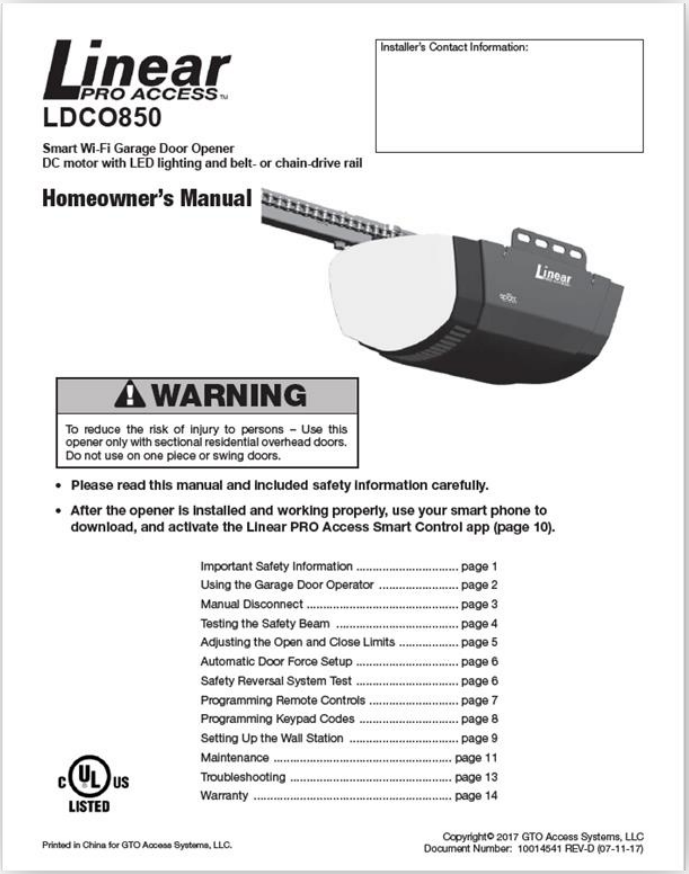
46. The Accused Products comprise a movable barrier system with a moving-barrier imminent motion notification, as recited in the claims of the '404 patent. For instance, claim 11 of the '404 patent recites:

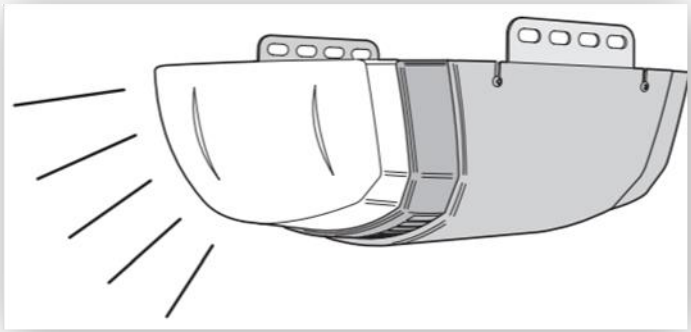
> A movable barrier system with a moving-barrier imminent motion notification, the system comprising:
>
> a movable [barrier] operator connected to control movement of a movable barrier between a first position and a second position;
>
> the movable barrier operator comprising:
>
> a communication connection comprising at least one of the group consisting of: a direct wireless connection to a transmitter, a local wired connection, a system wired connection, a network connection, and a wireless communication system connection; and
>
> a processor configured to determine whether a received command for a closing the movable barrier was received from at least one of the system wired connection, the network connection, and the wireless communication system connection;
>
> the processor configured to effect the closing of the movable barrier in combination with operating a moving barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the system wired connection, the network connection, and the wireless communication system connection;
>
> the processor configured to determine whether the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection;
>
> the processor configured to effect the closing of the movable barrier without operating the moving-barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection.

47. The following tables provide a representative example charting how the LDCO850, which is representative of the Accused Products, practices each and every limitation of representative claim 11 of the '404 patent. This demonstration of infringement is offered by way of example only and without limitation to CGI's ability to demonstrate Defendant's direct or indirect infringement of additional

'404 patent claims, including by making, using, selling, offering for sale, or importing additional products or inducing or contributing to such acts.

48. The Accused Products are "movable barrier system[s] with a moving-barrier imminent motion notification" as provided in the chart below:

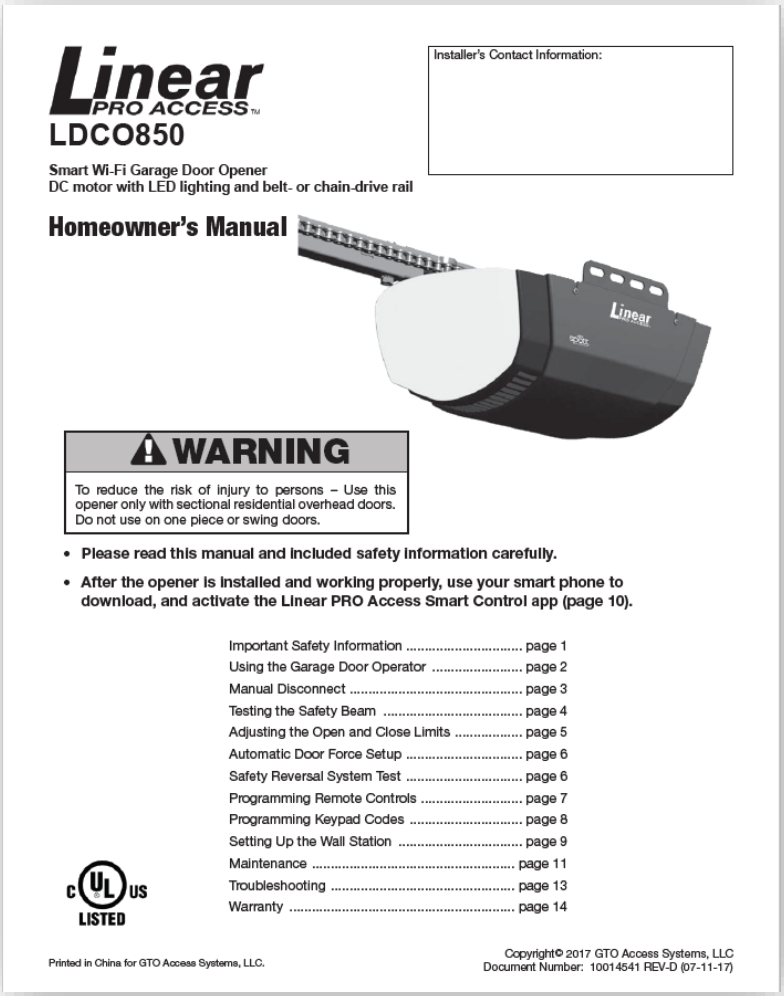
Claim Limitation	Exemplary Infringing Element of Defendant's Accused Products
1. A movable barrier system with a moving-barrier imminent motion notification, the system comprising:	The Accused Products are movable barrier systems with a moving barrier imminent motion notification.  Linear PRO ACCESS LDCO850 Smart Wi-Fi Garage Door Opener DC motor with LED lighting and belt- or chain-drive rail Installer's Contact Information: Homeowner's Manual WARNING To reduce the risk of injury to persons – Use this opener only with sectional residential overhead doors. Do not use on one piece or swing doors. • Please read this manual and included safety information carefully. • After the opener is installed and working properly, use your smart phone to download, and activate the Linear PRO Access Smart Control app (page 10). Important Safety Information ..... page 1 Using the Garage Door Operator ..... page 2 Manual Disconnect ..... page 3 Testing the Safety Beam ..... page 4 Adjusting the Open and Close Limits ..... page 5 Automatic Door Force Setup ..... page 6 Safety Reversal System Test ..... page 6 Programming Remote Controls ..... page 7 Programming Keypad Codes ..... page 8 Setting Up the Wall Station ..... page 9 Maintenance ..... page 11 Troubleshooting ..... page 13 Warranty ..... page 14 c UL us LISTED Printed in China for GTO Access Systems, LLC. Copyright© 2017 GTO Access Systems, LLC Document Number: 10014541 REV-D (07-11-17) *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Homeowner's Manual, at cover ("Smart Wi-Fi Garage Door Opener").

	 *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Homeowner's Manual, at 2 (Exemplary imminent motion notification). When operated with a remote signal, such as a Wi-Fi signal, the Linear Pro Access LDCO 850 provides moving-barrier imminent motion notification such as flashing lights and audible beeps.

49. The Accused Products comprise "a movable [barrier] operator connected to control movement of a movable barrier between a first position and a second position" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
a movable [barrier] operator connected to control movement of a movable barrier between a first position and a second position;	The Accused Products comprise a movable [barrier] operator connected to control movement of a movable barrier between a first position and a second position:



Linear PRO ACCESS™

LDCO850

Smart Wi-Fi Garage Door Opener
DC motor with LED lighting and belt- or chain-drive rail

Installer's Contact Information:

Homeowner's Manual

⚠ WARNING

To reduce the risk of injury to persons – Use this opener only with sectional residential overhead doors. Do not use on one piece or swing doors.

- **Please read this manual and included safety information carefully.**
- **After the opener is installed and working properly, use your smart phone to download, and activate the Linear PRO Access Smart Control app (page 10).**

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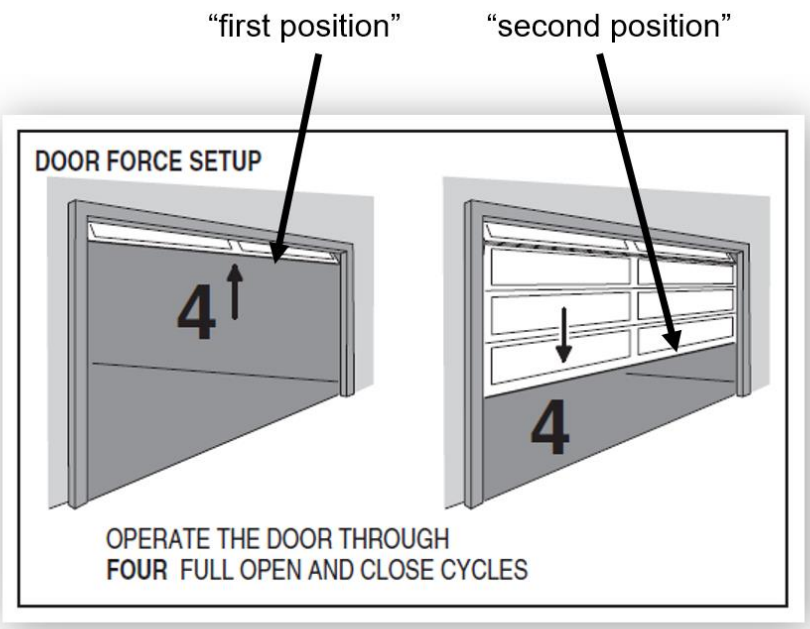
Printed in China for GTO Access Systems, LLC.

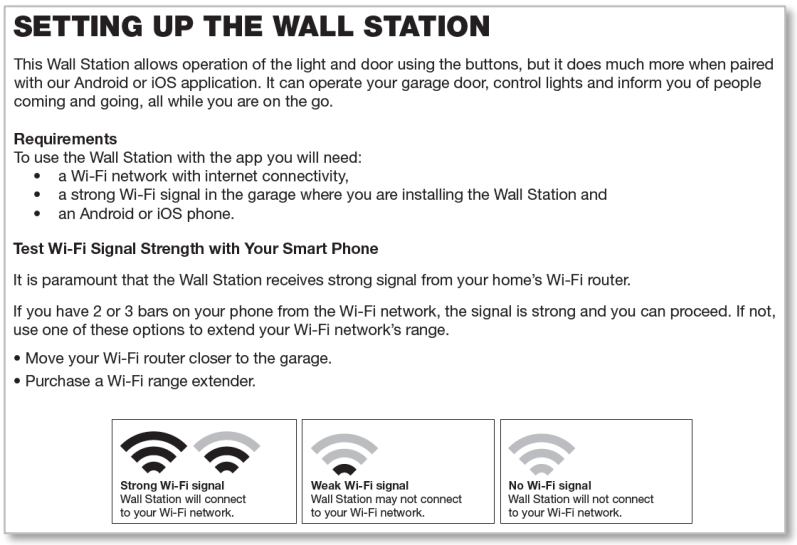
Document Number: 10014541 REV-D (07-11-17)

E.g., Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Homeowner's Manual, at cover ("Smart Wi-Fi Garage Door Opener").

	 *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Homeowner's Manual, at 6 (movable barrier between a first position and a second position).

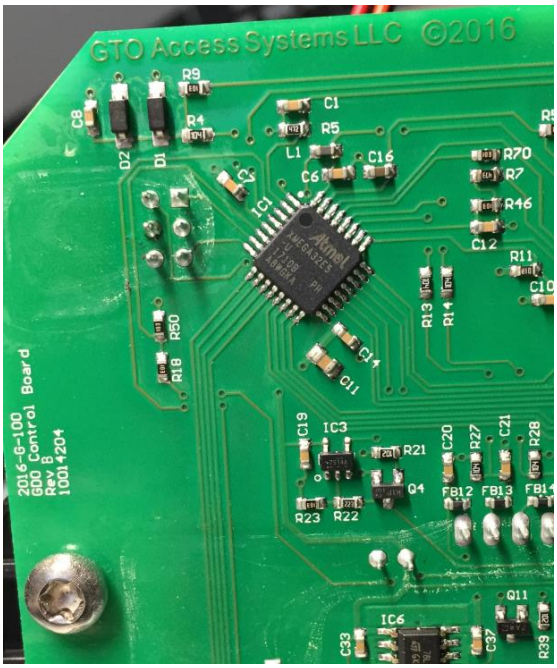
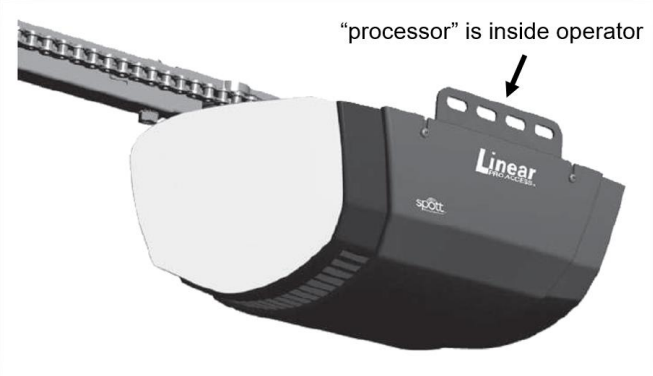
50. The Accused Products comprise "a communication connection comprising at least one of the group consisting of: a direct wireless connection to a transmitter, a local wired connection, a system wired connection, a network connection, and a wireless communication system connection" as provided in the chart below:

Claim Limitation	Exemplary Infringing Element of Defendant's Accused Products
the movable barrier operator comprising: a communication connection comprising at least one of the group consisting of: a direct	The Accused Products comprise a movable barrier operator comprising: a communication connection comprising at least one of the group consisting of: a direct wireless connection to a transmitter, a local wired connection, a system wired connection, a network connection, and a wireless communication system connection:

wireless connection to a transmitter, a local wired connection, a system wired connection, a network connection, and a wireless communication system connection;	 *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Homeowner's Manual, at 9 ("To use the Wall Station with the app you will need: a Wi-Fi network with internet connectivity").  *E.g.*, https://www.linearproaccess.com/wp-content/uploads/LDCO850-LDCO852-spott.pdf (Wi-Fi wall station and other transmitters).

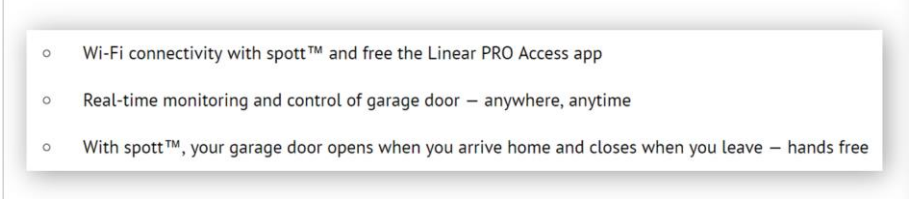
51. The Accused Products comprise a "processor configured to effect the closing of the movable barrier without operating the moving-barrier imminent motion notification in response to determining that the received command for the

closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection" as provided in the chart below:

Claim Limitation	Exemplary Infringing Element of Defendant's Accused Products
a processor configured to determine whether a received command for a closing the movable barrier was received from at least one of the system wired connection, the network connection, and the wireless communication system connection;	The Accused Products comprise a processor configured to determine whether a received command for a closing the movable barrier was received from at least one of the system wired connection, the network connection, and the wireless communication system connection:  *E.g.*, photo taken from LDCO850 unit. 

E.g., Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Homeowner's Manual, at cover ("processor").

E.g., https://www.linearproaccess.com/wp-content/uploads/LDCO850-LDCO852-spott.pdf (there are multiple ways to interface with the movable (barrier) operator).

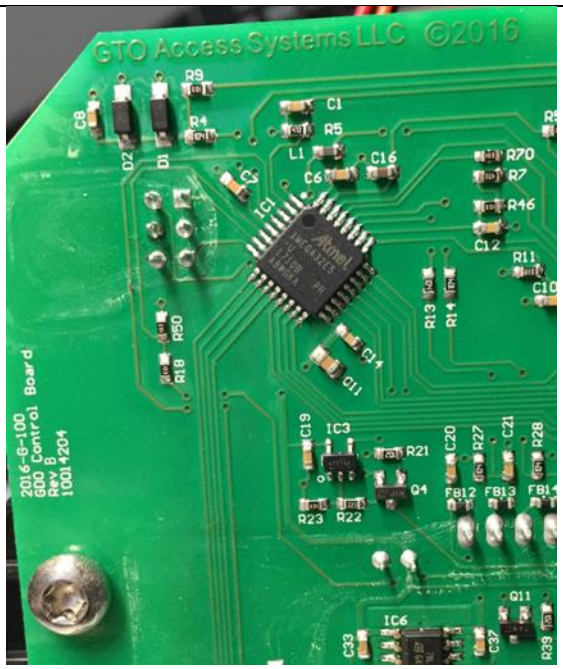


E.g., https://www.linearproaccess.com/garage-door-openers/ldco850/ ("spott ™ allows control and monitoring of the LDCO850 garage door operator via mobile device with the Linear PRO Access app").

	On information and belief, the wall station is connected to the garage door opener through a wired connection. On information and belief, the processor determines whether the type of signal received is local or remote. For example, when the garage door is closed using the wall station, there is no moving-barrier imminent motion notification, but when the garage door is closed with the Linear PRO Access app, it is closed with a moving-barrier imminent motion notification.

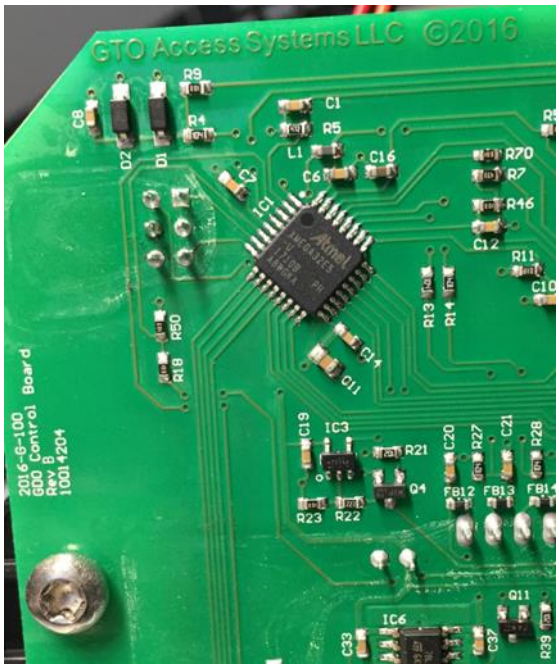
52. The Accused Products comprise a "processor configured to effect the closing of the movable barrier in combination with operating a moving barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the system wired connection, the network connection, and the wireless communication system connection" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
the processor configured to effect the closing of the movable barrier in combination with operating a moving barrier imminent motion notification in response to determining that the received	The Accused Products comprise a processor configured to effect the closing of the movable barrier in combination with operating a moving barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the system wired connection, the network connection, and the wireless communication system connection:

command for the closing was received from at least one of the system wired connection, the network connection, and the wireless communication system connection;	 *E.g.*, photo taken from LDCO850 unit. On information and belief, when the system determines the signal received comes from a remote location, it will operate with an imminent motion notification. For example, when the garage door is closed with the Linear PRO Access app, it is closed with a moving-barrier imminent motion notification. 

	E.g., https://www.linearproaccess.com/wp-content/uploads/LDCO850-LDCO852-spott.pdf.

53. The Accused Products comprise a "processor configured to determine whether the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
the processor configured to determine whether the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection;	The Accused Products comprise a processor configured to determine whether the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection: On information and belief, the processor determines whether the type of signal received is local or remote. For example, when the garage door is closed using the wall station, there is no moving-barrier imminent motion notification, but when the garage door is closed with the Linear PRO Access app, it is closed with a moving-barrier imminent motion notification.  *E.g.*, photo taken from LDCO850 unit.

	 *E.g.*, https://www.linearproaccess.com/wp-content/uploads/LDCO850-LDCO852-spott.pdf.

54. The Accused Products comprise a "processor configured to effect the closing of the movable barrier without operating the moving-barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
the processor configured to effect the closing of the movable barrier without operating the	The Accused Products comprise a processor configured to effect the closing of the movable barrier without operating the moving-barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection:

moving-barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection.	On information and belief, the wall station is connected to the garage door opener through a wired connection. On information and belief, when the processor determines that the command received comes from a local location, the system will operate without an imminent motion notification. For example, when the garage door is closed using the wall station, there is no moving-barrier imminent motion notification.

55. On information and belief, based on at least the prior litigation, the Agreement between NSC and CGI, and the correspondence regarding NSC's willful breach of its Agreement with CGI, NSC was aware of CGI patents beyond the Licensed Patents, including the Asserted Patents, before the filing of this suit.

56. On information and belief, Defendant has induced and continues to induce infringement of one or more claims of the '404 patent under 35 U.S.C. § 271(b). On information and belief, Defendant actively, knowingly, and intentionally induces, and will continue to actively, knowingly, and intentionally induce infringement of the '404 patent by selling or otherwise supplying the Accused Products with the knowledge and intent that third parties will import

and/or use the Accused Products to infringe the '404 patent, and with the knowledge and intent to encourage and facilitate third party infringement through the importation and/or dissemination of the Accused Products and the creation or dissemination, through its websites and other sources, of promotional materials, instructions, product manuals, and/or technical information related to the Accused Products.

57. On information and belief, Defendant has contributorily infringed, and continues to contributorily infringe, one or more claims of the '404 patent under 35 U.S.C. § 271(c). On information and belief, Defendant has sold or offered to sell within the United States or imported into the United States the Accused Products, and Defendant continues to offer to sell or sell within the United States or import into the United States the Accused Products with the knowledge that the Accused Products are especially made or especially adapted for use in an infringement of the '404 patent. On information and belief, the Accused Products are not a staple article or commodity of commerce suitable for substantial noninfringing use.

58. On information and belief, Defendant is aware and specifically intends that the ordinary and customary use of the Accused Products infringes the '404 patent. Defendant provides customers and other third parties with product manuals, technical information, and instructions that cause such customers and third parties to operate the Accused Products according to their ordinary and customary use. On information and belief, Defendant's customers and other third parties directly infringe the '404 patent through the normal and customary use of the Accused Products.

59. CGI has been and continues to be damaged by Defendant's infringement of the '404 patent.

60. Based on at least the prior litigation, the Agreement between NSC and CGI, and the correspondence regarding NSC's willful breach of its Agreement

with CGI, on information and belief, NSC's infringement of the '404 patent is and has been egregious and willful. At a minimum, NSC became aware of the '404 patent and the fact that the Accused Products infringe the '404 patent as of the filing of this suit. CGI is therefore entitled to enhanced damages under 35 U.S.C. § 284 and reasonable attorneys' fees and costs.

61. With no adequate remedy at law, CGI is entitled to injunctive relief, as it will continue to suffer irreparable harm, including loss of garage door opener sales and installations, loss of sales of related services and accessories, and harm to its reputation and brands, if Defendant's infringement of the '404 patent is not enjoined.

62. For all the reasons stated above, Defendant's conduct in infringing the '404 patent renders this case exceptional within the meaning of 35 U.S.C. § 285.

COUNT 2 – INFRINGEMENT OF THE '223 PATENT

63. CGI realleges and incorporates by reference each of the preceding paragraphs.

64. On information and belief, Defendant, directly or through the actions of its employees, divisions, and/or subsidiaries, has infringed and continues to infringe at least claim 1 of the '223 patent directly, literally, and/or by equivalents under 35 U.S.C. § 271(a) by, among other things, importing the Accused Products and making, using, offering for sale, and selling the Accused Products in the United States.

65. The Accused Products comprise a movable barrier operator, as recited in the claims of the '223 patent. For instance, claim 1 of the '223 patent recites:

> A movable barrier operator apparatus comprising:
>
> a power supply that operably couples to at least one source of alternating current;
>
> an obstacle detector; and

a movable barrier operator which includes a controller, the movable barrier operator operably coupled to the power supply, receives operating power from the power supply and has at least a first and second mode of energy consumption operation and being further configured and arranged to:

selectively open and close a corresponding movable barrier; and

develop an obstacle detector operating mode control signal from the controller as a function of movable barrier operator system state information that indicates whether the barrier is open or closed, the obstacle detector operating mode control signal being operable to directly control the energy usage of the obstacle detector, the control signal from the controller developed as a result of the state information, the state information selected from a group consisting of motor state information, time information, transmission state information, voltage state information, switch state information and combinations thereof,

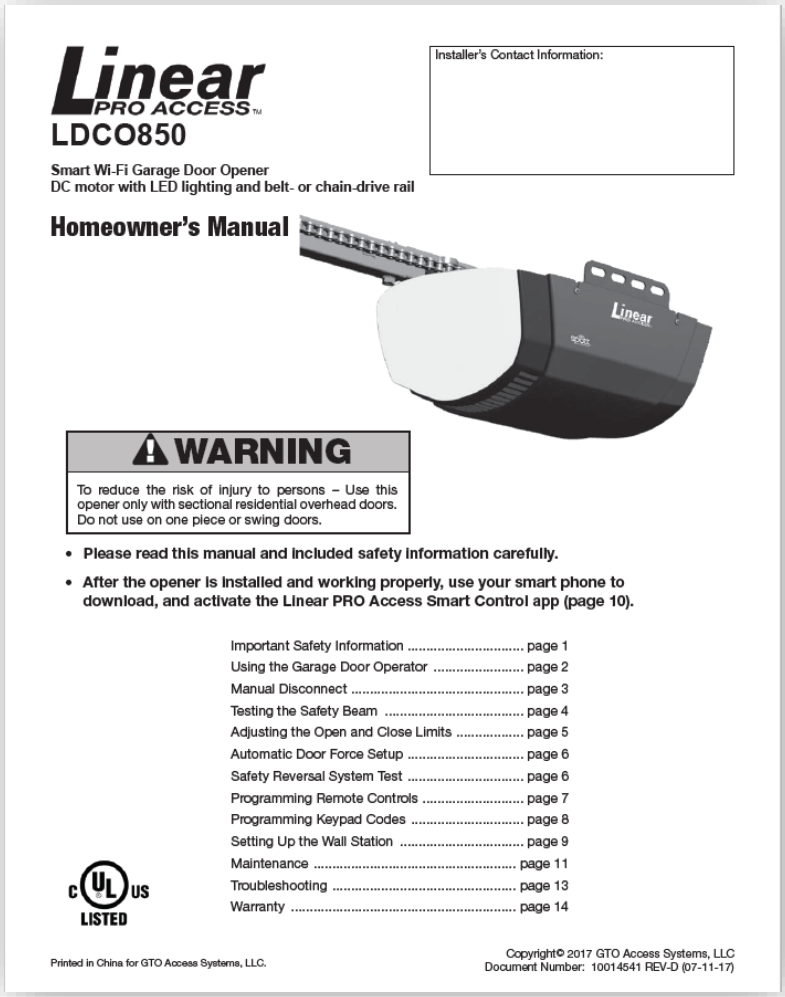
the obstacle detector operably coupled to the power supply and to the movable barrier operator, receives operating power from the power supply, and has a plurality of operating modes, wherein at least some of the operating modes have different energy usages, and wherein the obstacle detector is directly responsive to the movable barrier operator obstacle detector operating mode control signal such that:

during the first mode of energy consumption operation, the obstacle detector operates using a first energy usage; and

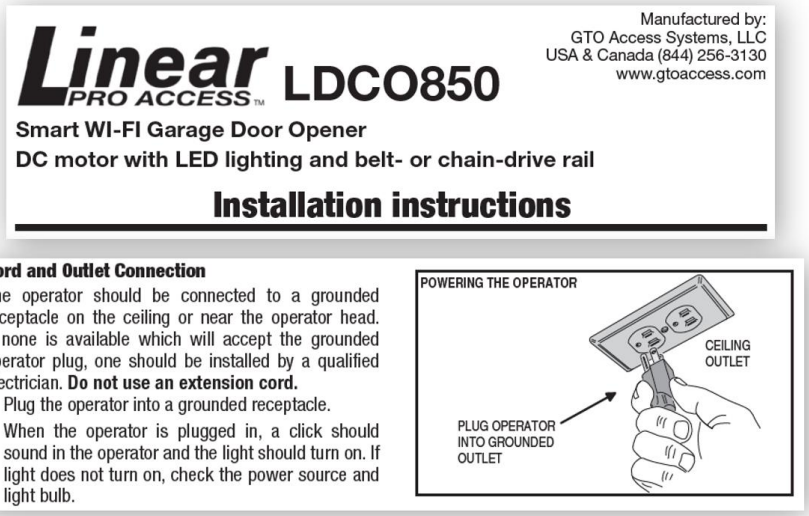
during the second mode of energy consumption operation, the obstacle detector operates using a second energy usage, wherein the operating power used in one of the energy usages is less than the power used by the other energy usage.

66. The following tables provide a representative example charting how the LDCO850, which is representative of the Accused Products, practices each and every limitation of representative claim 1 of the ’223 patent. This demonstration of infringement is offered by way of example only and without limitation to CGI’s ability to demonstrate Defendant’s direct or indirect infringement of additional ’223 patent claims, including by making, using, selling, offering for sale, or importing additional products or inducing or contributing to such acts.

67. The Accused Products are “movable barrier operator apparatus” as provided in the chart below:

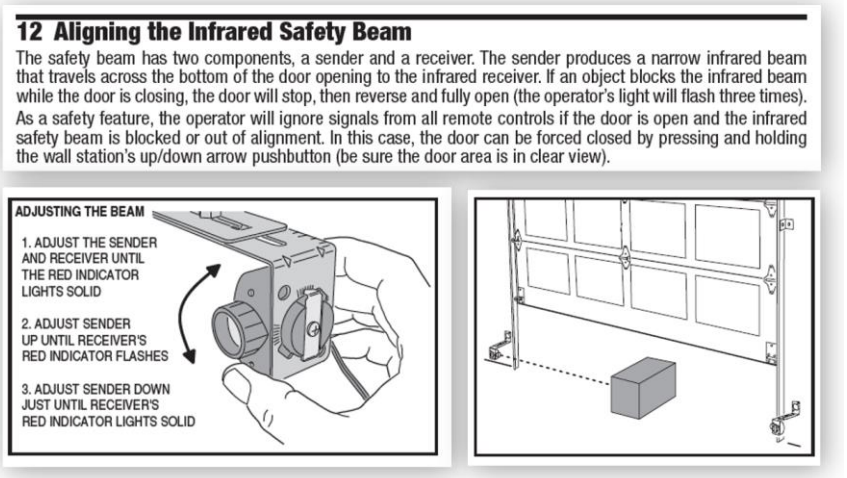
Claim Limitation	Exemplary Infringing Element of Defendant's Accused Products
A movable barrier operator apparatus comprising:	The Accused Products are movable barrier operator apparatus:  Linear PRO ACCESS™ LDCO850 Smart Wi-Fi Garage Door Opener DC motor with LED lighting and belt- or chain-drive rail Installer's Contact Information: Homeowner's Manual WARNING To reduce the risk of injury to persons – Use this opener only with sectional residential overhead doors. Do not use on one piece or swing doors. • Please read this manual and included safety information carefully. • After the opener is installed and working properly, use your smart phone to download, and activate the Linear PRO Access Smart Control app (page 10). Important Safety Information ..... page 1 Using the Garage Door Operator ..... page 2 Manual Disconnect ..... page 3 Testing the Safety Beam ..... page 4 Adjusting the Open and Close Limits ..... page 5 Automatic Door Force Setup ..... page 6 Safety Reversal System Test ..... page 6 Programming Remote Controls ..... page 7 Programming Keypad Codes ..... page 8 Setting Up the Wall Station ..... page 9 Maintenance ..... page 11 Troubleshooting ..... page 13 Warranty ..... page 14 c UL us LISTED Printed in China for GTO Access Systems, LLC. Copyright© 2017 GTO Access Systems, LLC Document Number: 10014541 REV-D (07-11-17) *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Homeowner's Manual, at cover ("Smart Wi-Fi Garage Door Opener DC motor with LED lighting and belt- or chain-drive rail").

68. The Accused Products comprise "a power supply that operably couples to at least one source of alternating current" as provided in the chart below:

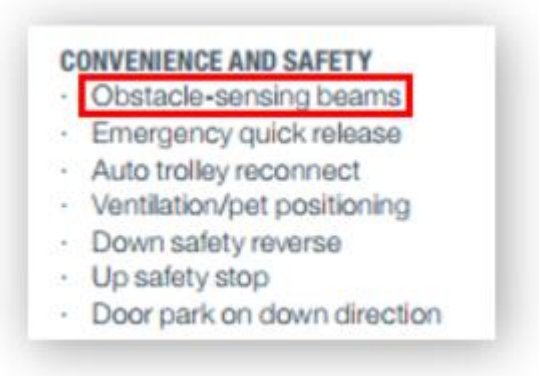
Claim Limitation	Exemplary Infringing Element of Defendant's Accused Products
a power supply that operably couples to at least one source of alternating current;	The Accused Products comprise a power supply that operably couples to at least one source of alternating current:  Manufactured by: GTO Access Systems, LLC USA & Canada (844) 256-3130 www.gtoaccess.com Linear PRO ACCESS LDCO850 Smart WI-FI Garage Door Opener DC motor with LED lighting and belt- or chain-drive rail Installation instructions **Cord and Outlet Connection** The operator should be connected to a grounded receptacle on the ceiling or near the operator head. If none is available which will accept the grounded operator plug, one should be installed by a qualified electrician. **Do not use an extension cord.** 1 Plug the operator into a grounded receptacle. 2 When the operator is plugged in, a click should sound in the operator and the light should turn on. If light does not turn on, check the power source and light bulb. POWERING THE OPERATOR CEILING OUTLET PLUG OPERATOR INTO GROUNDED OUTLET *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 2 ("plug operator into grounded outlet").

69. The Accused Products comprise "an obstacle detector" as provided in the chart below:

Claim Limitation	Exemplary Infringing Element of Defendant's Accused Products
an obstacle detector; and	The Accused Products comprise an obstacle detector:



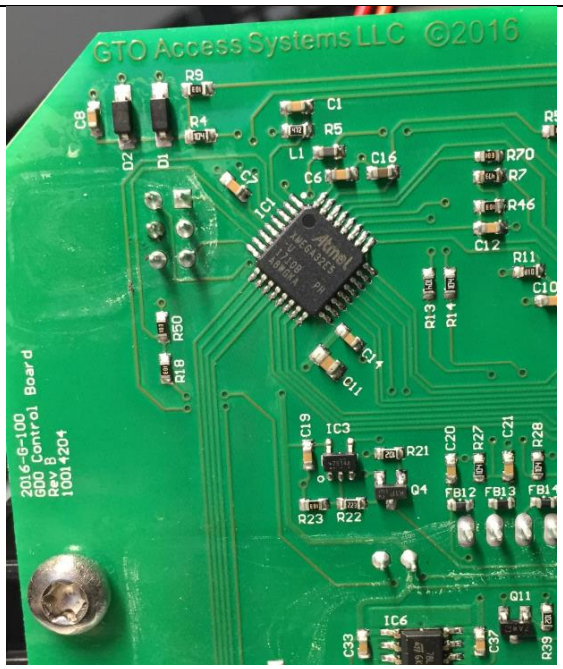
E.g., Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 3 ("Infrared Safety Beam").

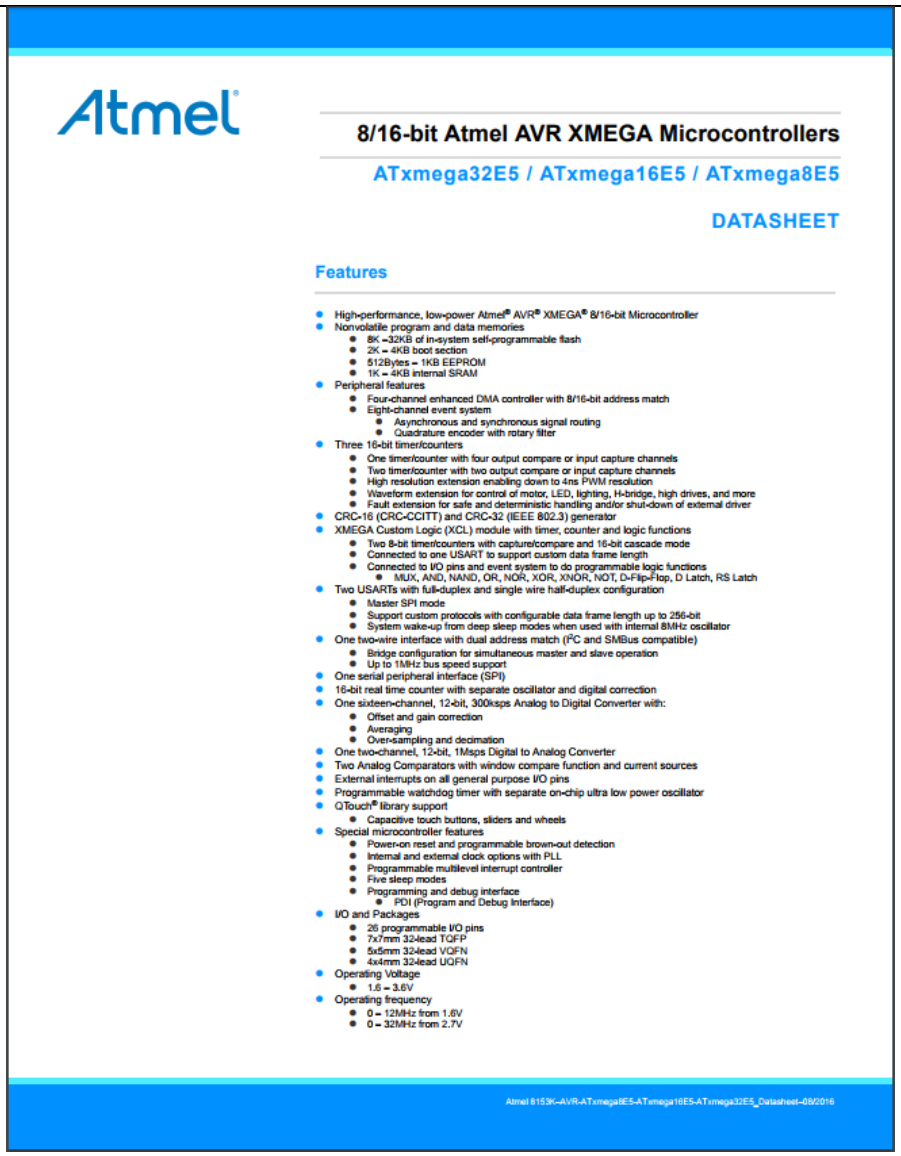


E.g., https://www.linearproaccess.com/wp-content/uploads/LDCO850-LDCO852-spott.pdf.

70. The Accused Products comprise "a movable barrier operator which includes a controller" as provided in the chart below:

Claim Limitation	Exemplary Infringing Element of Defendant's Accused Products
a movable barrier operator which includes a controller,	The Accused Products are movable barrier operators which include a controller: On information and belief, the Accused Products include the Atmel XMEGA32E5 processor.

	 *E.g.*, photo taken from LDCO850 unit.



Atmel

8/16-bit Atmel AVR XMEGA Microcontrollers

ATxmega32E5 / ATxmega16E5 / ATxmega8E5

DATASHEET

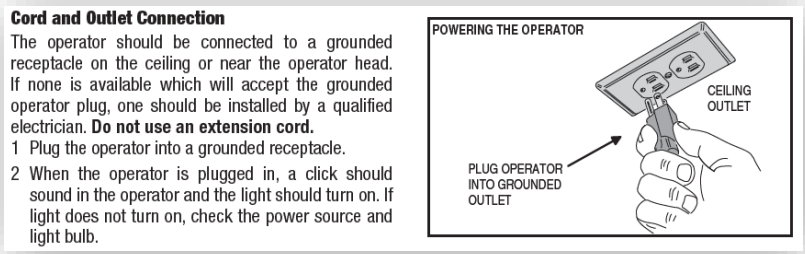
Features

- High-performance, low-power Atmel® AVR® XMEGA® 8/16-bit Microcontroller
- Nonvolatile program and data memories
  - 8K – 32KB of in-system self-programmable flash
  - 2K – 4KB boot section
  - 512Bytes – 1KB EEPROM
  - 1K – 4KB internal SRAM
- Peripheral features
  - Four-channel enhanced DMA controller with 8/16-bit address match
  - Eight-channel event system
    - Asynchronous and synchronous signal routing
    - Quadrature encoder with rotary filter
- Three 16-bit timer/counters
  - One timer/counter with four output compare or input capture channels
  - Two timer/counter with two output compare or input capture channels
  - High resolution extension enabling down to 4ns PWM resolution
  - Waveform extension for control of motor, LED, lighting, H-bridge, high drives, and more
  - Fault extension for safe and deterministic handling and/or shut-down of external driver
- CRC-16 (CRC-CCITT) and CRC-32 (IEEE 802.3) generator
- XMEGA Custom Logic (XCL) module with timer, counter and logic functions
  - Two 8-bit timer/counters with capture/compare and 16-bit cascade mode
  - Connected to one USART to support custom data frame length
  - Connected to I/O pins and event system to do programmable logic functions
    - MUX, AND, NAND, OR, NOR, XOR, XNOR, NOT, D-Flip-Flop, D Latch, RS Latch
- Two USARTs with full-duplex and single wire half-duplex configuration
  - Master SPI mode
  - Support custom protocols with configurable data frame length up to 256-bit
  - System wake-up from deep sleep modes when used with internal 8MHz oscillator
- One two-wire interface with dual address match (I²C and SMBus compatible)
  - Bridge configuration for simultaneous master and slave operation
  - Up to 1MHz bus speed support
- One serial peripheral interface (SPI)
- 16-bit real time counter with separate oscillator and digital correction
- One sixteen-channel, 12-bit, 300ksps Analog to Digital Converter with:
  - Offset and gain correction
  - Averaging
  - Over-sampling and decimation
- One two-channel, 12-bit, 1Msps Digital to Analog Converter
- Two Analog Comparators with window compare function and current sources
- External interrupts on all general purpose I/O pins
- Programmable watchdog timer with separate on-chip ultra low power oscillator
- QTouch® library support
  - Capacitive touch buttons, sliders and wheels
- Special microcontroller features
  - Power-on reset and programmable brown-out detection
  - Internal and external clock options with PLL
  - Programmable multilevel interrupt controller
  - Five sleep modes
  - Programming and debug interface
    - PDI (Program and Debug Interface)
- I/O and Packages
  - 26 programmable I/O pins
  - 7x7mm 32-lead TQFP
  - 5x5mm 32-lead VQFN
  - 4x4mm 32-lead UQFN
- Operating Voltage
  - 1.6 – 3.6V
- Operating frequency
  - 0 – 12MHz from 1.6V
  - 0 – 32MHz from 2.7V

Atmel 8153K–AVR-ATxmega8E5-ATxmega16E5-ATxmega32E5_Datasheet–05/2016

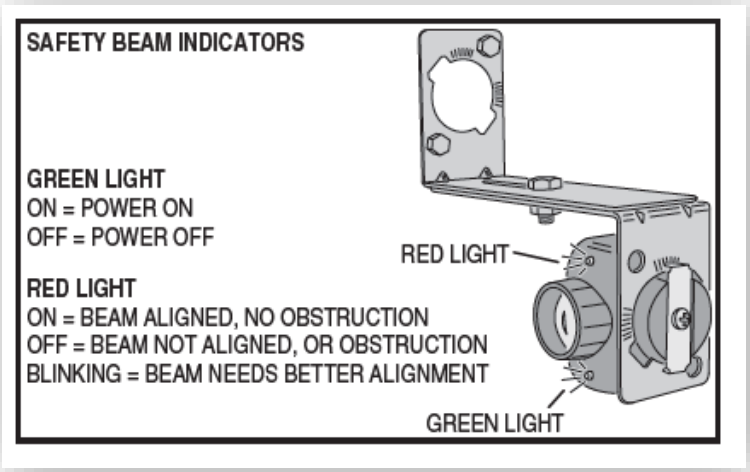
E.g., http://www.atmel.com/Images/Atmel-8153-8-and-16-bit-AVR-Microcontroller-XMEGA-E-ATxmega8E5-ATxmega16E5-ATxmega32E5_Datasheet.pdf.

71. The Accused Products comprise a "movable barrier operator operably coupled to the power supply" which "receives operating power from the power supply" as provided in the chart below:

Claim Limitation	Exemplary Infringing Element of Defendant's Accused Products
the movable barrier operator operably coupled to the power supply, receives operating power from the power supply,	The Accused Products comprise movable barrier operators operably coupled to a power supply, which receive operating power from the power supply:  **Cord and Outlet Connection** The operator should be connected to a grounded receptacle on the ceiling or near the operator head. If none is available which will accept the grounded operator plug, one should be installed by a qualified electrician. **Do not use an extension cord.** 1 Plug the operator into a grounded receptacle. 2 When the operator is plugged in, a click should sound in the operator and the light should turn on. If light does not turn on, check the power source and light bulb. POWERING THE OPERATOR CEILING OUTLET PLUG OPERATOR INTO GROUNDED OUTLET *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 2 ("plug operator into grounded outlet").

72. The Accused Products comprise a movable barrier operator that "has at least a first and second mode of energy consumption operation and being further configured and arranged to" as provided in the chart below:

Claim Limitation	Exemplary Infringing Element of Defendant's Accused Products
has at least a first and second mode of energy consumption operation and being further configured and arranged to:	The Accused Products comprise movable barrier operators that have at least a first and second mode of energy consumption operation:



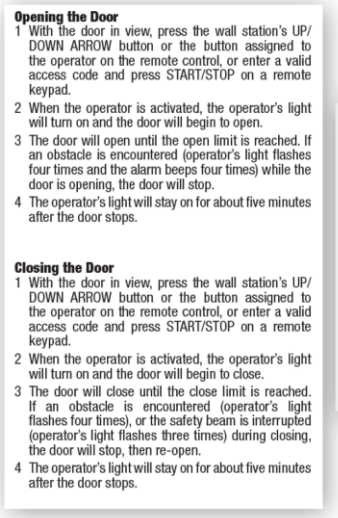
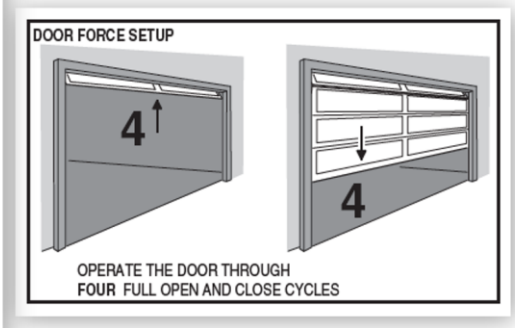
E.g., Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 3 ("Red Light, Green Light").

On information and belief, the obstacle detector operates in a first mode of energy consumption as indicated by the green light being on in the image below:

On information and belief, the obstacle detector operates in a second mode of energy consumption as indicated by the green light being off in the image below:

	 *E.g.*, photos taken from LDCO850 unit.

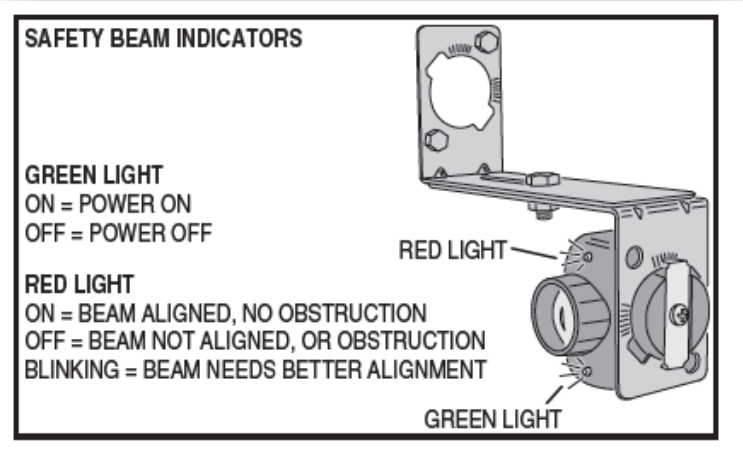
73. The Accused Products comprise movable barrier operators that are further configured and arranged to "selectively open and close a corresponding movable barrier" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
selectively open and close a corresponding movable barrier; and	The Accused Products comprise movable barrier operators further configured and arranged to selectively open and close a corresponding movable barrier:  **Opening the Door** 1 With the door in view, press the wall station's UP/ DOWN ARROW button or the button assigned to the operator on the remote control, or enter a valid access code and press START/STOP on a remote keypad. 2 When the operator is activated, the operator's light will turn on and the door will begin to open. 3 The door will open until the open limit is reached. If an obstacle is encountered (operator's light flashes four times and the alarm beeps four times) while the door is opening, the door will stop. 4 The operator's light will stay on for about five minutes after the door stops. **Closing the Door** 1 With the door in view, press the wall station's UP/ DOWN ARROW button or the button assigned to the operator on the remote control, or enter a valid access code and press START/STOP on a remote keypad. 2 When the operator is activated, the operator's light will turn on and the door will begin to close. 3 The door will close until the close limit is reached. If an obstacle is encountered (operator's light flashes four times), or the safety beam is interrupted (operator's light flashes three times) during closing, the door will stop, then re-open. 4 The operator's light will stay on for about five minutes after the door stops.  DOOR FORCE SETUP 4 4 OPERATE THE DOOR THROUGH FOUR FULL OPEN AND CLOSE CYCLES

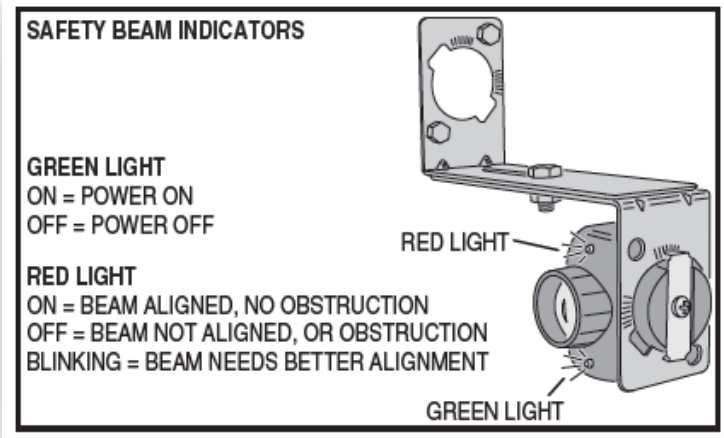
	E.g., Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 3-4 ("Opening the Door, Closing the Door").

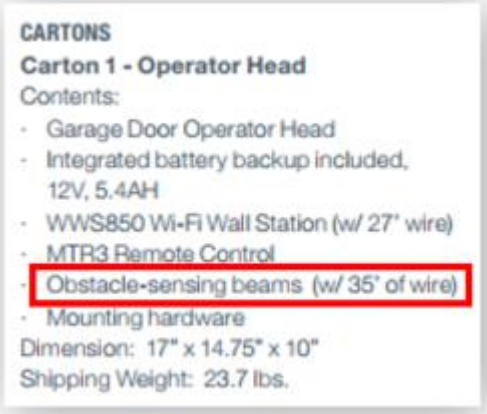
74. The Accused Products comprise movable barrier operators that are further configured and arranged to "develop an obstacle detector operating mode control signal from the controller as a function of movable barrier operator system state information that indicates whether the barrier is open or closed, the obstacle detector operating mode control signal being operable to directly control the energy usage of the obstacle detector, the control signal from the controller developed as a result of the state information, the state information selected from a group consisting of motor state information, time information, transmission state information, voltage state information, switch state information and combinations thereof " as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
develop an obstacle detector operating mode control signal from the controller as a function of movable barrier operator system state information that indicates whether the barrier is open or closed, the obstacle detector operating mode control signal being operable to	The Accused Products comprise movable barrier operators further configured and arranged to develop an obstacle detector operating mode control signal from the controller as a function of movable barrier operator system state information that indicates whether the barrier is open or closed, the obstacle detector operating mode control signal being operable to directly control the energy usage of the obstacle detector, the control signal from the controller developed as a result of the state information, the state information selected from a group consisting of motor state information, time information, transmission state information, voltage state information, switch state information and combinations thereof:

directly control the energy usage of the obstacle detector, the control signal from the controller developed as a result of the state information, the state information selected from a group consisting of motor state information, time information, transmission state information, voltage state information, switch state information and combinations thereof,	 *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 3 ("Red Light, Green Light"). On information and belief, when the garage door is opened, the obstacle detector turns on. On information and belief, when, for example, the wall station is used to open the garage door, a signal is sent from the processor to the obstacle detector, and that signal is a function of state information about the garage door opener system that indicates whether the garage door is open. On information and belief, the signal sent from the processor to the obstacle detector controls the energy usage of the obstacle detector by, for example, switching the obstacle detector on. On information and belief, the signal sent from the processor to the obstacle detector is developed as a result of information selected from a group including at least information about the state of the garage door and/or garage door opener and components thereof, including the motor, information about time, information about transmission state, and information about voltage, among other types of information.

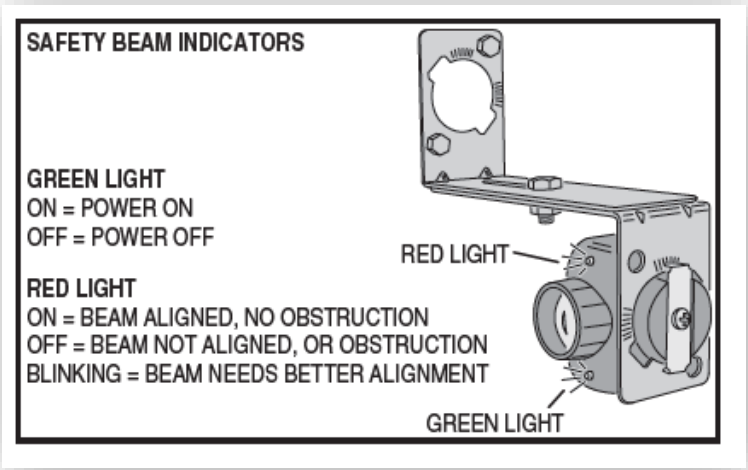
75. The Accused Products comprise an "obstacle detector operably coupled to the power supply and to the movable barrier operator, receives operating power from the power supply, and has a plurality of operating modes, wherein at least some of the operating modes have different energy usages, and wherein the obstacle detector is directly responsive to the movable barrier operator obstacle detector operating mode control signal" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
the obstacle detector operably coupled to the power supply and to the movable barrier operator, receives operating power from the power supply, and has a plurality of operating modes, wherein at least some of the operating modes have different energy usages, and wherein the obstacle detector is directly responsive to the movable barrier operator obstacle detector operating mode control signal such that:	The Accused Products comprise an obstacle detector operably coupled to the power supply and to the movable barrier operator, which receives operating power from the power supply, and has a plurality of operating modes, wherein at least some of the operating modes have different energy usages, and wherein the obstacle detector is directly responsive to the movable barrier operator obstacle detector operating mode control signal: On information and belief, the obstacle detector is coupled to the garage door opener and its power supply through wires that transmit power and signals that control whether the obstacle detector is on or off. 

	E.g., Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 3 ("Red Light, Green Light").  **CARTONS** **Carton 1 - Operator Head** Contents: - Garage Door Operator Head - Integrated battery backup included, 12V, 5.4AH - WWS850 Wi-Fi Wall Station (w/ 27' wire) - MTR3 Remote Control - Obstacle-sensing beams (w/ 35' of wire) - Mounting hardware Dimension: 17" x 14.75" x 10" Shipping Weight: 23.7 lbs. *E.g.*, https://www.linearproaccess.com/wp-content/uploads/LDCO850-LDCO852-spott.pdf.

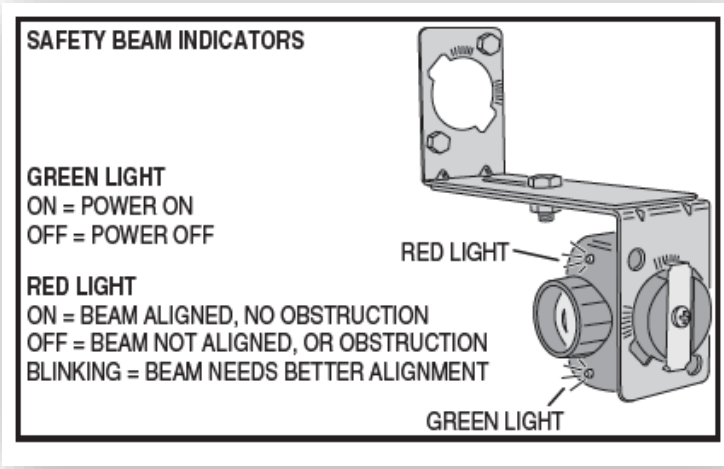
76. The Accused Products comprise an obstacle detector that is directly responsive to the movable barrier operator obstacle detector operating mode control signal such that "during the first mode of energy consumption operation, the obstacle detector operates using a first energy usage" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
during the first mode of energy consumption operation, the obstacle detector operates using a first energy usage; and	The Accused Products comprise an obstacle detector that is directly responsive to the movable barrier operator obstacle detector operating mode control signal such that during the first mode of energy consumption operation, the obstacle detector operates using a first energy usage: On information and belief, the obstacle detector is coupled to the garage door opener and its power supply through wires that transmit power and signals that control whether the obstacle detector is on or off.

	 *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 3 ("Red Light, Green Light"). On information and belief, the obstacle detector operates at 8.20 volts during a first state when the barrier is open or in motion (*i.e.*, normal state) and the photobeam LEDs are on.

77. The Accused Products comprise an obstacle detector that is directly responsive to the movable barrier operator obstacle detector operating mode control signal such that "during the second mode of energy consumption operation, the obstacle detector operates using a second energy usage, wherein the operating power used in one of the energy usages is less than the power used by the other energy usage" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
during the second mode of energy consumption operation, the obstacle detector operates using a	The Accused Products comprise an obstacle detector that is directly responsive to the movable barrier operator obstacle detector operating mode control signal such that during the second mode of energy consumption operation, the obstacle detector operates using a second energy usage, wherein the

second energy usage, wherein the operating power used in one of the energy usages is less than the power used by the other energy usage.	operating power used in one of the energy usages is less than the power used by the other energy usage: On information and belief, the obstacle detector is coupled to the garage door opener and its power supply through wires that transmit power and signals that control whether the obstacle detector is on or off.  *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 3 ("Red Light, Green Light"). On information and belief, the obstacle detector operates at 1.95 volts during a second state when the barrier is closed for greater than 5 minutes (*i.e.*, power saving mode) and the photobeam LEDs are off.

78. On information and belief, based on at least the prior litigation, the Agreement between NSC and CGI, and the correspondence regarding NSC's willful breach of its Agreement with CGI, NSC was aware of CGI patents beyond the Licensed Patents, including the Asserted Patents, before the filing of this suit.

79. On information and belief, Defendant has induced and continues to induce infringement of one or more claims of the '223 patent under 35 U.S.C. § 271(b). On information and belief, Defendant actively, knowingly, and

intentionally induces, and will continue to actively, knowingly, and intentionally induce infringement of the '223 patent by selling or otherwise supplying the Accused Products with the knowledge and intent that third parties will import and/or use the Accused Products to infringe the '223 patent, and with the knowledge and intent to encourage and facilitate third party infringement through the importation and/or dissemination of the Accused Products, and the creation or dissemination, through its websites and other sources, of promotional materials, instructions, product manuals, and/or technical information related to the Accused Products.

80. On information and belief, Defendant has contributorily infringed, and continues to contributorily infringe, one or more claims of the '223 patent under 35 U.S.C. § 271(c). On information and belief, Defendant has sold or offered to sell within the United States or imported into the United States the Accused Products, and Defendant continues to offer to sell or sell within the United States or import into the United States the Accused Products with the knowledge that the Accused Products are especially made or especially adapted for use in an infringement of the '223 patent. On information and belief, the Accused Products are not a staple article or commodity of commerce suitable for substantial noninfringing use.

81. On information and belief, Defendant is aware and specifically intends that the ordinary and customary use of the Accused Products infringes the '223 patent. Defendant provides customers and other third parties with product manuals, technical information, and instructions that cause such customers and third parties to operate the Accused Products according to their ordinary and customary use. On information and belief, Defendant's customers and other third parties directly infringe the '223 patent through the normal and customary use of the Accused Products.

82. CGI has been and continues to be damaged by Defendant's infringement of the '223 patent.

83. Based on at least the prior litigation, the Agreement between NSC and CGI, and the correspondence regarding NSC's willful breach of its Agreement with CGI, on information and belief, NSC's infringement of the '223 patent is and has been egregious and willful. At a minimum, NSC became aware of the '223 patent and the fact that the Accused Products infringe the '223 patent as of the filing of this suit. CGI is therefore entitled to enhanced damages under 35 U.S.C. § 284 and reasonable attorneys' fees and costs.

84. With no adequate remedy at law, CGI is entitled to injunctive relief, as it will continue to suffer irreparable harm, including loss of garage door opener sales and installations, loss of sales of related services and accessories, and harm to its reputation and brands, if Defendant's infringement of the '223 patent is not enjoined.

85. For all the reasons stated above, Defendant's conduct in infringing the '223 patent renders this case exceptional within the meaning of 35 U.S.C. § 285.

COUNT 3 – INFRINGEMENT OF THE '052 PATENT

86. CGI realleges and incorporates by reference each of the preceding paragraphs.

87. On information and belief, Defendant, directly or through the actions of its employees, divisions, and/or subsidiaries, has infringed and continues to infringe at least claim 1 of the '052 patent directly, literally, and/or by equivalents under 35 U.S.C. § 271(a) by, among other things, importing the Accused Products and making, using, offering for sale, and selling the Accused Products in the United States.

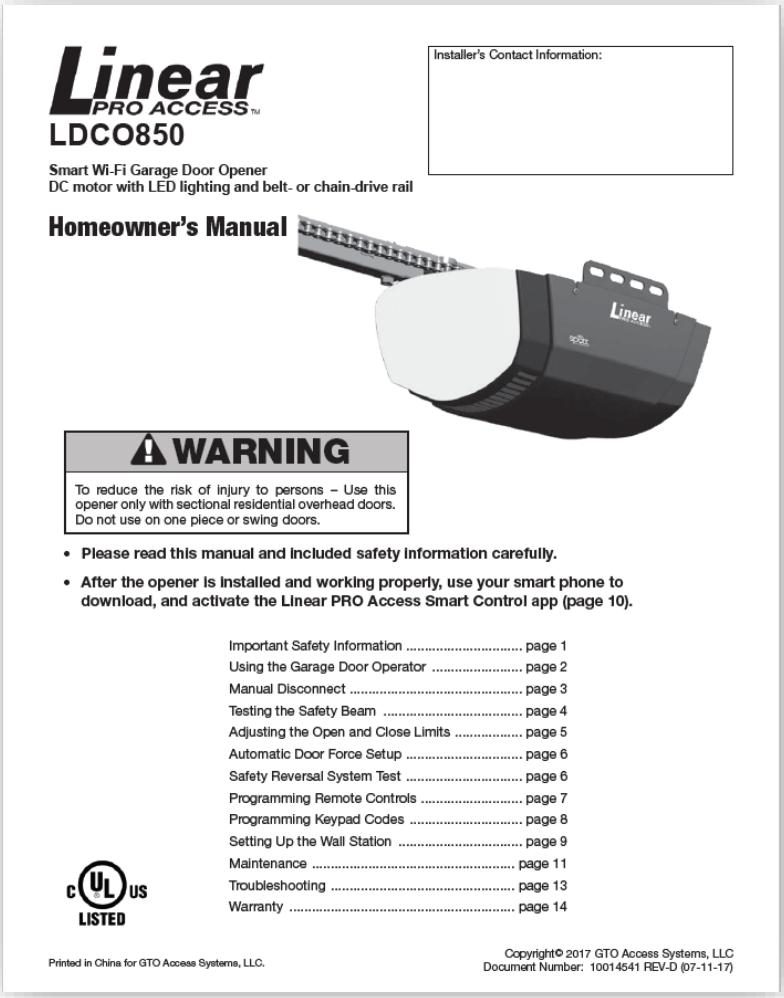
88. The Accused Products comprise an apparatus for use with a movable barrier, as recited in the claims of the '052 patent. For instance, claim 1 of the '052 patent recites:

> An apparatus for use with a movable barrier comprising:
>
> at least one motor operably coupleable to the movable barrier;
>
> a barrier movement control unit operably coupled to the at least one motor, which barrier movement control unit includes:
>
> a processor operably coupled to receive information regarding at least some forces acting upon the movable barrier when the movable barrier is moving and being arranged and configured to automatically determine at least one force threshold during a first mode of operation for use by the barrier movement control unit when controlling the motor in a second mode of operation; and
>
> a user manipulable force threshold modification control having an output that provides force threshold modification information for use by the barrier movement control unit when controlling the motor in the second mode of operation.

89. The following tables provide a representative example charting how the LDCO850, which is representative of the Accused Products, practices each and every limitation of representative claim 1 of the '052 patent. This demonstration of infringement is offered by way of example only and without limitation to CGI's ability to demonstrate Defendant's direct or indirect infringement of additional '052 patent claims, including by making, using, selling, offering for sale, or importing additional products or inducing or contributing to such acts.

90. The Accused Products are "apparatus for use with a movable barrier" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
An apparatus for use with a movable barrier comprising:	The Accused Products are apparatus for use with a movable barrier:



Linear PRO ACCESS™

LDCO850

Smart Wi-Fi Garage Door Opener
DC motor with LED lighting and belt- or chain-drive rail

Installer's Contact Information:

Homeowner's Manual

⚠ WARNING

To reduce the risk of injury to persons – Use this opener only with sectional residential overhead doors. Do not use on one piece or swing doors.

- **Please read this manual and included safety information carefully.**
- **After the opener is installed and working properly, use your smart phone to download, and activate the Linear PRO Access Smart Control app (page 10).**

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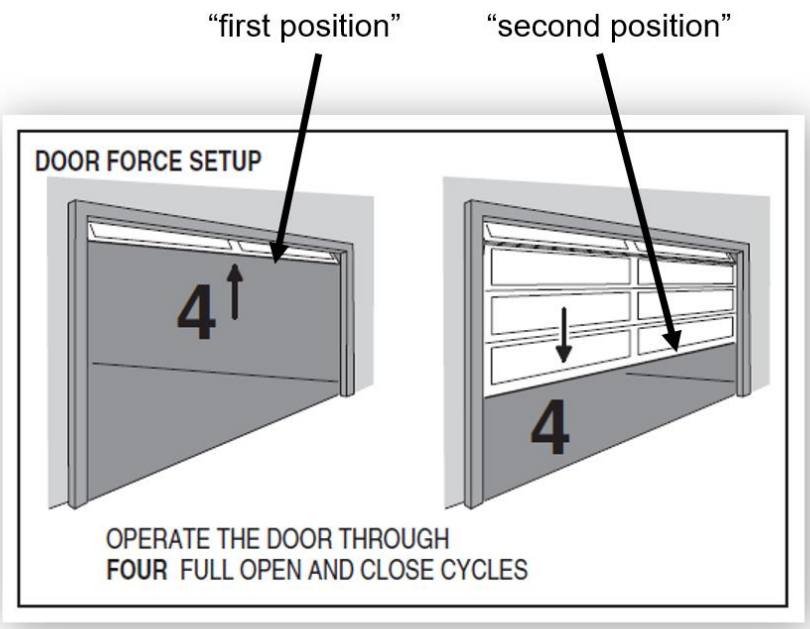
Printed in China for GTO Access Systems, LLC.

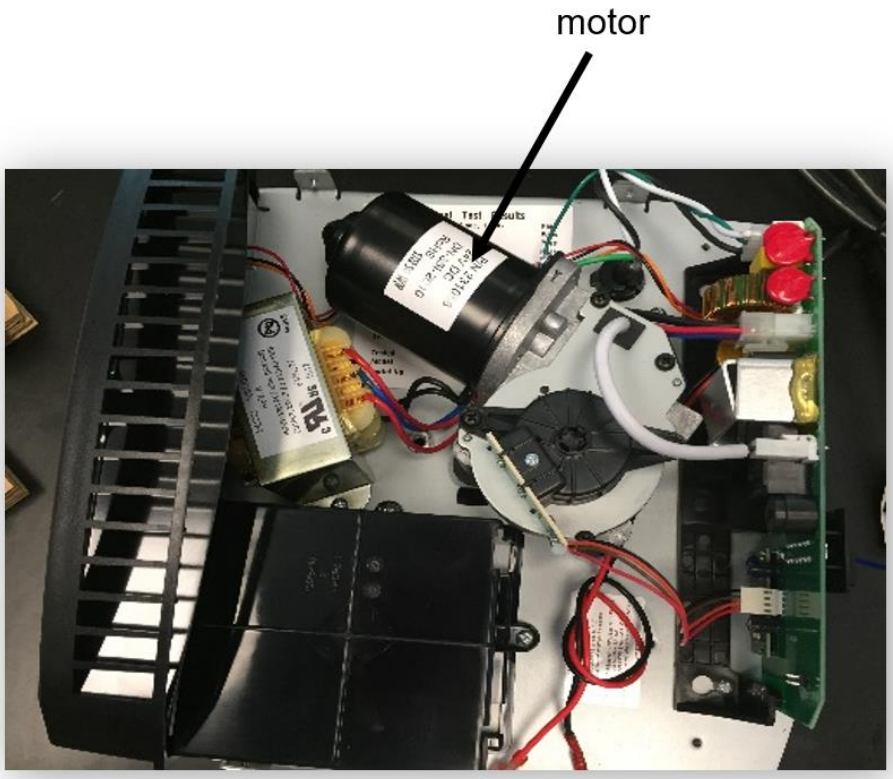
Document Number: 10014541 REV-D (07-11-17)

E.g., Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Homeowner's Manual, at cover ("Smart Wi-Fi Garage Door Opener").

	 *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Homeowner's Manual, at 6 (movable barrier between a first position and a second position).

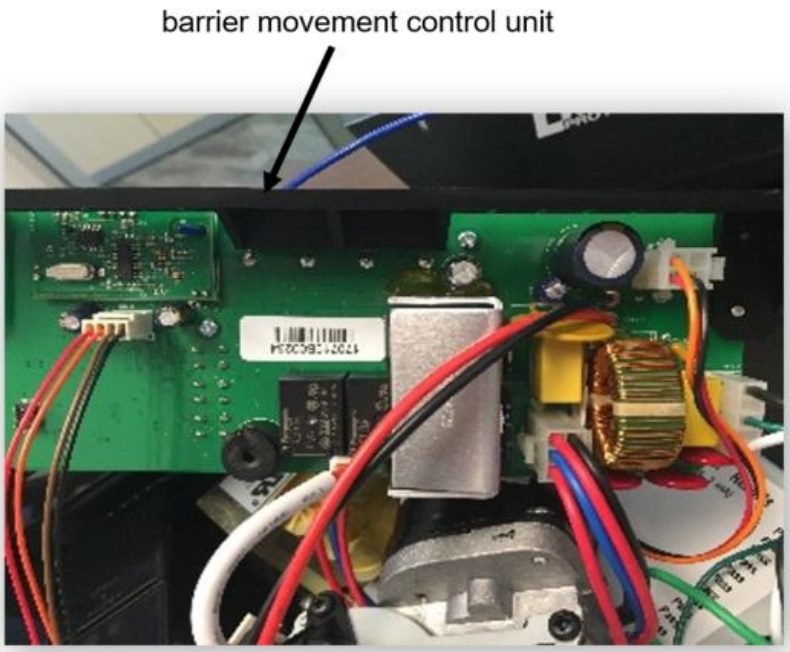
91. The Accused Products comprise "at least one motor operably coupleable to the movable barrier" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
at least one motor operably coupleable to the movable barrier;	The Accused Products comprise at least one motor operably coupleable to the movable barrier;

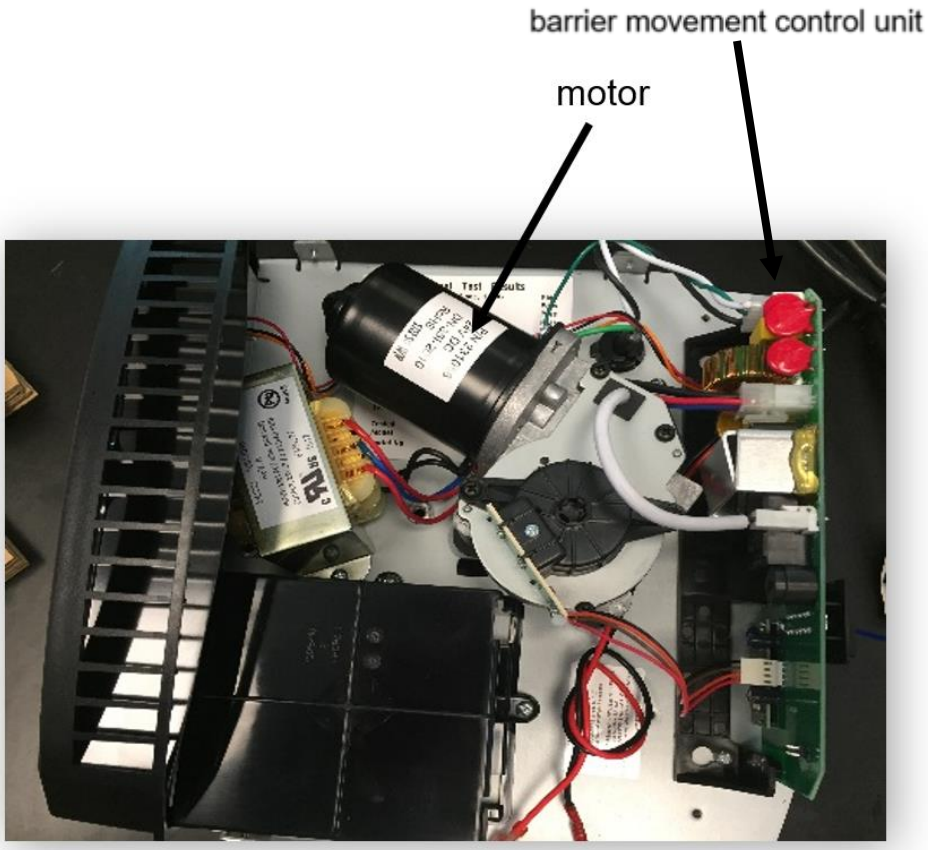
	 *E.g.*, photo taken from LDCO850 unit.

92. The Accused Products comprise "a barrier movement control unit operably coupled to the at least one motor, which barrier movement control unit includes" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
a barrier movement control unit operably coupled to the at least one motor, which barrier movement control unit includes:	The Accused Products comprise a barrier movement control unit operably coupled to the at least one motor, which barrier movement control unit includes:

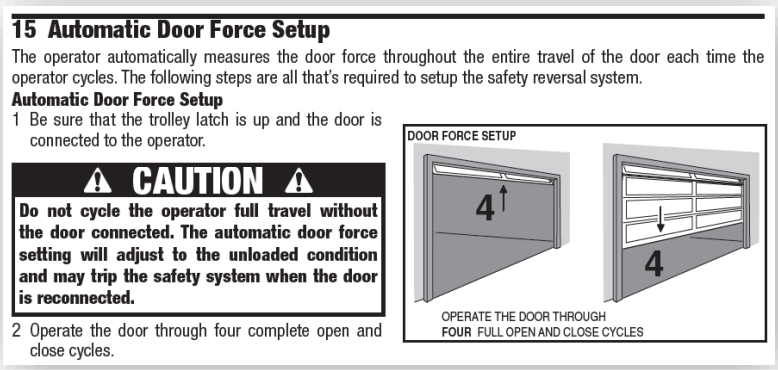


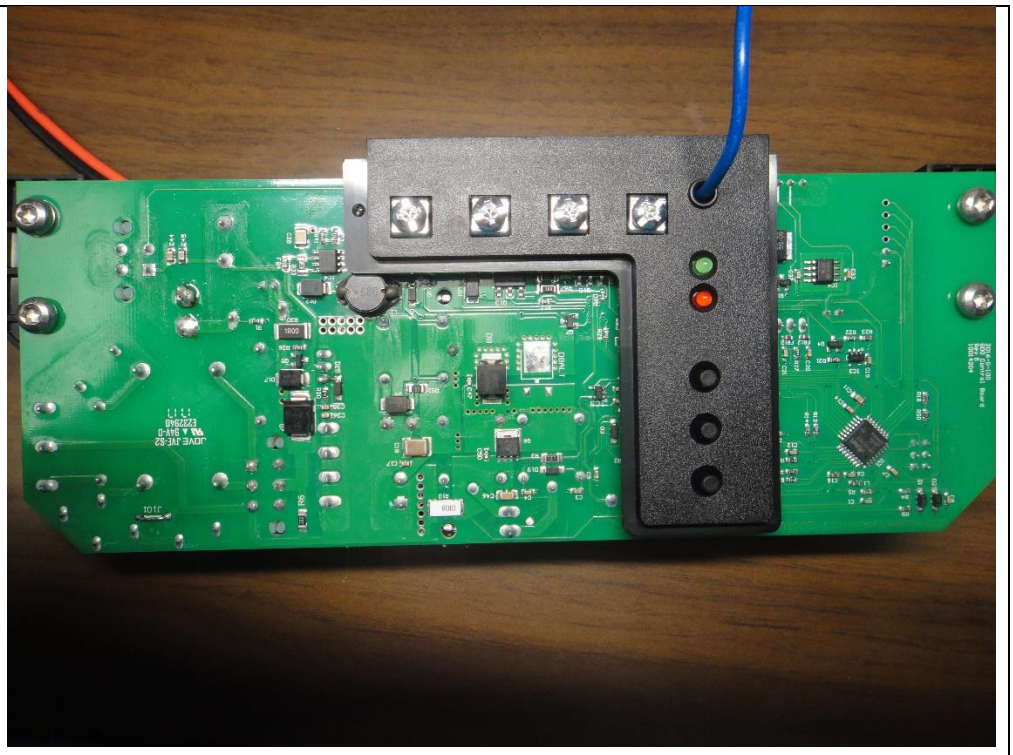
E.g., photo taken from LDCO850 unit.



E.g., photo taken from LDCO850 unit.

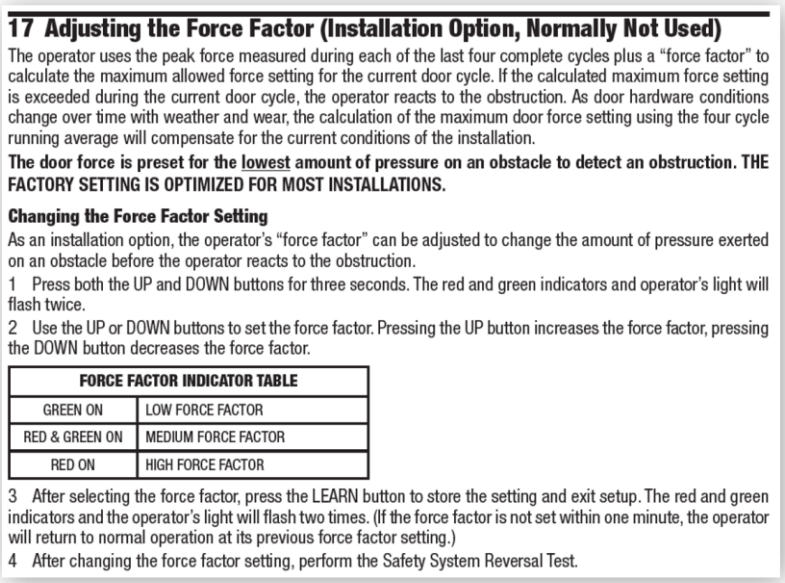
93. The Accused Products comprise "a processor operably coupled to receive information regarding at least some forces acting upon the movable barrier when the movable barrier is moving and being arranged and configured to automatically determine at least one force threshold during a first mode of operation for use by the barrier movement control unit when controlling the motor in a second mode of operation" as provided in the chart below:

Claim Limitation	Exemplary Infringing Element of Defendant's Accused Products
a processor operably coupled to receive information regarding at least some forces acting upon the movable barrier when the movable barrier is moving and being arranged and configured to automaticall y determine at least one force threshold during a first mode of operation for use by the barrier movement control unit	The Accused Products comprise a processor operably coupled to receive information regarding at least some forces acting upon the movable barrier when the movable barrier is moving and being arranged and configured to automatically determine at least one force threshold during a first mode of operation for use by the barrier movement control unit when controlling the motor in a second mode of operation:  **15 Automatic Door Force Setup** The operator automatically measures the door force throughout the entire travel of the door each time the operator cycles. The following steps are all that's required to setup the safety reversal system. **Automatic Door Force Setup** 1 Be sure that the trolley latch is up and the door is connected to the operator. **⚠ CAUTION ⚠** **Do not cycle the operator full travel without the door connected. The automatic door force setting will adjust to the unloaded condition and may trip the safety system when the door is reconnected.** 2 Operate the door through four complete open and close cycles. DOOR FORCE SETUP 4 4 OPERATE THE DOOR THROUGH **FOUR** FULL OPEN AND CLOSE CYCLES *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 3 ("Automatic Door Force Setup"). On information and belief, the processor is coupled to a current sensor, and sends information about current to the processor. On information and belief, the current information is proportional to the torque used to move the garage door.

when controlling the motor in a second mode of operation; and	 *E.g.*, photo taken from LDCO850 unit (showing processor to current sensor through a circuit board).

94. The Accused Products comprise "a user manipulable force threshold modification control having an output that provides force threshold modification information for use by the barrier movement control unit when controlling the motor in the second mode of operation" as provided in the chart below:

Claim Limitation	**Exemplary Infringing Element of Defendant's Accused Products**
a user manipulable force threshold modification control having an output that provides force threshold modification	The Accused Products comprise a user manipulable force threshold modification control having an output that provides force threshold modification information for use by the barrier movement control unit when controlling the motor in the second mode of operation:

information for use by the barrier movement control unit when controlling the motor in the second mode of operation.	 **17 Adjusting the Force Factor (Installation Option, Normally Not Used)** The operator uses the peak force measured during each of the last four complete cycles plus a "force factor" to calculate the maximum allowed force setting for the current door cycle. If the calculated maximum force setting is exceeded during the current door cycle, the operator reacts to the obstruction. As door hardware conditions change over time with weather and wear, the calculation of the maximum door force setting using the four cycle running average will compensate for the current conditions of the installation. **The door force is preset for the lowest amount of pressure on an obstacle to detect an obstruction. THE FACTORY SETTING IS OPTIMIZED FOR MOST INSTALLATIONS.** **Changing the Force Factor Setting** As an installation option, the operator's "force factor" can be adjusted to change the amount of pressure exerted on an obstacle before the operator reacts to the obstruction. 1 Press both the UP and DOWN buttons for three seconds. The red and green indicators and operator's light will flash twice. 2 Use the UP or DOWN buttons to set the force factor. Pressing the UP button increases the force factor, pressing the DOWN button decreases the force factor. **FORCE FACTOR INDICATOR TABLE** GREEN ON — LOW FORCE FACTOR RED & GREEN ON — MEDIUM FORCE FACTOR RED ON — HIGH FORCE FACTOR 3 After selecting the force factor, press the LEARN button to store the setting and exit setup. The red and green indicators and the operator's light will flash two times. (If the force factor is not set within one minute, the operator will return to normal operation at its previous force factor setting.) 4 After changing the force factor setting, perform the Safety System Reversal Test. *E.g.*, Linear Pro Access LDCO850 Smart Wi-Fi Garage Door Opener Installation Instructions, at 3 ("Adjusting the Force Factor").

95. On information and belief, based on at least the prior litigation, the Agreement between NSC and CGI, and the correspondence regarding NSC's willful breach of its Agreement with CGI, NSC was aware of CGI patents beyond the Licensed Patents, including the Asserted Patents, before the filing of this suit.

96. On information and belief, Defendant has induced and continues to induce infringement of one or more claims of the '052 patent under 35 U.S.C. § 271(b). On information and belief, Defendant actively, knowingly, and intentionally induces, and will continue to actively, knowingly, and intentionally induce infringement of the '052 patent by selling or otherwise supplying the Accused Products with the knowledge and intent that third parties will import and/or use the Accused Products to infringe the '052 patent, and with the knowledge and intent to encourage and facilitate third party infringement through the importation and/or dissemination of the Accused Products and the creation or

dissemination, through its websites and other sources, of promotional materials, instructions, product manuals, and/or technical information related to the Accused Products.

97. On information and belief, Defendant has contributorily infringed, and continues to contributorily infringe, one or more claims of the '052 patent under 35 U.S.C. § 271(c). On information and belief, Defendant has sold or offered to sell within the United States or imported into the United States the Accused Products, and Defendant continues to offer to sell or sell within the United States or import into the United States the Accused Products with the knowledge that the Accused Products are especially made or especially adapted for use in an infringement of the '052 patent. On information and belief, the Accused Products are not a staple article or commodity of commerce suitable for substantial noninfringing use.

98. On information and belief, Defendant is aware and specifically intends that the ordinary and customary use of the Accused Products infringes the '052 patent. Defendant provides customers and other third parties with product manuals, technical information, and instructions that cause such customers and third parties to operate the Accused Products according to their ordinary and customary use. On information and belief, Defendant's customers and other third parties directly infringe the '052 patent through the normal and customary use of the Accused Products.

99. CGI has been and continues to be damaged by Defendant's infringement of the '052 patent.

100. Based on at least the prior litigation, the Agreement between NSC and CGI, and the correspondence regarding NSC's willful breach of its Agreement with CGI, on information and belief, NSC's infringement of the '052 patent is and has been egregious and willful. At a minimum, NSC became aware of the '052 patent and the fact that the Accused Products infringe the '052 patent as of the

filing of this suit. CGI is therefore entitled to enhanced damages under 35 U.S.C. § 284 and reasonable attorneys' fees and costs.

101. With no adequate remedy at law, CGI is entitled to injunctive relief, as it will continue to suffer irreparable harm, including loss of garage door opener sales and installations, loss of sales of related services and accessories, and harm to its reputation and brands, if Defendant's infringement of the '052 patent is not enjoined.

102. For all the reasons stated above, Defendant's conduct in infringing the '052 patent renders this case exceptional within the meaning of 35 U.S.C. § 285.

DAMAGES AND RELIEF

103. As a consequence of Defendant's infringement of the Asserted Patents, CGI has been damaged in an amount not yet determined and will suffer additional irreparable damage unless Defendant's infringing acts are enjoined by this Court.

PRAYER FOR RELIEF

WHEREFORE, CGI requests that the Court enter judgment in its favor and against Defendant as follows:

a. Determine that Defendant has infringed and continue to infringe one or more claims of the Asserted Patents;

b. Enter a preliminary and permanent injunction prohibiting Defendant, its subsidiaries, divisions, agents, servants, employees, and all those acting in concert with and/or who are in privity with Defendant and/or any of the foregoing from infringing and/or inducing infringement of the Asserted Patents, and for all further proper injunctive relief;

c. Order Defendant to account for and pay to CGI all damages suffered by CGI as a result of Defendant's infringement of the Asserted

Patents, with pre-judgment and post-judgment interest, as determined by the Court;

d. Trebling or otherwise increasing CGI's damages under 35 U.S.C. § 284 on the grounds that Defendant's infringement of one or more of the Asserted Patents was deliberate and willful;

e. Declaring that this case is exceptional and awarding CGI their costs and reasonable attorneys' fees in accordance with 35 U.S.C. § 285; and

f. Grant any and all such further relief as the Court deems just and proper.

JURY DEMAND

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, CGI hereby requests a trial by jury for all issues so triable.

Dated: November 30, 2017

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EXHIBIT INDEX

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2	U.S. Patent No. 7,755,223	16-32
3	U.S. Patent No. 6,741,052	33-42

EXHIBIT 1

US008587404B2

(12) **United States Patent**
Laird

(10) **Patent No.: US 8,587,404 B2**
(45) **Date of Patent: Nov. 19, 2013**

(54) **MOVABLE BARRIER OPERATOR AND TRANSMITTER WITH IMMINENT BARRIER MOVING NOTIFICATION**

(75) Inventor: **Edward T. Laird**, Lombard, IL (US)

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1079 days.

(21) Appl. No.: **12/409,584**

(22) Filed: **Mar. 24, 2009**

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(51) **Int. Cl.**
B60R 25/00 (2013.01)

(52) **U.S. Cl.**
USPC **340/5.7**; 340/5.71; 340/426.15; 116/2; 116/6; 116/8; 49/30; 49/31; 49/357; 49/358

(58) **Field of Classification Search**
USPC 340/5.7, 5.71, 12.4, 12.5, 13.24, 13.25, 340/686.1, 691.6, 693.1, 426.15, 426.22, 340/426.28; 49/30, 31, 357, 358, 506, 507; 116/2, 4, 9, 10, 12, 6, 8; 318/268, 468, 318/480, 484, 565; 455/41.2, 63.1, 404.1, 455/552.1, 556.1, 566
See application file for complete search history.

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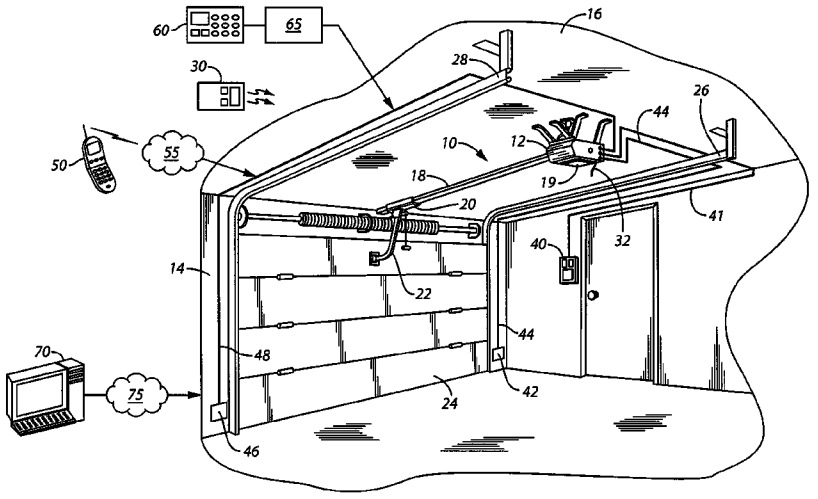
(57) **ABSTRACT**

A movable barrier system with a moving-barrier imminent motion notification includes a movable barrier and a movable barrier operator connected to control movement of the movable barrier between a first position and a second position. To reduce user dissatisfaction with the moving-barrier imminent motion notification, communications to the movable barrier operator include information to assist the operator in determining whether to operate the moving-barrier imminent motion notification in combination with moving the door or to specifically command that the moving-barrier imminent motion notification operate or not. The communication may include a signal or input separate from and in addition to a typical command signal or input to the operator. By other approaches, the method of communication can provide information to the operator with respect to operation of the moving-barrier imminent motion notification, or a transmitter identifier can provide information with respect to operation of the moving-barrier imminent motion notification.

22 Claims, 4 Drawing Sheets



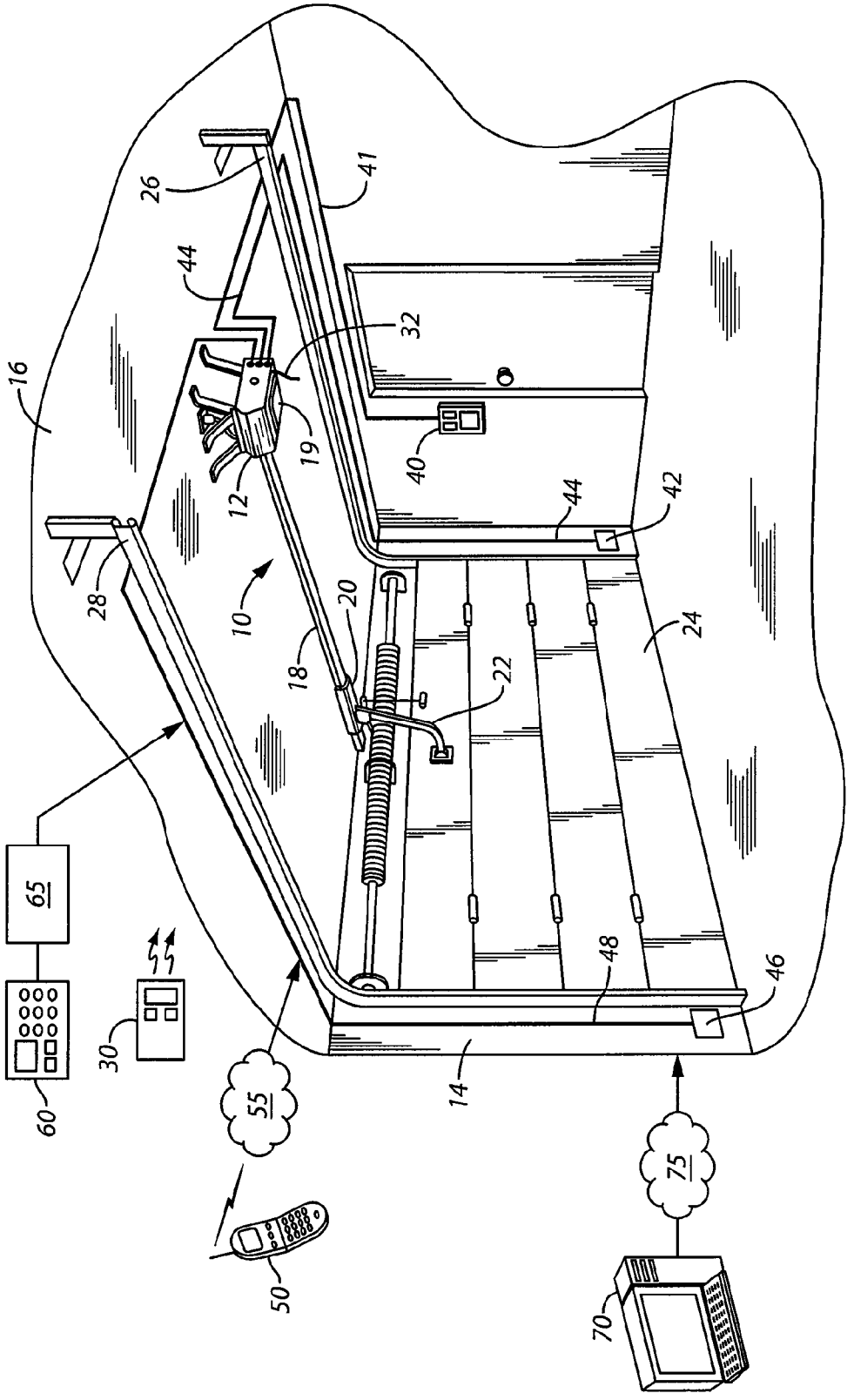

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FIG. 1

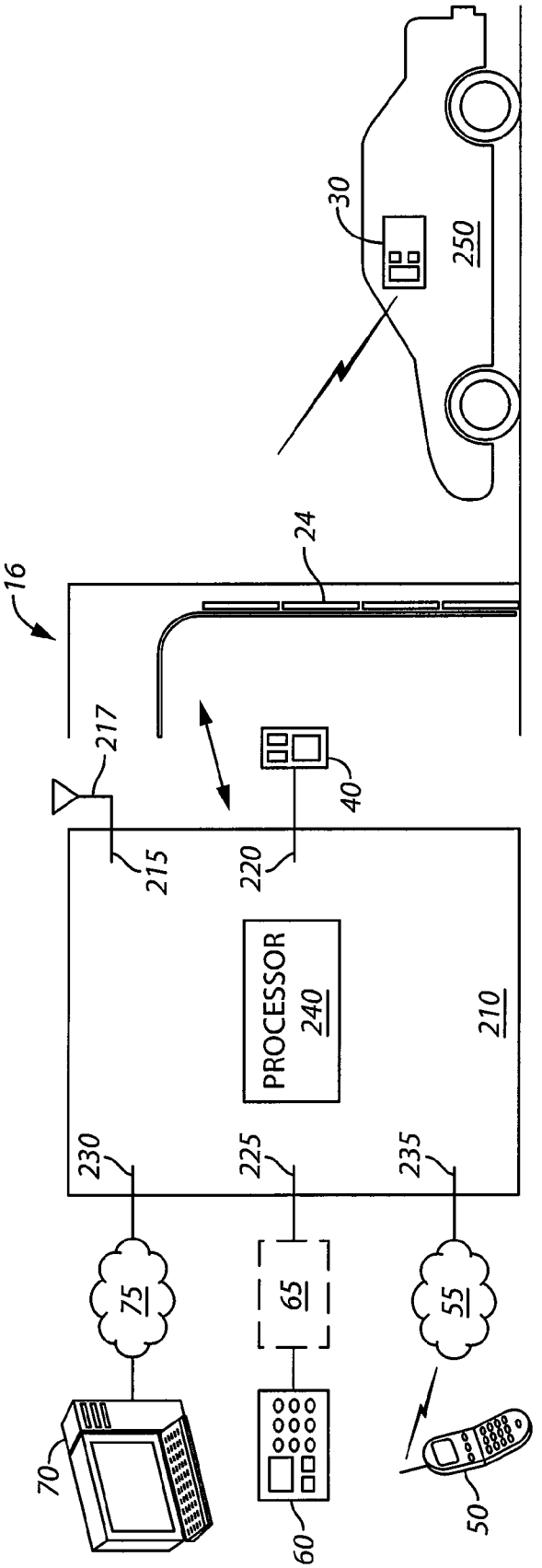
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FIG. 2

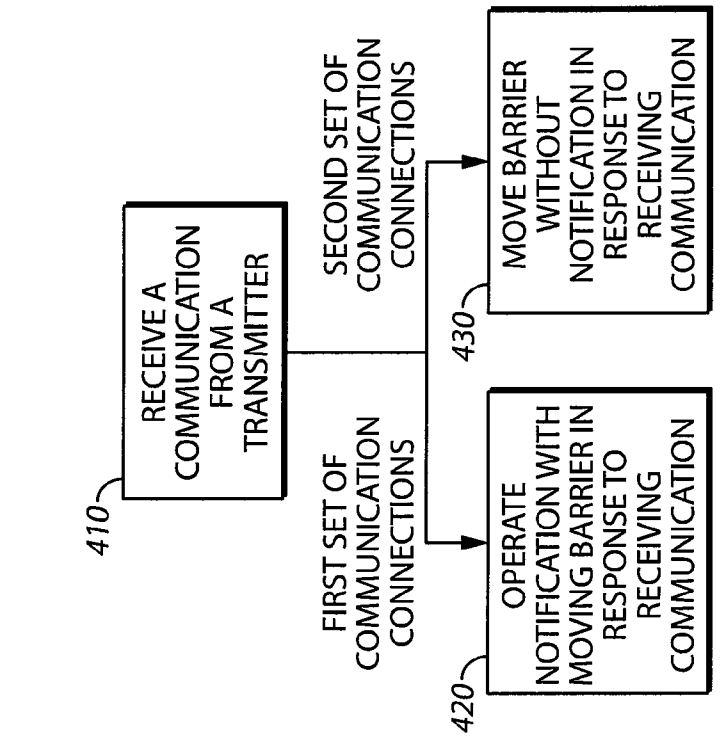

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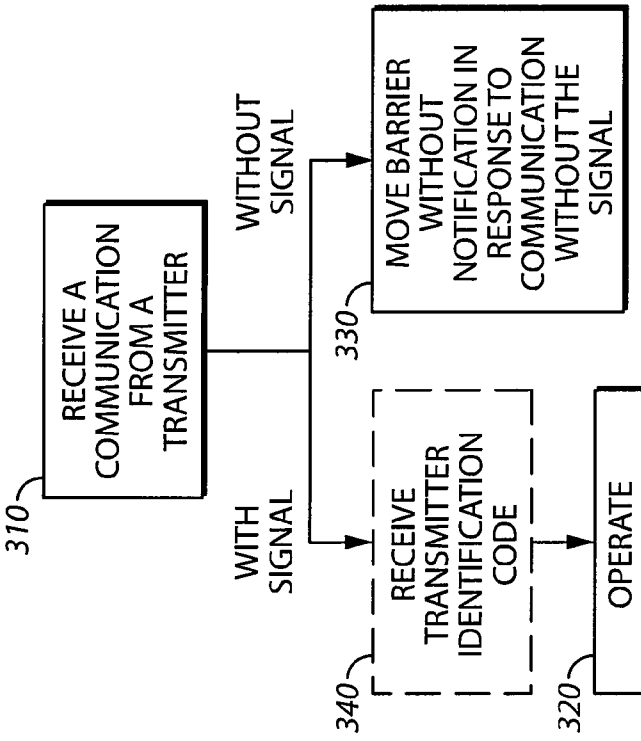
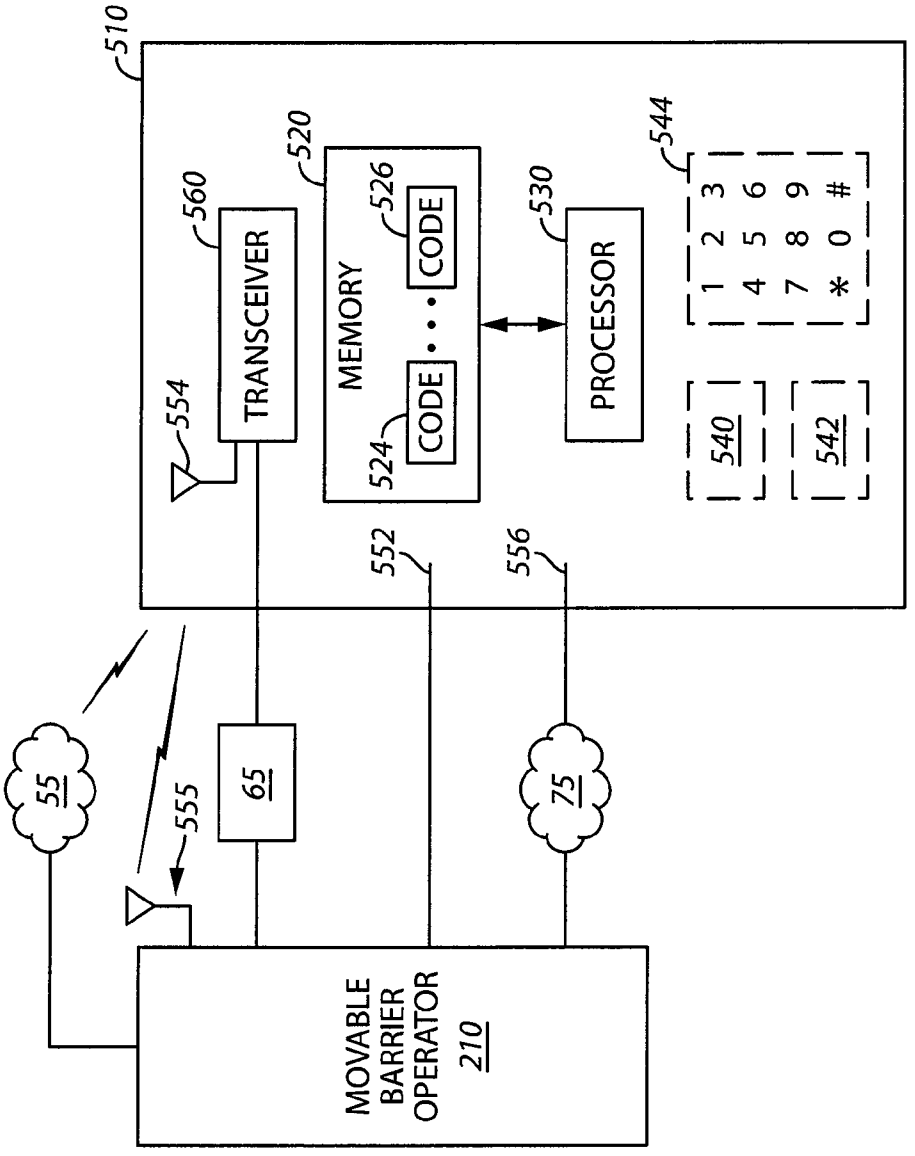
FIG. 4



300

FIG. 3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MOVABLE BARRIER OPERATOR
210

FIG. 5

MOVABLE BARRIER OPERATOR AND TRANSMITTER WITH IMMINENT BARRIER MOVING NOTIFICATION

TECHNICAL FIELD

This invention relates generally to barrier movement operators and more specifically to the operation of barrier movement operators with imminent barrier moving notification systems.

BACKGROUND

Systems for operating and controlling various types of barriers such as garage doors, swing gates, sliding gates, and the like are well known. To increase security, movable barrier systems have been developed that include an auto-close feature such that barriers that remain open for a given amount of time without user input are automatically closed. Such systems may also include an imminent moving notification system designed to alert people both prior to and during the door's closing so that people may avoid the closing door. Timer-to-close with imminent moving notification has been in operators for years.

In addition to the possibility of the auto-close feature, the movable barrier systems may be configured to be operated by a user from a distance or a location that is remote from the barrier. In such a circumstance, the user may not know whether any people are in the vicinity of a barrier actuated to move by the user. For example, a movable barrier system may be configured to be operated via a security system that a user can access via a centralized control, the Internet, or a conventional mobile communication device. In such systems, the user may be able to close a barrier without having any information regarding people that may be located next to the barrier. In such circumstances, it is advantageous to include the notification feature to warn those near the barrier of the barrier's imminent movement when actuated to move by a user that is not present at the barrier.

Such imminent movement notification, however, typically include a delay in barrier motion in addition to light provision, sound provision, or partial movement of the barrier as a notification of imminent barrier movement. The operator or user of the movable barrier system may be located near the door such that delay in the operation of the movable barrier system can result in user frustration because the user will typically expect immediate operation of the movable barrier operator upon actuation by the user. Therefore, there is a need to differentiate inputs that are received locally or within sight of the operator (either physically or by a camera) as opposed to inputs that can be generated from a long distance or not within sight of the operator.

SUMMARY

Generally speaking, pursuant to these various embodiments, a movable barrier system with a moving-barrier imminent motion notification includes a movable barrier and a movable barrier operator connected to control movement of the movable barrier between a first position and a second position. To reduce user dissatisfaction with the moving-barrier imminent motion notification, communications to the movable barrier operator include information to assist the operator in determining whether to operate the moving-barrier imminent motion notification in combination with moving the door or to specifically command that the moving-barrier imminent motion notification to operate or not. The communication may include a signal or input separate from and in addition to a typical command signal or input to the operator. By another approach, the method of communication can provide information to the operator with respect to operation of the moving-barrier imminent motion notification. By still another approach, a transmitter identifier can provide information to the operator with respect to operation of the moving-barrier imminent motion notification. Other approaches are possible as may become apparent through study of the following disclosure.

The movable barrier operator in one example is configured to receive a first command from a transmitter and to move the movable barrier in combination with operating a moving-barrier imminent motion notification in response to receipt of the first command. The movable barrier operator is also configured to receive a second command and to move the movable barrier without operating the moving-barrier imminent motion notification in response to receipt of the second command. By one approach, the first command comprises a signal that triggers operation of the moving-barrier imminent motion notification. The signal can be at least one selected from the group consisting of a transmission method identification code, a code value, a code format, a signal frequency, and a signal modulation to evidence that the command is coming from a remote location where the user is unlikely to be in visual contact with the movable barrier. So configured, the movable barrier operator may operate with or without operating the moving-barrier imminent motion notification based upon the type of commands received by the movable barrier operator.

By another approach, the movable barrier operator is configured to receive a transmitter identification code from a transmitter as part of a communication from the transmitter. The transmitter identification code helps the movable barrier operator to determine whether to move the movable barrier in combination with operating a moving-barrier imminent motion notification in response to receipt of a command based at least in part on the transmitter identification code. The movable barrier operator is configured to determine whether to move the movable barrier without operating the moving-barrier imminent motion notification based at least in part on the transmitter identification code. Typically, the movable barrier operator is configured to move the movable barrier in combination with operating the moving-barrier imminent motion notification when the transmitter identification code indicates that the transmitter is located remotely of the movable barrier.

By still another approach, a movable barrier system with a moving-barrier imminent motion notification includes a movable barrier and a movable barrier operator connected to control movement of the movable barrier between a first position and a second position. The movable barrier operator in this approach includes a communication connection comprising at least one of a direct wireless connection to a transmitter, a local wire connection, a system wired connection, a network connection, and a wireless communication system connection. The movable barrier operator also includes a processor configured to receive a command from the communication connection. In response to receiving the command from one of the system wired connection, the network connection, and the wireless communication system connection, the processor is configured to move the movable barrier operator in combination with operating a moving-barrier imminent motion notification in response to receipt of the command. The processor is also configured to operate the movable barrier operator in response to receiving the command from the direct wireless connection to the transmitter

and the local wire connection without operating the moving-barrier imminent motion notification. In this approach, by determining how the command was received, via the communication connection, the movable barrier operator may operate either with or without the moving-barrier imminent motion notification. For instance, by receiving the command to operate via a local wire connection, it is likely that a user is in visual contact with the movable barrier such that operating the movable barrier operator in conjunction with operating the moving-barrier imminent motion notification is not needed. Similarly, the movable barrier operator may be operated in combination with the moving-barrier imminent motion notification when the processor receives a command via a network connection because it is likely that the user is not in visual communication with the movable barrier when operating the system via network connection.

A method of operating a movable barrier system with a moving-barrier imminent motion notification includes operating the movable barrier systems described above. For example, one method of operating a movable barrier system with a moving-barrier imminent motion notification includes receiving a communication at one of a plurality of communication connections comprising at least a first set of communication connections and a second set of communication connections. The method includes operating the moving-barrier imminent motion notification in combination with moving the movable barrier in response to receiving the communication over one of the first set of communication connections and operating the movable barrier system without operating the moving-barrier imminent motion notification in response to receiving the communication over one of the second set of communication connections. So configured, the movable barrier system will operate or move the movable barrier in combination with the moving-barrier imminent motion notification based on which type of communication connection over which the system received the command to operate.

Another approach to the method includes the steps of receiving a communication from a transmitter and operating the moving-barrier imminent motion notification in combination with moving the movable barrier in response to receiving a signal with the communication from the transmitter. This method includes moving the movable barrier in response to receiving the communication without operating the moving-barrier imminent motion notification when receiving the communication without the signal from the transmitter. In this approach, the signal with the communication may comprise a code, a transmitter identification code, or a type of signal modulation that indicates to the movable barrier system that the communication was likely sent by the user from a position where the user is not in visual contact with the movable barrier.

One approach to a transmitter for use with a movable barrier system with a moving-barrier imminent motion notification includes a memory that stores at least a first code containing a command to effect an action by the movable barrier system and a second code containing information regarding the transmitter. A processor is configured to send a communication containing at least in part the first code and the second code in response to a user command. The communication is configured to trigger the action by the movable barrier operator and to provide the information regarding the transmitter to the movable barrier operator to determine whether to move the movable barrier with or without operating the moving-barrier imminent motion notification. The second code is any type of code, transmitter identification, or signal formatting that would provide information to the movable barrier operator regarding whether to move the movable barrier in combination with operating the moving-barrier imminent motion notification, for example, in a situation where the user is likely to not be in visual contact with the movable barrier.

An example method of operating a transmitter for use with a movable barrier system with a moving-barrier imminent motion notification includes operating the transmitter described above. By one approach, the method includes receiving a user input and sending, in response to receiving the first user input, a communication configured to trigger the movable barrier operator to move a movable barrier. The communication also provides information regarding the transmitter to the movable barrier operator to determine whether to move the movable barrier with or without operating the moving-barrier imminent motion notification.

By another approach, the method may include receiving a first user input and sending, in response to receiving the first user input, a communication configured to trigger the movable barrier operator to move a movable barrier in combination with operating the moving-barrier imminent motion notification. The method also includes receiving a second user input and sending, in response to the receiving the second user input, a second communication configured to trigger the movable barrier operator to operate without operating the moving-barrier imminent motion notification. So configured, the first communication triggers the movable barrier operator to operate without activating the moving-barrier imminent motion notification in situations where it is likely that the user is in visual contact with the movable barrier or would prefer to not have the movable barrier imminent motion notification activated so as to reduce user annoyance with the moving-barrier imminent motion notification. The second communication indicates to the movable barrier operator that the user is either not in visual contact either locally or via a camera with the movable barrier or would prefer to operate the movable barrier operator in conjunction with the moving-barrier imminent motion notification.

So configured, a movable barrier system provides the ability to selectively use the moving-barrier imminent motion notification in combination with moving a barrier. User annoyance with the moving-barrier imminent motion notification as may occur when the imminent motion notification includes a delay in moving the movable barrier can thereby be reduced by eliminating (or at least reducing) the delay when the user can likely see the moving barrier. Such a system may still operate a moving-barrier imminent motion notification when the user is not in visual contact with the moving door, for example, when the user is located in a remote location or operating the door via a security system. These and other benefits may become clearer upon making a thorough review and study of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

The above needs are at least partially met through provision of the movable barrier operator and transmitter with barrier imminent motion notification described in the following detailed description, particularly when studied in conjunction with the drawings, wherein:

FIG. **1** comprises a perspective view of a garage and various transmitters as may communicate with a movable barrier operator as configured in accordance with various embodiments of the invention;

FIG. **2** comprises a diagram of a movable barrier system configured in accordance with various embodiments of the invention;

FIG. **3** comprises a flow diagram of an example method of operation of a movable barrier system with a moving-barrier imminent motion notification as configured in accordance with various embodiments of the invention;

FIG. **4** comprises a flow diagram of another example method of operation of a movable barrier system with a moving-barrier imminent motion notification as configured in accordance with various embodiments of the invention; and

FIG. **5** comprises a block diagram of a transmitter configured to work with a movable barrier system with a moving-barrier imminent motion notification as configured in accordance with various embodiments of the invention.

Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions and/or relative positioning of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of various embodiments of the present invention. Also, common but well-understood elements that are useful or necessary in a commercially feasible embodiment are often not depicted in order to facilitate a less obstructed view of these various embodiments. It will further be appreciated that certain actions and/or steps may be described or depicted in a particular order of occurrence while those skilled in the art will understand that such specificity with respect to sequence is not actually required. It will also be understood that the terms and expressions used herein have the ordinary technical meaning as is accorded to such terms and expressions by persons skilled in the technical field as set forth above except where different specific meanings have otherwise been set forth herein.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

Referring now to the drawings, especially FIG. **1**, an example movable barrier system **10** including a movable barrier operator **12**, here a head unit, mounted within a garage **14** and employed for controlling the opening and closing of the movable barrier **24**, here a garage door, is generally shown. The movable barrier operator **12** is mounted to the ceiling **16** of the garage **14**. The movable barrier operator **12** includes a motor and an operator controller for controlling electrical power supplied to the motor. The operator controller for the movable barrier system **10** responds to various inputs by starting and stopping the motor, which is used to move the barrier, and by turning a light **19** on and off. Extending from the movable barrier operator **12** is a rail **18** having a releasable trolley **20** attached thereto and arm **22** extending from the trolley **20** to a multiple paneled garage door **24** positioned for movement along a pair of door rails **26** and **28**. The movable barrier operator **12** transfers the garage door **24** between open and closed positions for allowing access to and from the garage **14**.

For safety purposes, an optical emitter **42** and optical detector **46** are provided. These are coupled to the movable barrier operator **12** by a pair of wires **44** and **48**. The emitter **42** and detector **46** are used to provide safety of operation in barrier movement. To provide such safety of operation, the controller responds to the emitter **42** and detector **46** and will reverse and open the door if an obstruction is sensed in the doorway.

At least one wireless transmitter unit **30** is adapted to send signals to the antennas **32** positioned in, on, or extending from the movable barrier operator **12**. The antenna **32** is coupled to a receiver located within the movable barrier operator **12**. A wall mounted wired transmitter **40**, which may include any number of switches as required for a given system, is mounted on a wall of the garage **14**. The wired transmitter **40** communicates with the movable barrier operator **12** through a direct physical wired connection **41** to the movable barrier operator **12** using any commonly known method of communication, including serial bus communication. A variety of other communication options may be available to allow a user to communicate with and control the movable barrier system **10**. By one example, a mobile communication device **50** is configured to send signals through a wireless communication network **55** to the movable barrier operator **12** to control operation of the movable barrier system **10**. Mobile communication devices **50** such as mobile phones and other mobile devices are known. Another example includes a security system interface **60** configured to send signals via a security system **65**, such as a home security system or other building security system, to the movable barrier operator **12** to control operation of the movable barrier system **10**. Such communication paths between security systems and mobile barrier operators are readily configurable by one skilled in the art. Still another example includes a networked communication device **70**, such as a computer or similar device, that communicates through a network **75**, such as the Internet or a local network, to the movable barrier operator **12** to control operation of the movable barrier system **10**. Other communication paths and devices are possible. Each of these communication devices can be called a transmitter in that each transmits signals to the movable barrier operator **12**, and the communication path for each device to the movable barrier system **10** is readily configurable by those skilled in the art.

An additional security/convenience feature is the provision of an overhead light **19** (also sometimes referred to as a workspace light). The movable barrier operator **12** includes an overhead light **19** for illuminating the interior of the garage **14** in which the movable barrier operator **12** is located. The light **19** is activated or deactivated either by pressing the appropriate switch on the wall mounted controller **40**, by breaking the optical beam that runs between the optical emitter **42** and the optical detector **46**, or by sending a command from another source.

By one approach, a movable barrier system **10** with a moving-barrier imminent motion notification includes a movable barrier **24** and a movable barrier operator **12** connected to control movement of the movable barrier **24** between a first position and a second position. The movable barrier operator **12** is configured to receive a first command from a transmitter and to move the movable barrier **24** in combination with operating a moving-barrier imminent motion notification in response to receipt of the first command. The moving-barrier imminent motion notification may comprise a number of methods of notification to people in the vicinity of the movable barrier system **10** to indicate that the movable barrier **24** is about to move or is in the process of moving. The moving-barrier imminent motion notification may include, for example, flashing of the light **19**, starting and stopping of movement of the door **24**, sounding of a noise from a sound emitter (not shown), a combination of the above, or any other method known in the art. The movable barrier operator **12** is also configured to receive a second command and to move the movable barrier **24** without operating the moving-barrier imminent motion notification in response to receipt of the second command.

In one approach, the first command includes a first signal triggering movement of the movable barrier **24** and a second signal triggering operation of the moving-barrier imminent motion notification in combination with movement of the movable barrier **24**. For example, the first signal may be any

signal or code that is typically used to trigger the operation of the movable barrier system **10** to move the movable barrier **24** between an open position and a closed position. The second signal in this example may comprise any further signal that indicates to the movable barrier operator **12** to operate the moving-barrier imminent motion notification in combination with movement of the movable barrier **24**. The second signal may include at least one of the group consisting of a transmission method identification code, a code value, a code format, a signal frequency, and a signal modulation.

The transmission method identification code comprises a code that identifies to the movable barrier operator **12** the transmission method used to send the signal to the movable barrier operator **12**. The transmission method identification code may be included in the information sent from the transmitter to the movable barrier operator **12**. For example, the transmission method identification code may be included in an identification code typically sent with almost every communication between the transmitter and the movable barrier operator **12**. By another example approach, the transmission method identification code may be sent primarily when the transmission method indicates to the movable barrier operator **12** that the user is not within visual contact with the movable barrier **24**. In still another approach, the transmission method identification code may be sent when the transmission method indicates to the movable barrier operator **12** that the user is within visual contact with the movable barrier **24**.

A code value may be a value of a code sent as part of the transmission between the transmitter and the movable barrier operator **12** such that when the movable barrier operator **12** receives the code value, the movable barrier operator **12** is triggered to operate the moving-barrier imminent motion notification in combination with movement of the movable barrier **24**. The code value may be included anywhere within the transmission of the information sent by the transmitter to the movable barrier operator **12**.

With respect to code formats, for example, fixed code or rolling code formats with and without encryption as known in the art, codes may be sent in a number of formats between communicating devices. One or more particular code formats used for communication between a transmitter and the movable barrier operator **12** may be set aside such that when the movable barrier operator **12** receives a transmission using one of the particular code formats, the movable barrier operator **12** operates the moving-barrier imminent motion notification in combination with the movable barrier **24** or otherwise responds in a particular way.

Signals, such as radio frequency or other wireless transmission carriers, may be sent between the transmitter and receiver for the movable barrier operator **12** according to a variety of frequencies or modulations. By one approach, one or more signal frequencies may be set aside such that when the movable barrier operator **12** receives a communication from a transmitter over a particular signal frequency, the movable barrier operator is triggered to operate the moving-barrier imminent motion notification in combination with moving the movable barrier **24**. Signals may also be modulated in a number of different ways; thus, the transmitter may be configured to communicate with the movable barrier operator **12** via a variety of signal modulations. One or more of these signal modulations may be set aside such that when the movable barrier operator **12** receives a communication from the transmitter via one of their particular signal modulations, the movable barrier operator **12** is triggered to operate the moving-barrier imminent motion notification in combination with moving the movable barrier **24**. For example, should the movable barrier operator **12** receive a communication from a transmitter not using a signal modulation that has been set aside, the movable barrier operator is not triggered to operate the moving-barrier imminent motion notification in combination with moving the movable barrier **24**.

In a different approach, a movable barrier system **10** with a moving-barrier imminent motion notification includes a movable barrier **24** and a movable barrier operator **12** connected to control movement of the movable barrier **24** between a first position and a second position. In this approach, the movable barrier operator **12** is configured to receive a transmitter identification code from a transmitter as part of a communication from the transmitter and to determine whether to move the movable barrier **24** in combination with operating the moving-barrier imminent motion notification in response to receipt of a command based at least in part on the transmitter identification code. The movable barrier operator **12** is also configured to determine whether to move the movable barrier **24** without operating the moving-barrier imminent motion notification based at least in part on the transmitter identification code. In this approach, the transmitter identification code communicates to the movable barrier operator **12** a type of transmitter that is used to send the communication. Using this information, the movable barrier operator **12** is able to determine the likelihood that the user is located within sight of the movable barrier **24**. As discussed above, the transmitter for any of these approaches may comprise any of the group consisting of a wireless transmitter **30**, a wired transmitter **40**, a network communication device **70**, a mobile communication device **50**, and a security system interface **60**. From this information, the movable barrier operator **12** can determine whether to operate the moving-barrier imminent motion notification in combination with moving the movable barrier **24** such that should the user be within sight of the movable barrier **24**, the moving-barrier imminent motion notification will not be operated in combination with movement of the movable barrier **24**. So configured, the movable barrier operator **12** is configured to move the movable barrier **24** in combination with operating a moving-barrier imminent motion notification when the transmitter identification code indicates that the transmitter is located remotely of the movable barrier **24**.

With reference to FIG. **2**, still another approach to the movable barrier system with a moving-barrier imminent motion notification will be described. In this approach, the movable barrier operator **210** includes a communication connection comprising at least of the group consisting of a direct wireless connection **215** to a transmitter, a local wire connection **220**, a system wired connection **225**, a network connection **230**, and a wireless communication system connection **235**. Other communication connections may be possible including any of the known methods of communicating with transmitters to send/receive information at the movable barrier operator **210** to affect control of the operator **210** such as to trigger movement of the movable barrier **24**.

The movable barrier operator **210** also includes a processor **240** configured to receive a command from the communication connection. The processor **240** is also configured to move the movable barrier **24** in combination with operating a moving-barrier imminent motion notification in response to receipt of a command from one of the system wired connection **225**, the network connection **230** and the wireless communication system connection **235**. The processor **240** is also configured to move the movable barrier **24** without operating the moving-barrier imminent motion notification in response

to receiving the command from the direct wireless connection **215** to the transmitter and from the local wired connection **220**.

So configured, the movable barrier operator **210** determines from the type of connection over which the communication was received whether to operate the moving-barrier imminent motion notification in combination with moving the movable barrier **24**. For instance, communications received from a direct wireless transmitter, for example, a wireless transmitter **30** located in a car **250** communicating directly to the movable barrier operator **210** via its antenna **217** and/or a transceiver (not shown), or from a direct wired connection **220** via a wall mounted wire transmitter **40** located in the garage **16**, indicate that the user is likely in visual contact with the movable barrier **24**. Therefore, the movable barrier operator **210** operates the movable barrier **24** between the open or closed position without operating the moving-barrier imminent motion notification to reduce user annoyance. When the movable barrier operator **210**, however, receives communications over one of the other communication connections, for example, from a computer **70**, a security system interface **60**, or from a mobile communication device **50**, it is likely (or at least more likely) that the user is not in visual contact with the movable barrier **24** when providing that command. Therefore, in those circumstances, the movable barrier operator **210** operates the moving-barrier imminent motion notification in combination with moving the movable barrier **24** to alert any people that may be in the vicinity as to the closing of the door **24**.

A method of operating the movable barrier system **10** with a moving-barrier imminent motion notification will be described with reference to FIG. **3**. An example method **300** includes the step **310** of receiving a communication from a transmitter. The method **300** includes at step **320** operating the moving-barrier imminent motion notification in combination with moving a movable barrier in response to receiving a signal with the communication from the transmitter. At step **330**, the method **300** includes moving the movable barrier in response to receiving the communication without the signal from the transmitter. In this approach, the communication received from the transmitter is reviewed to determine whether there is an indication that the moving-barrier imminent motion notification should be operated in response to receipt of the communication. Such a signal may come in a variety of forms. By one approach, the step of receiving the signal with the communication from the transmitter includes receiving one of the group consisting of a transmission method identification code, a code value, a code format, a signal frequency, and a signal modulation, each of which has been described above. The step of receiving the communications from the transmitter may be performed in any one of a number of ways. For example, the step may include receiving a wireless communication at the movable barrier system directly from the transmitter or receiving the communication via a wired connection between the movable barrier system and the transmitter. Another approach includes receiving a communication via a network connection providing a communication path to the movable barrier system from the transmitter. Still another approach includes receiving the communication via a wireless communication system.

In still another approach to the method **300** of FIG. **3**, a step **340** of receiving a transmitter identification code that identifies the transmitter type for the transmitter is included. In this approach, the determination of whether to operate a moving-barrier imminent motion notification in combination with moving the movable barrier is based at least in part on the transmitter identification code. In such an approach, the step **320** of operating the movable door imminent motion notification with moving the movable barrier in response to receiving the signal is performed when it is determined that the transmitter identification code identifies a transmitter type that is likely to be used by a user that is not in visual contact with or in the vicinity of the movable barrier. Should the transmitter identification code identify the transmitter as being a type used by a user that is in the vicinity of the movable barrier, step **330** is performed such that the movable barrier is moved without operation of the moving-barrier imminent motion notification in response to receiving the communication.

With reference to FIG. **4**, another method **400** of operating a movable barrier system with the moving-barrier imminent motion notification includes at step **410** receiving a communication at one of a plurality of communication connections comprising at least a first set of communication connections and a second set of communication connections. The method **400** includes at step **420** operating the moving-barrier imminent motion notification in combination with moving a movable barrier in response to receiving the communication over one of the first set of communication connections. At step **430**, the method **400** includes operating the movable barrier system without operating the moving-barrier imminent motion notification in response to receiving the communication over one of the second set of communication connections. In this approach and with brief reference to FIG. **2**, the first set of communication connections may comprise at least one of the group consisting of the system wired connection **225**, a network connection **230**, and a wireless communication system connection **235**. The second set of communication connections may include at least one of the group consisting of the direct wireless connection **215** and the local wire connection **220**. So configured, the movable barrier operator **210** determines from the type of connection over which the communication was received whether to operate the moving-barrier imminent motion notification in combination with moving the movable barrier **24**. For instance, communications received from a direct wireless transmitter, for example a wireless transmitter **30** located in a car **250**, or from a direct wired connection **220** via a wall mounted wire transmitter **40** located in the garage **16** indicate that the user is likely in visual contact with the movable barrier **24**. Therefore, the movable barrier operator **210** moves the movable barrier **24** without operating the moving-barrier imminent motion notification to thereby reduce user annoyance. When the movable barrier operator **210**, however, receives communications over one of the other communication connections, for example, from a computer **70**, a security system interface **60**, or from a mobile communication device **50**, it is likely that the user is not in visual contact with the movable barrier **24** when providing that command. Therefore, in those circumstances, the movable barrier operator **210** operates the moving-barrier imminent motion notification in combination with moving the movable barrier **24** to thereby alert any people that may be in the vicinity as to the closing of the door **24**.

With reference to FIG. **5**, a transmitter **510** for use with a movable barrier operator **210** with a moving-barrier imminent motion notification will be described. The movable barrier operator **210** is configured to receive a command from the transmitter **510** and to move the movable barrier **24** in combination with operating the moving-barrier imminent motion notification in response to receipt of the command. The transmitter **510** includes a memory **520** that stores at least a first code **524** containing a command to effect an action by the movable barrier operator **210** and a second code **526** containing information regarding the transmitter **510**. The transmit-

ter **510** also includes a processor **530** configured to send a communication containing at least in part the first code **524** and the second code **526** in response to a user command. One skilled in the art will recognize and appreciate that such a processor **530** can comprise a fixed-purpose hard-wired platform or can comprise a partially or wholly programmable platform to direct other elements to send the communication. All of these architectural options are well known and understood in the art. The communication itself is configured according to a suitable format to trigger the action by the movable barrier operator **210** and to provide the information regarding the transmitter **510** to the movable barrier operator **210** such that the movable barrier operator **210** can determine whether to move the movable barrier **24** with or without the moving-barrier imminent motion notification.

As described above, the transmitter **510** may comprise any of a number of forms. Such a transmitter **510** may include user actuable buttons **540** and **545**, and/or the transmitter **510** may include a keyboard **544**. Depending on its configuration, the transmitter **510** may include one of the group consisting of a wired connection **552** to the movable barrier operator **210**, an antenna **554** configured to send the communication directly to a transceiver **555** with the movable barrier operator **210**, a network connection **556** providing a communication path to the movable barrier operator **210**, a transceiver **560** configured to send the communication via a wireless communication system **55**, and a transceiver **560** configured to send the communication via a wired security system connection **65**. In this approach, the second code may comprise at least one of the group consisting of the transmitter identification code, a transmission method identification code, a code value, a code format, signal frequency, and a signal modulation to trigger the movable barrier operator **210** to move the movable barrier **24** in combination with operating the moving-barrier imminent motion notification.

Another method of operating the transmitter **510** for use with the movable barrier operator **210** with the moving-barrier imminent motion notification includes receiving a user input and sending a communication in response to receiving the user input. The communication is configured to trigger the movable barrier operator **210** to move a movable barrier **24** and to provide information regarding the transmitter **510** to the movable barrier operator **210** such that the movable barrier operator **210** determines whether the move the movable barrier **24** with or without operating the moving-barrier imminent motion notification.

In yet still another approach, a method of operating a transmitter **510** for use with a movable barrier operator **210** with a moving-barrier imminent motion notification includes receiving a first user input and sending in response to receiving the first user input a first communication configured to trigger the movable barrier operator **210** to move a movable barrier operator **24** in combination with operating the moving-barrier imminent motion notification. The method also includes receiving a second user input and sending in response to receiving a second user input a second communication configured to trigger the movable barrier operator **210** to operate without operating the moving-barrier imminent motion notification. By this approach, the transmitter allows the user to determine whether the movable barrier **24** should be moved in combination with operation of the moving-barrier imminent motion notification by providing separate inputs for operating the movable barrier operator **210** with or without operating the moving-barrier imminent motion notification.

So configured, a movable barrier system provides the ability to selectively use the moving-barrier imminent motion notification in combination with moving a barrier. Such a configuration can reduce user annoyance when operating a movable barrier as may occur when the imminent motion notification includes a delay in moving the movable barrier upon receipt of a command from the user. Such a system may still operate a moving-barrier imminent motion notification when the user is not in visual contact with the moving door, for example, when the user is located in a remote location or operating the door via a security system.

Those skilled in the art will recognize that a wide variety of modifications, alterations, and combinations can be made with respect to the above described embodiments with departing from the scope of the invention. For instance, although the described embodiment included a garage door, various types of movable barrier systems can employ these teachings, for example, swinging gates, rolling gates, rising gates, and the like. Such modifications, alterations, and combinations are to be viewed as being within the ambit of the inventive concept.

What is claimed is:

1. A movable bather system with a moving-bather imminent motion notification, the system comprising:

a movable bather operator connected to control movement of a movable barrier between a first position and a second position;

the movable barrier operator configured to receive a first command from a transmitter in response to a first user input at the transmitter, wherein the first command comprises a first signal configured to instruct the movable barrier operator to trigger closing the movable barrier and a second signal configured to instruct the movable barrier operator regarding triggering operation of the moving-barrier imminent motion notification in combination with the movement of the movable bather;

the movable barrier operator configured to determine whether the second signal instructs the movable barrier operator to trigger operation of the moving-barrier imminent motion notification in combination with the closing of the movable barrier;

the movable barrier operator configured to effect the closing of the movable barrier in combination with operating the moving-barrier imminent motion notification in response to determining that the second signal instructs the movable barrier operator to trigger operation of the moving-barrier imminent motion notification in combination with the closing of the movable barrier;

the movable barrier operator configured to receive a second command to effect the closing of the movable barrier without operating the moving-barrier imminent motion notification in response to receipt of the second command.

2. The movable barrier system of claim **1** wherein the second signal comprises at least one of the group consisting of: a transmission method identification code, a code value, a code format, a signal frequency, and a signal modulation.

3. The movable barrier system of claim **1** wherein the transmitter comprises any of the group consisting of: a wireless transmitter, a wired transmitter, a networked communication device, a mobile communication device, and a security system interface.

4. A movable barrier system with a moving-barrier imminent motion notification, the system comprising:

a movable barrier operator connected to close a movable barrier;

the movable barrier operator configured to receive a transmitter identification code from a transmitter as part of a communication from the transmitter triggered in response to a first user input at the transmitter, the com-

munication comprising a command to close configured to effect closing of the movable barrier, the movable barrier operator also configured to determine whether to close the movable barrier in combination with operating a moving-barrier imminent motion notification in response to receipt of the command to close the movable barrier based at least in part on the transmitter identification code;

the movable barrier operator configured to determine whether to close the movable barrier without operating the moving-barrier imminent motion notification based at least in part on the transmitter identification code.

5. The movable barrier system of claim **4** wherein the movable barrier operator is configured to close the movable barrier in combination with operating a moving-barrier imminent motion notification when the transmitter identification code indicates that the transmitter is located remotely of the movable barrier.

6. The movable barrier system of claim **4** wherein the transmitter comprises any of the group consisting of: a wireless transmitter, a wired transmitter, a networked communication device, a mobile communication device, and a security system interface.

7. A method of operating a movable barrier system with a moving-barrier imminent motion notification, the method comprising:

receiving a communication from a transmitter;

determining whether the communication from the transmitter contains a signal indicating a need to operate a moving barrier imminent motion notification together with a command to close a movable barrier;

operating the moving-barrier imminent motion notification in combination with closing the movable barrier in response to determining that the communication from the transmitter contains the signal;

closing the movable barrier without operating the moving-barrier imminent motion notification in response to determining that the communication from the transmitter does not contain the signal.

8. The method of claim **7** wherein the receiving the communication from the transmitter comprises at least one of the group consisting of:

receiving a wireless communication at the movable barrier system directly from the transmitter;

receiving the communication via a wired connection between the movable barrier system and the transmitter;

receiving the communication via a network connection providing a communication path to the movable barrier system from the transmitter;

receiving the communication via a wireless communication system.

9. The method of claim **7** wherein determining that the communication from the transmitter contains the signal comprises determining that the signal comprises at least one of the group consisting of: a transmission method identification code, a code value, a code format, a signal frequency, and a signal modulation.

10. The method of claim **7** wherein determining that the communication from the transmitter contains the signal comprises determining that the signal comprises a transmitter identification code that identifies a transmitter type for the transmitter indicating that the transmitter is a distance from the movable barrier.

11. A movable barrier system with a moving-barrier imminent motion notification, the system comprising:

a movable bather operator connected to control movement of a movable barrier between a first position and a second position;

the movable barrier operator comprising:

a communication connection comprising at least one of the group consisting of: a direct wireless connection to a transmitter, a local wired connection, a system wired connection, a network connection, and a wireless communication system connection; and

a processor configured to determine whether a received command for a closing the movable barrier was received from at least one of the system wired connection, the network connection, and the wireless communication system connection;

the processor configured to effect the closing of the movable barrier in combination with operating a moving barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the system wired connection, the network connection, and the wireless communication system connection;

the processor configured to determine whether the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection;

the processor configured to effect the closing of the movable barrier without operating the moving-barrier imminent motion notification in response to determining that the received command for the closing was received from at least one of the direct wireless connection to the transmitter and the local wired connection.

12. A method of operating a movable barrier system with a moving-barrier imminent motion notification, the method comprising:

receiving a communication to effect closing of a movable barrier at one or more of a plurality of communication connections comprising at least a first set of communication connections and a second set of communication connections entirely different from the first set of communication connections;

determining whether the communication was received at one or more of the first set of communication connections or one or more of the second set of communication connections;

operating the moving-barrier imminent motion notification in combination with effecting the closing of the movable barrier in response to determining that the communication was received over one or more of the first set of communication connections, wherein the first set of communication connections comprises at least one of the group consisting of: a system wired connection, a network connection, and a wireless communication system connection;

effecting the closing of the movable barrier without operating the moving barrier imminent motion notification in response to determining that the communication was received over one or more of the second set of communication connections, wherein the second set of communication connections comprises at least one of the group consisting of: a direct wireless connection to a transmitter and a local wired connection.

13. A transmitter for use with a movable barrier operator with a moving-barrier imminent motion notification, the movable barrier operator configured to receive a command from a transmitter and to move a movable barrier in combi-

nation with operating a moving-barrier imminent motion notification in response to receipt of the command, the transmitter comprising:

a memory that stores at least a first code containing a command to effect closing the movable barrier by the movable barrier operator and a second code containing information regarding whether to operate a moving-barrier imminent motion notification in combination with effecting the closing by the movable barrier operator;

a processor configured to send a communication containing at least in part the first code and the second code in response to a user command, the communication configured to trigger the closing by the movable barrier operator and to provide the information regarding whether to operate the moving-barrier imminent motion notification to the movable barrier operator such that the movable barrier operator can determine whether to close the movable barrier with or without operating the moving barrier imminent motion notification.

14. The transmitter of claim **13** further comprising at least one of the group consisting of:

a wired connection to the movable barrier operator;

an antenna configured to send the communication directly to a transceiver of the movable barrier operator;

a network connection providing a communication path to the movable barrier operator;

a transceiver configured to send the communication via a wireless communication system; and

a transceiver configured to send the communication via a wired security system connection.

15. The transmitter of claim **13** wherein the second code comprises at least one of the group consisting of a transmitter identification code, a transmission method identification code, a code value, a code format, a signal frequency, and a signal modulation to trigger the movable bather operator to move the movable bather in combination with operating the moving-bather imminent motion notification.

16. A method of operating a transmitter for use with a movable bather operator with a moving-bather imminent motion notification, the movable barrier operator configured to receive communications from a transmitter and to operate the movable barrier operator in response to receipt of the communications, the method comprising:

receiving a user input;

sending, in response to receiving the user input, a communication configured to trigger the movable barrier operator to close a movable bather and to provide information regarding whether to operate the moving-barrier imminent motion notification to the movable barrier operator such that the movable barrier operator determines whether to close the movable bather with or without operating the moving-barrier imminent motion notification.

17. The method of claim **16** wherein the step of sending the communication comprises at least one of the group consisting of:

sending the communication via a wired connection to the movable barrier system;

sending the communication via an antenna configured to send at least in part the communication code directly to the movable barrier system;

sending the communication via a network connection providing a communication path to the movable barrier system;

sending the communication via a transceiver configured to send information via a wireless communication system.

18. The method of claim **16** wherein the information regarding whether to operate the moving-barrier imminent motion notification comprises at least one of the group consisting of: a transmission method identification code, a code value, a code format, a signal frequency, and a signal modulation.

19. A method of operating a transmitter for use with a movable bather operator with a moving-bather imminent motion notification, the movable barrier operator configured to receive communications from a transmitter and to operate the movable barrier operator in response to receipt of the communications, the method of operating the transmitter comprising:

receiving a first user input;

sending, in response to receiving the first user input, a first communication configured to trigger the movable bather operator to close a movable barrier in combination with operating the moving-barrier imminent motion notification based on the first communication and its method of communication, wherein the method of communication comprises at least one of the group consisting of:

sending the first communication via a network connection providing a communication path to the movable barrier system;

sending the first communication via a transceiver configured to send information via a wireless communication system.

20. A method of operating a transmitter for use with a movable barrier operator with a moving-barrier imminent motion notification, the movable barrier operator configured to receive communications from a transmitter and to operate the movable barrier operator in response to receipt of the communications, the method of operating the transmitter comprising:

receiving a first user input;

sending, in response to receiving the first user input, a first communication configured to trigger the movable bather operator to close a movable barrier in combination with operating the moving-barrier imminent motion notification based on the first communication and its method of communication, wherein the method of communication comprises at least one of the group consisting of: a transmission method identification code, a code format, a signal frequency, and a signal modulation to trigger the movable barrier operator to move the movable barrier in combination with operating the moving-bather imminent motion notification.

21. The method of claim **19** further comprising:

receiving a second user input;

sending, in response to the receiving the second user input, a second communication configured to trigger the movable barrier operator to operate without operating the moving-barrier imminent motion notification.

22. The method of claim **20** further comprising:

receiving a second user input;

sending, in response to the receiving the second user input, a second communication configured to trigger the movable barrier operator to operate without operating the moving-barrier imminent motion notification.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 8,587,404 B2
APPLICATION NO. : 12/409584
DATED : November 19, 2013
INVENTOR(S) : Edward T. Laird

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

IN THE CLAIMS:

Claim 1, Column 12, Line 20: Change “bather” to -- barrier --;
Claim 1, Column 12, Line 20: Change “moving-bather” to -- moving-barrier --;
Claim 1, Column 12, Line 22: Change “bather” to -- barrier --;
Claim 1, Column 12, Line 33: Change “bather” to -- barrier --;

Claim 11, Column 14, Line 3: Change “bather” to -- barrier --;
Claim 11, Column 14, Line 13: After “for” delete “a”;

Claim 15, Column 15, Line 35: Change “bather” to -- barrier --;
Claim 15, Column 15, Line 36: Change “bather” to -- barrier --;
Claim 15, Column 15, Line 37: Change “moving-bather” to -- moving-barrier --;

Claim 16, Column 15, Line 39: Change “bather” to -- barrier --;
Claim 16, Column 15, Line 39: Change “moving-bather” to -- moving-barrier --;
Claim 16, Column 15, Line 47: Change “bather” to -- barrier --;
Claim 16, Column 15, Line 51: Change “bather” to -- barrier --;

Claim 19, Column 16, Line 10: Change “bather” to -- barrier --;
Claim 19, Column 16, Line 10: Change “moving-bather” to -- moving-barrier --;
Claim 19, Column 16, Line 19: Change “bather” to -- barrier --;

Claim 20, Column 16, Line 41: Change “bather” to -- barrier --;
Claim 20, Column 16, Line 49: Change “moving-bather” to -- moving-barrier --.

Signed and Sealed this
Thirteenth Day of May, 2014

Michelle K. Lee

Michelle K. Lee
Deputy Director of the United States Patent and Trademark Office

EXHIBIT 2

US007755223B2

(12) **United States Patent**
Fitzgibbon

(10) **Patent No.: US 7,755,223 B2**
(45) **Date of Patent: Jul. 13, 2010**

(54) **MOVABLE BARRIER OPERATOR WITH ENERGY MANAGEMENT CONTROL AND CORRESPONDING METHOD**

(75) Inventor: **James J. Fitzgibbon**, Batavia, IL (US)

(73) Assignee: **The Chamberlain Group, Inc.**, Elmhurst, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 608 days.

(21) Appl. No.: **10/227,182**

(22) Filed: **Aug. 23, 2002**

(65) **Prior Publication Data**

US 2004/0227410 A1 Nov. 18, 2004

(51) **Int. Cl.**
H02H 1/06 (2006.01)
H02H 9/00 (2006.01)
B66B 12/24 (2006.01)

(52) **U.S. Cl.** **307/326**; 187/317

(58) **Field of Classification Search** 307/326; 187/317

See application file for complete search history.

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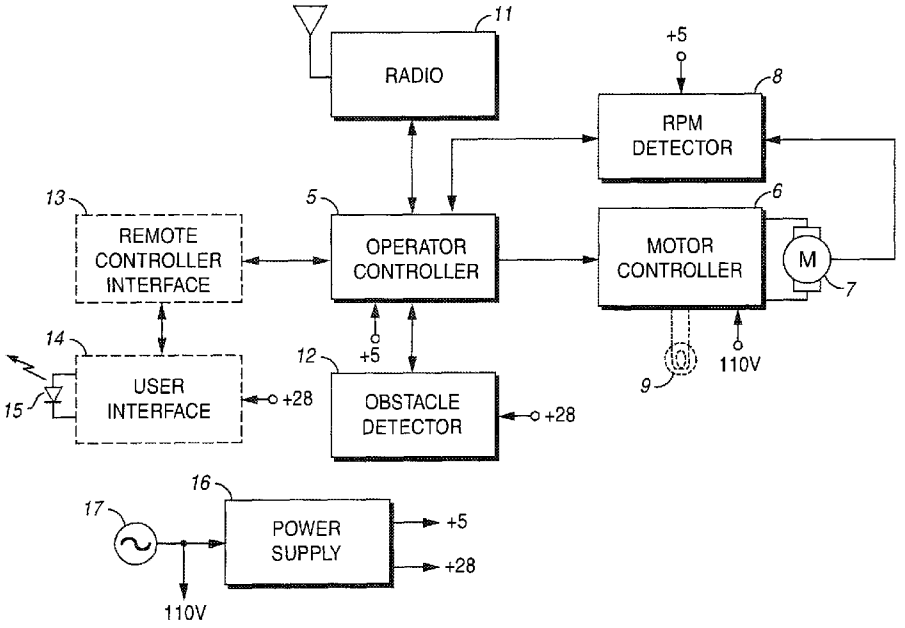
Primary Examiner—Stephen W Jackson
Assistant Examiner—Adi Amrany
(74) *Attorney, Agent, or Firm*—Fitch Even Tabin & Flannery

(57) **ABSTRACT**

A movable barrier operator system wherein one or more of the various components of the system is configured to operate selectively in at least either of two operational modes. Each operating mode is characterized by a corresponding energy usage profile. The operational status of the system is monitored and operating modes are selected that serve both to substantially ensure proper operation given current likely operational expectations and an overall desire to reduce energy consumption.

34 Claims, 6 Drawing Sheets



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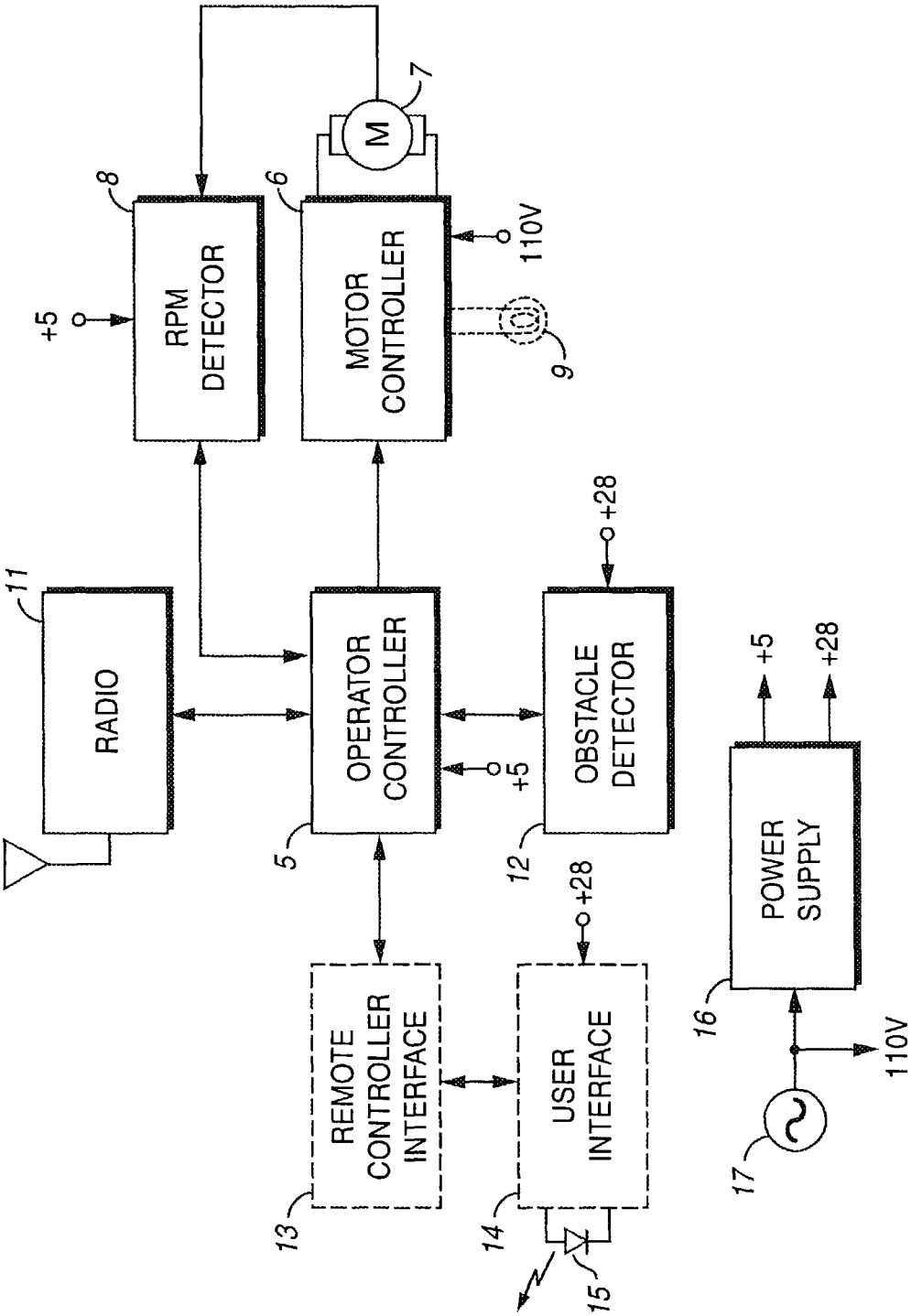
RPM DETECTOR
MOTOR CONTROLLER
M
+5
110V
RADIO
OPERATOR CONTROLLER
OBSTACLE DETECTOR
+28
+5
POWER SUPPLY
REMOTE CONTROLLER INTERFACE
USER INTERFACE
110V
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6
7
8
9
11
12
13
14
15
16
17

FIG. 1

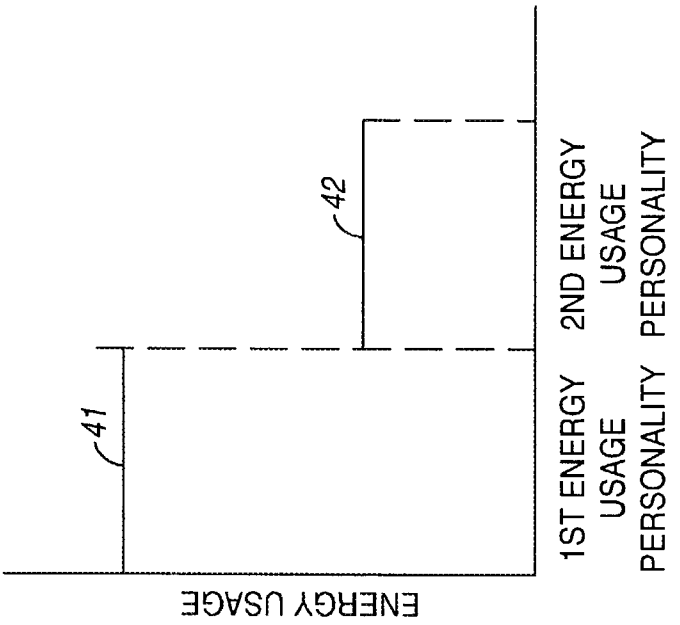

FIG. 4

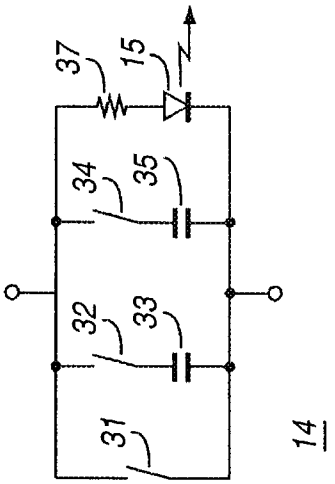

FIG. 3

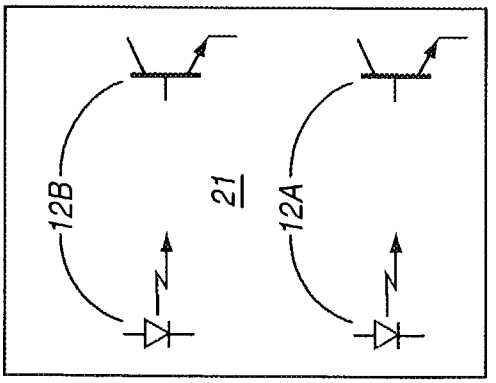

FIG. 2

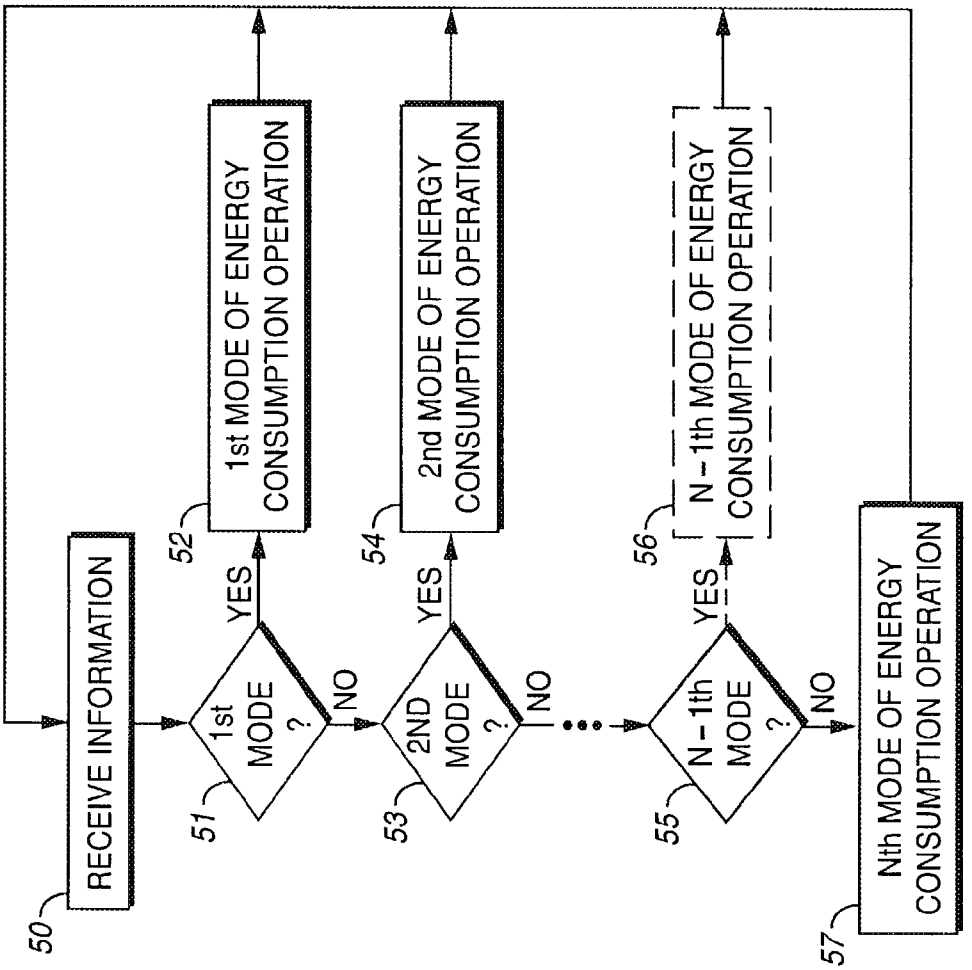
RECEIVE INFORMATION
50
1st MODE ?
51
YES
1st MODE OF ENERGY CONSUMPTION OPERATION
52
NO
2ND MODE ?
53
YES
2nd MODE OF ENERGY CONSUMPTION OPERATION
54
NO
N-1th MODE ?
55
YES
N-1th MODE OF ENERGY CONSUMPTION OPERATION
56
NO
Nth MODE OF ENERGY CONSUMPTION OPERATION
57

FIG. 5

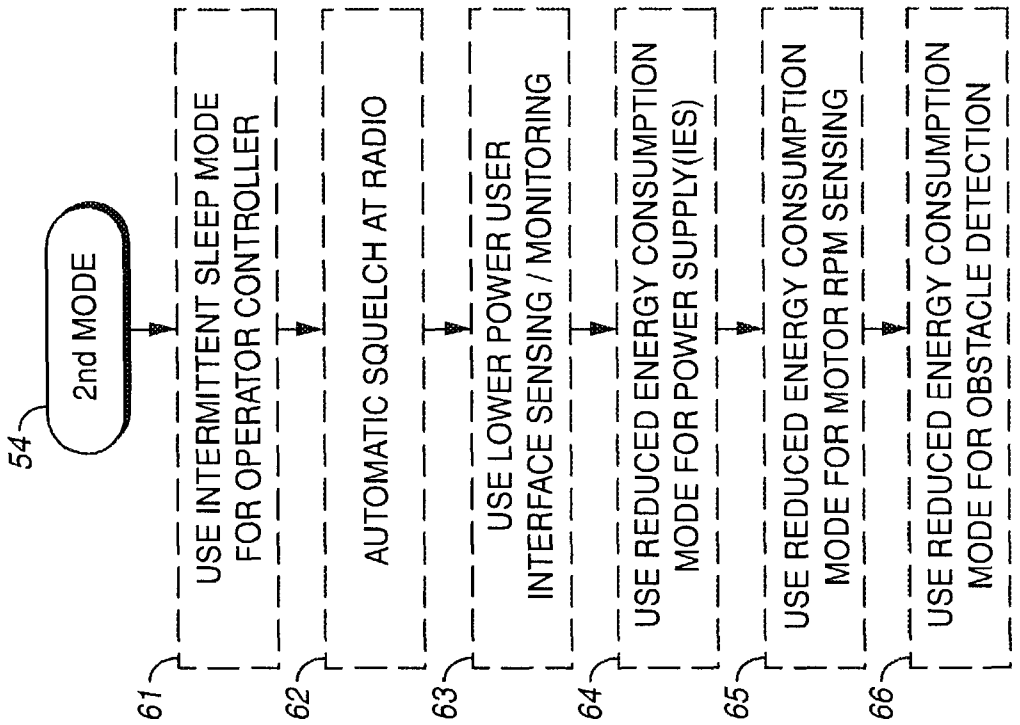
2nd MODE
54
USE INTERMITTENT SLEEP MODE FOR OPERATOR CONTROLLER
61
AUTOMATIC SQUELCH AT RADIO
62
USE LOWER POWER USER INTERFACE SENSING / MONITORING
63
USE REDUCED ENERGY CONSUMPTION MODE FOR POWER SUPPLY(IES)
64
USE REDUCED ENERGY CONSUMPTION MODE FOR MOTOR RPM SENSING
65
USE REDUCED ENERGY CONSUMPTION MODE FOR OBSTACLE DETECTION
66

FIG. 6

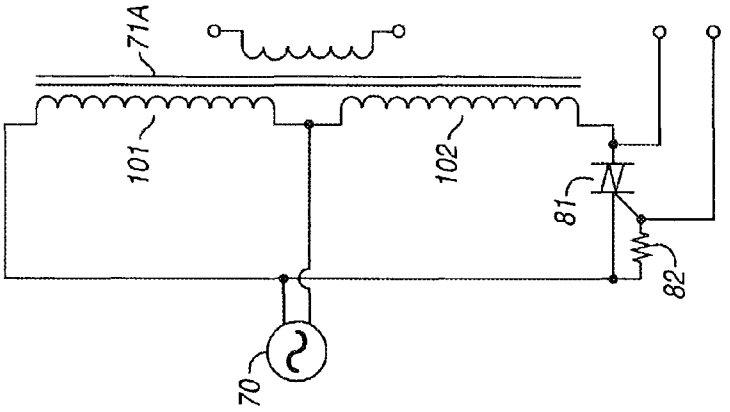

FIG. 10

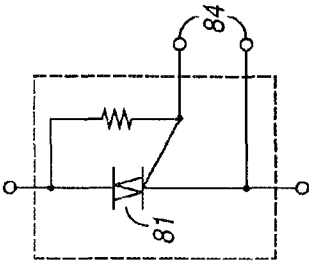

FIG. 9

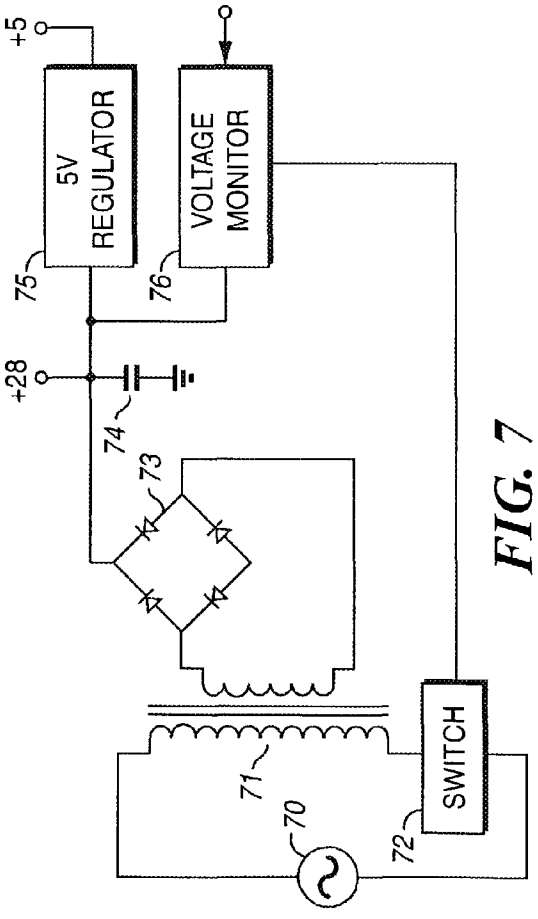

FIG. 7

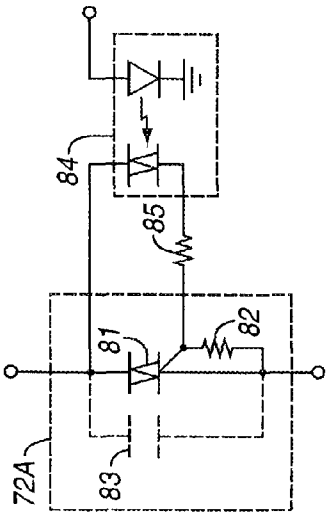

FIG. 8

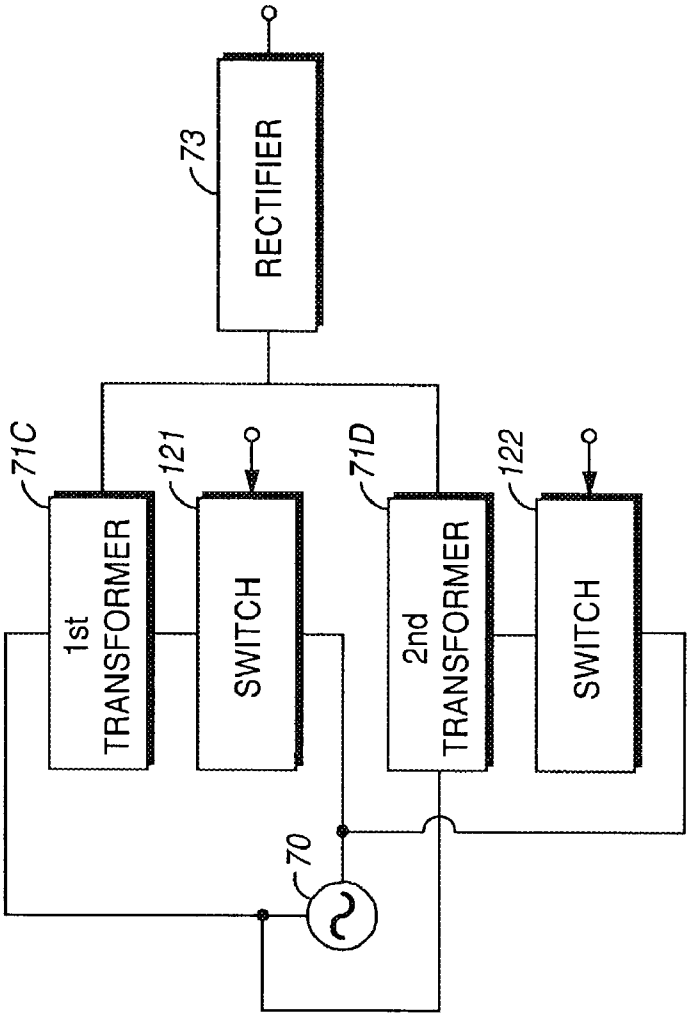
73
RECTIFIER
71C
1st TRANSFORMER
121
SWITCH
71D
2nd TRANSFORMER
122
SWITCH
70

FIG. 12

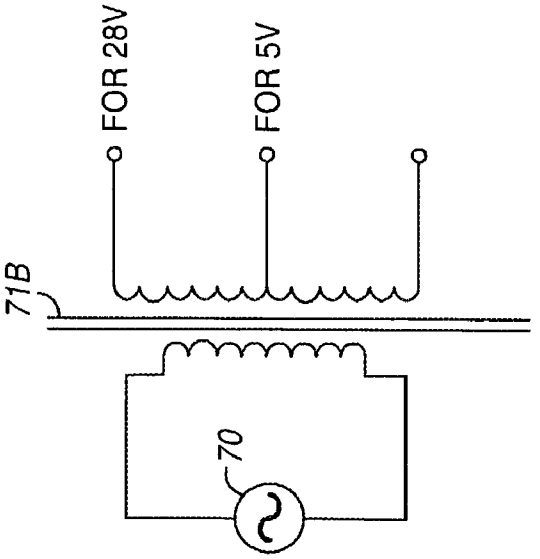
FOR 28V
FOR 5V
71B
70

FIG. 11

MOVABLE BARRIER OPERATOR WITH ENERGY MANAGEMENT CONTROL AND CORRESPONDING METHOD

TECHNICAL FIELD

This invention relates generally to movable barrier operators and more particularly to energy management in such an operator.

BACKGROUND

Movable barrier operators are well understood in the art and include a wide variety of openers for garage doors (with both residential and commercial/industrial variations being available), sliding and swinging gates, rolling shutters, and so forth. Such operators usually include a programmable platform comprising a programmable gate array, a microcontroller, a microprocessor, or the like that controls various operational states of the operator (including movement of a corresponding barrier, light operation, state monitoring, unauthorized entry detection, and so forth). Many operators also include other elements and components including but not limited to a motor and motor controller, a motor RPM detector, one or more wired remote control interfaces that are at least semi-permanently mounted remotely from the movable barrier operator itself, a wireless remote control interface, one or more worklights, and an obstacle detector, to name a few. Such operators also typically include a power supply to provide energy for all of the above components.

In general, movable barrier operators are designed to provide full power at all times to all elements of the system. For example, an obstacle detector (and the circuitry/logic that monitors and responds to the obstacle detector) will frequently be active and fully powered regardless of whether the corresponding barrier is opened or closed. As a result, the average power draw of a typical prior art movable barrier operator over time is often likely to be higher than might genuinely be merited. For example, many movable barrier operators draw more than five watts of power even during a relatively quiescent state such as when the corresponding barrier is fully closed.

Also, the power supply for many movable barrier operators tends to be simplistic and relatively static in operation in that the power supply is designed and built to operate at full capacity and provide full potentially necessary operating power to all components of the movable barrier operator regardless of the genuine need at any given moment for such power. Waste heat production and radiation due to the power supply design (often primarily due in many cases to the power supply transformer) alone can account for a considerable portion of the so-called stand-by energy needs of a prior art movable barrier operator.

BRIEF DESCRIPTION OF THE DRAWINGS

The above needs are at least partially met through provision of the movable barrier operator with energy management control and method described in the following detailed description, particularly when studied in conjunction with the drawings, wherein:

FIG. **1** comprises a block diagram view of a movable barrier operator as configured in accordance with an embodiment of the invention;

FIG. **2** comprises a schematic front elevational view of an obstacle detector as configured in accordance with an embodiment of the invention;

FIG. **3** comprises a schematic view of the switches of a remotely disposed user interface as configured in accordance with an embodiment of the invention;

FIG. **4** comprises a graph that generally illustrates energy usage for differing energy usage personalities for movable barrier system elements as configured in accordance with an embodiment of the invention;

FIG. **5** comprises a flow diagram as configured in accordance with an embodiment of the invention;

FIG. **6** comprises a flow diagram as configured in accordance with an embodiment of the invention;

FIG. **7** comprises a schematic view of a power supply as configured in accordance with an embodiment of the invention;

FIG. **8** comprises a detailed schematic view of a portion of a power supply as configured in accordance with an embodiment of the invention;

FIG. **9** comprises a detailed schematic view of a portion of a power supply as configured in accordance with another embodiment of the invention;

FIG. **10** comprises a detailed schematic view of a portion of a power supply as configured in accordance with yet another embodiment of the invention;

FIG. **11** comprises a detailed schematic view of a portion of a power supply as configured in accordance with yet another embodiment of the invention; and

FIG. **12** comprises a block diagram view of a portion of a power supply as configured in accordance with another embodiment of the invention.

Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of various embodiments of the present invention. Also, common but well-understood elements that are useful or necessary in a commercially feasible embodiment are typically not depicted in order to facilitate a less obstructed view of these various embodiments of the present invention.

DETAILED DESCRIPTION

Generally speaking, pursuant to these various embodiments, a movable barrier operator that includes a motor and a plurality of additional components has at least a first mode of operation and a second mode of operation. In the first mode of operation, the operator automatically initiates (following at least apparent attainment of a given operational state) one or more actions that configures or otherwise controls one or more components of the movable barrier operator to effect, in part, a particular corresponding level of energy consumption. In a preferred embodiment, this level of energy as provided pursuant to the first mode of operation is sufficient to power at least most of the components in a substantially fully-active mode of operation. In the second mode of operation, the operator automatically initiates (again preferably based on some indicia of an attained operational state) one or more actions that configures or controls the movable barrier operator to effect, at least in part, a reduced corresponding level of energy consumption.

By appropriate selection of the dynamic alterations that facilitate the selection of reduced energy consumption operating states, and by appropriately selecting when to use such operating states, operational efficacy and safety are not unduly compromised while simultaneously achieving considerable power savings over time.

In differing embodiments, various alterations can be introduced for use with various ones of the components to realize the dynamically utilized reduced energy consumption needs of the components and/or overall operator. Varying levels of energy savings are typically possible with, for example, the motor RPM sensor, the movable barrier operator itself, the radio that supports the wireless user interface, the wired remotely disposed user interface, and the obstacle detector, to name a few. In addition, the power supply can be more efficiently designed and/or provided with dynamic reconfigurable functionality to also support immediate and/or average energy usage reductions.

Referring now to FIG. **1**, a movable barrier operator system can include, for example, an operator controller **5** that serves to interact with a variety of other components of the operator system. Such controllers **5** are well known in the art and usually comprise a programmable platform (such as a microprocessor, microcontroller, programmable gate array, or the like) that is readily amenable to such alterations as are suggested below in these various embodiments. The operator controller **5** couples to a motor controller **6** that in turn couples to a motor **7**. So configured, the operator controller **5** controls the motor controller **6** and the motor controller **6** in turn converts such control information into specific drive signals for the motor **7** to thereby cause the motor to function in a specifically desired fashion. (The motor **7** will usually be coupled to a movable barrier through any of a variety of well understood drive mechanisms. For the sake of brevity and the preservation of focus, additional detail will not be presented here regarding such well understood peripheral structure.)

In addition, in this embodiment, a worklight **9** provides light (for example, upon opening or closing a garage door for a short predetermined period of time). Such a worklight **9** can share a common housing with the motor **7** and motor controller **6** or can be remotely mounted. In addition, two or more such worklights can be provided. When multiple worklights are used, such lights can operate in parallel or can respond to differing control strategies as desired for a particular application.

In a preferred embodiment, an RPM detector **8** provides information regarding the mechanical output of the motor **7** to the operator controller **5**. In a preferred embodiment the RPM detector **8** will include one or more optical sensors and a light source wherein one moves with respect to the other as a given output member (such as an output drive shaft) rotates. The resultant signals will be synchronized to the rotation of the motor **7** and hence provide the desired RPM information. There are other ways, however, to provide such information and this particular embodiment should be viewed as being illustrative rather than limiting.

A radio **11** (typically comprising a receiver though two-way capability can be provided as appropriate to suit the needs of a given situation) serves to receive wireless remote control signals and to provide such received signals to the operator controller **5**.

An obstacle detector **12** of choice couples to the operator controller **5** and serves primarily to detect when an obstacle lies in the path of the moving barrier. The operator controller **5** uses such information to control the movable barrier accordingly (for example, to cause a closing moving barrier to stop or reverse direction upon detecting an obstacle in order to avoid injuring the obstacle or the movable barrier itself). A variety of known obstacle detectors exist For purposes of this illustration, the obstacle detector **12** is comprised of a photobeam-based obstacle detector.

Referring momentarily to FIG. **2**, a pair of photobeam elements **12**A (such as a source and a receptor) are positioned near the bottom of an opening **21** (such as a garage opening) to detect when an obstacle is disposed within the opening **21** and hence potentially within the path of the moving movable barrier (not shown) As well understood in the art, additional such pairs of photobeam elements **12**B can be disposed at other locations within the opening **21** to improve the likelihood of detecting a given obstacle. Typically in such an arrangement, the photobeam sources are energized on a relatively frequent basis and usually are substantially continuously energized.

In this embodiment the operator controller **5** also couples to a wired remotely disposed user interface **14** via a remote controller interface **13**. The remotely disposed user interface **14** typically includes one or more user assertable buttons and often include one or more display elements (such as one or more light emitting diodes **15**). The buttons serve to permit a user to signal the operator controller **5** to, for example, move the movable barrier, to switch on or off the worklight **9**, or to facilitate some other communication (for example, to place the operator controller **5** into a so-called vacation mode of operation). There are various known ways to facilitate the provision of such a user interface **14**. For purposes of this illustration, and referring momentarily to FIG. **3**, three user assertable switches **31**, **32**, and **34** are arranged in parallel with one another, with the latter two switches **32** and **34** also being arranged in series with a corresponding capacitor **33** or **35** respectively. A parallel-configured series-coupled resistor **37** and light emitting diode **15** complete a typical user interface **14** of this type. So configured, the remote controller interface **13** will pulse the above-described circuit with 28 volts DC from the power supply **16** (the power supply is described below) and then monitor the electrical response of the user interface circuit. By varying the values of the capacitors **33** and **35**, one can rapidly ascertain when a given switch has been closed by a user as well as identify the particular switch.

As already noted for some of the above specific elements, all of these components are well understood in the art. This understanding includes knowledge regarding a variety of ways to facilitate the realization of each described function. Additional description has therefore not been provided for these various components. In addition, there are other components that can be utilized in conjunction with such an operator controller, including Bluetooth-style data link modules, carbon monoxide detectors, smoke detectors, and so forth. It should be clearly understood that the embodiments described below are compatible with and suitable for use with such other components as well as the specific components and elements that are generally depicted in FIG. **1**.

All of the above components, including the operator controller **5** itself, utilize electricity. Some (such as the motor **7** and the worklight **9**) utilize standard 110 volt alternating current. Others (such as the obstacle detector **12** and the user interface **14**) utilize, in this embodiment, 28 volts direct current. Yet others (such as the operator controller **5** and the RPM detector **8**) utilize, in this embodiment, 5 volts direct current. Such electricity can be provided in a wide variety of ways, including through use of multiple independent power supplies. More typically, however, a single power supply **16** serves to supply the power needs of all the components in the system. So configured, in this embodiment, the power supply **16** couples to a standard source **17** of alternating current. The AC power is made available via the power supply **16** to those elements that require it. That AC power is also processed to yield both the 5 volt and the 28 volt DC power signals noted above.

As already noted, a typical movable barrier operator will have a power supply that provides full power at all times and all of the components will be operating in a full power standby mode as well. This does not mean, of course, that all of the components utilize maximum power at all times. For example, the motor **7** only draws full power when it is operating. But, as an example, the RPM detector **8** in a prior art configuration will draw full power even when the motor **7** is quiescent and there are no revolutions to detect. Pursuant to these embodiments, various components are configured to have at least two energy usage personalities. That is, when the operator controller **5** operates in a first mode of energy consumption operation, at least one of these components will operate using a first energy usage personality. Similarly, when the operator controller **5** operates using a second mode of energy consumption operation, that same component will operate using a second energy usage personality. With reference to FIG. **4**, and seeking only to illustrate the point generally at this time, the first energy usage personality will tend to comprise a first average level **41** of energy usage and the second energy usage personality will tend to comprise a second average level **42** of energy usage that is less than the first average level **41**. So configured, the operator controller **5** will now have the ability to manage the energy usage of one or more components of the system by selecting between at least these two modes of operation.

As noted above, the operator controller **5** comprises a programmable platform. Pursuant to these embodiments, the operator controller **5** is programmed to select from amongst a plurality of energy management operating modes as a function, at least in part, of the operational status of one or more elements of the system itself and/or the movable barrier. Generally speaking, and with reference to FIG. **5**, the operator controller **5** receives **50** information and then uses this information to determine **51** whether to operate in a first mode of operation **52**, to determine **53** whether to operate in a second mode of operation, and so forth. If desired, any number N of operating modes can be defined and accommodated, such that a determination **55** is eventually made as to an N−1th mode of operation **56** and a final Nth mode of operation. For purposes of clarity, however, in this illustration only two such modes of operation will henceforth be discussed and elaborated upon.

The information received **50** by the operator controller **5** can comprise, for example, information regarding one or more operational states of the movable barrier operator system. Such information could reflect, for example, that the movable barrier is at a particular position and/or is stationary at either of a fully opened or a fully closed position. The monitored operational state can further include, in a preferred embodiment, a temporal aspect as well. For example, the information can specifically reflect that a given stationary position of the movable barrier has been continuously maintained for at least a predetermined period of time (such as a specific number of seconds or minutes). When the movable barrier is at a fully opened or especially at a fully closed position, the operational state of the system often comprises a quiescent state, and especially so when the stationary position has been continuously maintained for a period of time.

Each operating mode as is selectable by the operator controller **5** pursuant to this approach can have a corresponding level of energy consumption. Through this process, the operator controller **5** establishes a level of operability that is appropriate and commensurate with the likely needs of the system at a given point in time. More particularly, the operator controller **5** further selects operating modes that tend to result in a reduced level of energy consumption for at least some levels of maintained activity. In general, little or no reduction in energy consumption during high levels of usage are especially expected through this approach. Since most moving barrier operator systems spend most of their time in a fully or partially quiescent operating state, however, considerable opportunity exists for energy savings during such periods.

As one illustrative example, consider the above process as applied to an obstacle detector **12**. As already described, the obstacle detector **12** in this embodiment includes two pairs **12**A and **12**B of photobeam elements that are positioned within the opening **21** that is governed by the movable barrier. The obstacle detector **12** serves an important safety purpose. In this regard, when the operator controller **5** receives **50** information indicating that the movable barrier is moving from an open to a closed position, a first mode of energy consumption operation **52** that comprises, in this example, normal full energization and operation of the obstacle detector **12** is appropriate to ensure that this feature is fully enabled. Once the movable barrier has moved to a fully closed position, however, and further has remained in that position for a predetermined period of time (such as, for example, five minutes), this information as received **50** by the operator controller **5** can be used to select instead a second mode of energy consumption operation **54**. In this embodiment, pursuant to the second mode of energy consumption operation, one pair **12**B of the photobeam elements can be switched off, thus saving 50% in energy utilized to power the photobeam operation. This energy savings is achieved at the expense of now providing only one pair of photobeam elements, of course. By ensuring that such a selection only occurs when the movable barrier is fully closed, however, such a compromise will be quite reasonable for many applications.

The above example is intended to be illustrative only, of course, and there are other ways to achieve an energy savings in the same situation. For example, the periodicity or duty cycle for energizing the photobeams elements **12**A or **12**B can be reduced. Instead of continuous or near-continuous energization, the elements can be strobed on a less frequent basis. In this and other ways as will occur to one skilled in the art, the energy consumption operating mode of the obstacle detector **12** is controlled while simultaneously assuring that the operability and efficacy of the overall system is not unduly compromised.

In a simple system where only two operating modes are available for consideration, again, the first mode is likely to represent a full-power mode suitable for use during ordinary operations. The second mode, however, can be used to modify the energy consumption of any given component of the system or any combination of components. For example, and referring now to FIG. **6**, the second mode **54** can be used to optionally modify and reduce the energy usage of any of the operator controller itself **61**, the radio **62**, the remotely disposed user interface **63**, the power supply **64**, the motor RPM detector **65**, and/or the obstacle detector **66** (as well as any other components or features that have been incorporated into a given movable barrier operator system). A number of examples will now be provided as exemplary illustrations of how energy management options can be realized for each such component/function.

The Operator Controller

The operator controller **5** can be configured to toggle itself between an ordinary mode of operation and a so-called sleep mode of operation. During a sleep mode of operation, the processing platform that comprises the operator controller **5** can power down significant portions of its relevant circuitry and then only intermittently re-power such circuitry to respond to any system needs that may have arisen in the meantime. As another example, significant portions of the

processing platform can be powered down and left powered down. A remaining portion of the platform can serve to receive signals that indicate when processing requirements now exist and to interrupt and awaken the remaining circuitry to tend to the task at hand. Such operating modes are generally well understood in the art for microprocessors and the like though used uniquely here to facilitate the energy management of a movable barrier operator system.

The Radio

The radio is ordinarily on at all times and available to receive remote control transmissions from a corresponding wireless remote control user device as well understood in the art. The operator controller **5** could be configured to receive **50** information regarding the fully open status of the movable barrier, which status has been maintained for at least a predetermined period of time (such as, for example fifteen minutes). A second mode of operation **54** could configure the radio **11**, under such conditions, to enter an intermittent mode of operation. For example, the radio receiver could be cycled on and off for brief intervals in accord with a predetermined duty cycle, such as fifty percent. So configured, energy consumption for the radio would drop during a period of time when a wireless transmission from a user is statistically somewhat less likely (at least for some applications and installations).

As another example, the radio **11** could be configured, pursuant to a second mode of operation, to effect a local squelch function (whereas in ordinary course, the squelch function may be handled by the operator controller **5**). Doing this, of course, would possibly increase the energy requirements of the radio **11**, but would permit the operator controller **5** to be relieved of this function. Accordingly, this offloading of functionality might then more readily permit a complete (possibly intermittent) powering down of the operator controller **5** into a sleep mode as suggested above. So configured, it can be seen that the functionality of one component can be modified in order to effect a corresponding change in functionality elsewhere in the system along with a commensurate reduction in energy consumption. (Whether such a shifting will result in an overall reduction in energy consumption for a given system will of course vary with respect to the system itself.)

The Remotely Disposed User Interface

As noted above, during ordinary (first mode) operation, this interface **14** can illuminate display elements such as one or more light emitting diodes **15**. For example, such a display can be provided in order to provide a location beacon to aid a user in finding the interface **14** under darkened circumstances. By using information regarding available light (such as can be obtained through use of, for example, a photocell circuit as well understood in the art), the operator controller **5** can receive **50** information regarding ambient light and use this information to select a second mode of operation **52** wherein such a light emitting diode **15** is powered down (this being based upon the supposition that such a beacon is not especially helpful when the interface **14** is otherwise readily viewable given present lighting conditions).

As another example, it was disclosed above that a particular switch closure sensing mechanism is used in many such interfaces **14** wherein a 28 volt pulse is repeatedly sent to the interface **14** such that the remote controller interface **13** can thereby actively sense the closure and identity of a given switch. Upon receiving **50** information that indicates a particular operational state (such as, for example, that the movable barrier is and has been fully closed for at least a predetermined period of time), the operator controller **5** can effect a second mode of operation **52** that utilizes an alternative, less energy-consumptive switch sensing mechanism. For example, whereas the primary mode of operation provides for actively sensing a closed circuit, a second mode of operation can instead more passively detect charging of the capacitors **33** and **35** in the interface circuit as described earlier. Sensing switch closure in this fashion is not as rapid or necessarily as accurate as the use of active sensing, but the energy expenditure required for the second mode of operation is also considerably reduced. By limiting use of the less operationally optimum but more energy efficient second mode of operation to circumstances where actual usage of the interface **14** is less likely, overall energy management is served without significant impairment of the overall operation of the system.

The Power Supply

A number of improvements can be made with respect to energy efficiency of the power supply and/or its interaction with the remainder of the system. For example, with reference to FIG. **7**, a transformer **71** as coupled to a source of alternating current **70** can have a switch **72** coupled in series with a primary winding thereof. The secondary winding of the transformer **71** couples through a rectifier **73** and provides a 28 volt DC output in accordance with well understood practice (other typically appropriate components, such as filtering capacitors and the like, are not shown for purposes of clarity). This 28 volt line is then coupled to the input of a 5 volt DC regulator **75** that serves to provide the 5 volt power signal required by some of the components of the system as related above. In this embodiment, however, an energy storage capacitor (or capacitors, with only one being shown for the sake of simplicity) **74** is disposed and will serve to store voltage at the input to the 5 volt regulator **75**. In addition, a voltage monitor **76** is coupled to detect the voltage level at the input to the 5 volt regulator **75** and to provide a corresponding control signal to the switch **72** that controls the flow of current through the transformer **71** primary winding.

During ordinary operation, when all power is to be made available to all components of the system (for example), the switch **72** remains closed and 28 volts and 5 volts remain fully available at all times to all components. During more quiescent modes of operation, however, the second mode of operation **54** can provide for essentially shutting down the 28 volt supply (which will shut down, partially or completely, those components that ordinarily require such a supply to operate in an ordinary fashion). At the same time, however, the energy storage capacitor **74** will be able to maintain a supply of 5 volts at the output of regulator **75** for short periods of time. The voltage monitor **76** can detect when the voltage across this capacitor **74** is falling too low (such as, for example, below 7 volts) and can then close the switch **72**. This will permit the building up of voltage across the capacitor **74** and will also result in a still-continuing availability of 5 volts at the output of the regulator **75**. The voltage monitor **76** can again cause the switch **72** to open when the voltage across the capacitor **74** reaches or exceeds some predetermined threshold (such as, for example, 12 volts). By toggling back and forth in this fashion, 5 volts remains available to power certain components (or portions of components as the case may be) but the 28 volt components are essentially powered down. As a result, energy requirements are greatly reduced when operating in this fashion. If, in a given embodiment, there are components that require 28 volts that should not be shut down in this fashion, it would be possible to provide two power supplies, wherein one supply continues to provide 28 volts to such components and the other supply operates as just described to reduce power availability to those components where such denial is acceptable and to otherwise provide 5 volt power to the remaining components.

There are a variety of ways by which the switch **72** can be realized. For example, the switch **72** can be comprised of a relatively small low power relay (especially when the pulse rate is relatively slow). The switch **72** could also be realized through appropriate use of an active device such as, for example, a triac. For example, as shown in FIG. **8**, the switch **72**A can comprise a triac **81** coupled in series with the primary of the transformer (not shown in this figure). The triac **81** will preferably have a resistor coupled between its control input and ground. (In addition, if desired, a passive device such as a capacitor **83** can be disposed in parallel with the triac **81**. This capacitor **83**, which is also, of course, disposed in series with the primary winding of the transformer, will limit the amount of energy in the primary when the triac is off and will thereby limit the amount of energy in the secondary. With less energy in the core, the transformer will typically function more efficiently.) So configured, the triac **81** can operate as a switch element being either on or off as desired to support corresponding power requirements. Also as shown in FIG. **8**, the voltage monitor **76** can effect provision of control signals via an optical coupler **84** and coupling resistor **85** as are well known in the art. In this particular embodiment, the optical coupler **84**, when energized, will switch on the triac **81**. If desired, and as shown in FIG. **9**, the optical coupler **84** (or other isolation coupler of choice) can instead be connected across the triac **81** so that energizing the triac **81** will short the control gate of the triac **81** and thereby switch the triac **81** off.

Yet other useful and applicable power supply embodiments are possible as well. For example, with reference to FIG. **10**, the power supply transformer **71**A can be comprised of a split primary **101** and **102**. A first primary section **101** would comprise a low power primary to supply power during, for example, a second mode of operation. The second primary section **102** could comprise a higher power primary that is switched in via a switch **81** as needed during higher power modes of operation. As yet another example, and referring now to FIG. **11**, the secondary of the power supply transformer **71**B can be split or tapped to provide two different resultant voltage levels. While such a design is not especially dynamic in that it does not switch between such voltage levels in response to changing operational states, it may, under at least some operating conditions, represent a more efficient overall design.

As noted above, more than one power supply may be appropriate in some circumstances to support dynamic reconfiguration for energy management purposes. With reference to FIG. **12**, a first and second transformer **71**C and **71**D can each be configured in series with a switch **121** and **122** respectively (the switch can be coupled in series with the primary or the secondary winding of the power supply transformer of each power supply as appropriate to the particular needs of the application). So configured, the switches **121** and **122** can respond to appropriate control signals from the operator controller **5** to open or close and thereby combine or isolate the transformers **71**C and **71**D to provide resultant corresponding power capabilities as limited and/or as unlimited as may be desired.

As already noted, various components of the movable barrier operator system can be configured to effect dynamic changes in response to certain operational states to thereby minimize the power requirements of such components. By also modifying the power supply to itself reduce its power provisioning capabilities in tandem with such dynamic alterations to the components, significant energy savings can be attained.

The RPM Detector

The RPM detector **8**, at a minimum, expends energy to sense a signal that relates to the position of an object that itself correlates to the position of the output shaft of the motor. Often, the detector **8** will also expend energy to create that signal to be sensed. When the system attains a quiescent state such as occurs when the movable barrier is and has been fully closed for at least some predetermined period of time, a second mode of operation **54** can include reducing the duty cycle of so energizing the detector **8** and/or powering down the detector **8** completely.

The Obstacle Detector

As already described above, a photobeam-based obstacle detector **12** can be configured to permit reduction of the energization cycle and/or complete powering down to accommodate a reduced energy consumption mode of operation. Other embodiments are of course possible. For example, in some embodiments, the remotely disposed wired user interface **14** will include a passive infrared (PIR) device that can detect the presence of a human in the vicinity of the system. To the extent that a system utilizes the obstacle detector **12** to also detect the presence of a person and to trigger the illumination of the worklight **9** in response to such detection, when at least a quiescent condition has been reached where the movable barrier is and has been closed for at least a predetermined period of time, control of the worklight **9** can be left exclusively to the PIR device and the obstacle detector **12** can be relieved of this function. This, in turn, may more readily facilitate the partial or complete powering down of the obstacle detector **12** as already suggested above.

So configured, it can be seen that one or more components of a movable barrier operator system can be configured to operate in at least two different modes of operation, wherein each mode has a differing corresponding energy consumption profile. The mode that requires less energy is frequently less optimum with respect to performance. By matching use of such lower power modes of operation with operational states that present reduced operational challenges, however, a reasonable compromise can be reached as between operational efficacy on the one hand and well managed energy usage on the other.

Those skilled in the art will recognize that a wide variety of modifications, alterations, and combinations can be made with respect to the above described embodiments without departing from the spirit and scope of the invention, and that such modifications, alterations, and combinations are to be viewed as being within the ambit of the inventive concept.

I claim:

1. A movable barrier operator apparatus comprising:

a power supply that operably couples to at least one source of alternating current;

an obstacle detector; and

a movable barrier operator which includes a controller, the movable barrier operator operably coupled to the power supply, receives operating power from the power supply and has at least a first and a second mode of energy consumption operation and being further configured and arranged to:

selectively open and close a corresponding movable barrier; and

develop an obstacle detector operating mode control signal from the controller as a function of movable barrier operator system state information that indicates whether the barrier is open or closed, the obstacle detector operating mode control signal being operable to directly control the energy usage of the

obstacle detector, the control signal from the controller developed as a result of the state information, the state information selected from the group consisting of motor state information, time information, transmission state information, voltage state information, switch state information and combinations thereof,

the obstacle detector operably coupled to the power supply and to the movable barrier operator, receives operating power from the power supply, and has a plurality of operating modes, wherein at least some of the operating modes have different energy usages, and wherein the obstacle detector is directly responsive to the movable barrier operator obstacle detector operating mode control signal such that:

during the first mode of energy consumption operation, the obstacle detector operates using a first energy usage; and

during the second mode of energy consumption operation, the obstacle detector operates using a second energy usage, wherein the operating power used in one of the energy usages is less than the power used by the other energy usage.

2. The movable barrier operator apparatus of claim **1** wherein the obstacle detector comprises a photobeam-based obstacle detector.

3. The movable barrier operator apparatus of claim **1** wherein the first energy usage comprises at least relatively frequent energization of an obstacle sensor.

4. The movable barrier operator apparatus of claim **3** wherein at least relatively frequent energization comprises substantially continuous energization.

5. The movable barrier operator apparatus of claim **3** wherein the relatively frequent energization of the obstacle sensor includes energization of the obstacle sensor using at least some power from the power supply.

6. The movable barrier operator apparatus of claim **3** wherein the second energy usage comprises, at most, relatively infrequent energization of the obstacle sensor.

7. The movable barrier operator apparatus of claim **6** wherein the relatively infrequent energization comprises substantially no energization.

8. The movable barrier operator apparatus of claim **6** wherein the relatively infrequent energization of the obstacle sensor comprises energization of the obstacle sensor using at least some power from the power supply.

9. The movable barrier operator apparatus system of claim **1** wherein the operating power used in the second the energy usage is less than the operating power used by the first energy usage and the second energy usage corresponds to a quiescent state of a movable barrier as is operably coupled to the movable barrier operator system.

10. The movable barrier operator apparatus of claim **1** wherein the power supply comprises a plurality of power supplies.

11. The movable barrier operator apparatus system of claim **9** wherein the second energy usage comprises an intermittent sleep mode of operation.

12. The movable barrier operator apparatus of claim **1** wherein the state information includes motor state information and the motor state information includes information about motor RPMs, the movable barrier operator further comprising a motor and a motor RPM sensor, and wherein the state information includes motor RPMs.

13. The moveable barrier operator apparatus of claim **1** wherein at least some of the different energy usages have different levels of use of the alternating current such that:

during the first mode of energy consumption operation, the obstacle detector operates using a first level of use of alternating current where the obstacle detector has an increased use of the alternating current; and

during the second mode of energy consumption operation, the obstacle detector operates using a second level of use of alternating current, wherein the second level of use of alternating current is lower than the first level of use of alternating current.

14. The movable barrier operator apparatus of claim **1** wherein the state information includes time information which provides information about the barrier being stationary for a period of time.

15. The movable barrier operator apparatus of claim **1** wherein the state information includes transmission state information, the transmission state information including transmissions which effect movement of the barrier.

16. The moveable barrier operator apparatus of claim **1** wherein the state information includes switch state information which switch state information includes the identity of a switch having a status which is effected by movement of the barrier.

17. The moveable barrier operator apparatus of claim **1** wherein the state information includes voltage state information which includes information about voltage which is effected by movement of the barrier.

18. A movable barrier operator apparatus as used with a movable barrier, comprising:

a power supply that operably couples to at least one source of alternating current;

obstacle detection means operably coupled to the power supply to receive operating power from the power supply for detecting an obstacle to the movable barrier;

control means operably coupled to the power supply to receive operating power from the power supply and to the obstacle detection means for automatically selectively directly controlling:

opening and closing of the movable barrier; and

energy consumption of the obstacle detection means as a function of movable barrier operator system state information that indicates whether the barrier is open or closed and the state information selected from the group consisting of motor state information, time information, transmission state information, voltage state information, switch state information and combinations thereof, the state information effecting a plurality of power consumption modes which are different, at least one of the power consumption mode consuming less power than another power consumption mode.

19. The movable barrier operator apparatus of claim **18** wherein the obstacle detection means comprises photobeam-based obstacle detection mean for detecting an obstacle by detecting an interrupted photobeam.

20. The movable barrier operator apparatus of claim **18** wherein the power supply further comprises energy storage means, such that the energy storage means will provide energy to the obstacle detection means when at least portions of the power supply are rendered non-operable by the control means.

21. A movable barrier operator apparatus comprising:

a power supply that operably couples to at least one source of alternating current;

an obstacle detector; and

a movable barrier operator which a controller, the movable barrier operator operably coupled to the power supply, receives operating power from the power supply and has

at least a first and a second mode of energy consumption operation and being further configured and arranged to:

selectively open and close a corresponding movable barrier; and

develop an obstacle detector operating mode control signal from the controller as a function of movable barrier operator system state information that indicates whether the barrier is travelling, the obstacle detector operating mode control signal being operable to directly control the energy usage of the obstacle detector and the state information selected from the group consisting of motor state information, time information, transmission state information, voltage state information, switch state information and combinations thereof,

the obstacle detector operably coupled to the power supply and to the movable barrier operator, receives operating power from the power supply, and has a plurality of operating modes, wherein at least some of the operating modes have different energy usages, and wherein the obstacle detector is directly responsive to the movable barrier operator obstacle detector operating mode control signal such that:

during the first mode of energy consumption operation, the obstacle detector operates using a first energy usage; and

during the second mode of energy consumption operation, the obstacle detector operates using a second energy usage, wherein the second energy usage is lower than the first energy usage.

22. The movable barrier operator apparatus of claim **21** wherein the obstacle detector comprises a photobeam-based obstacle detector.

23. The movable barrier operator apparatus of claim **21** wherein the first energy usage personality comprises at least relatively frequent energization of an obstacle sensor.

24. The movable barrier operator apparatus of claim **23** wherein at least relatively frequent energization comprises substantially continuous energization.

25. The movable barrier operator apparatus of claim **23** wherein the relatively frequent energization of the obstacle sensor includes energization of the obstacle sensor using at least some power from the power supply.

26. The movable barrier operator apparatus of claim **23** wherein the second energy usage personality comprises, at most, relatively infrequent energization of the obstacle sensor.

27. The movable barrier operator apparatus of claim **26** wherein the relatively infrequent energization comprises substantially no energization.

28. The movable barrier operator apparatus of claim **26** wherein the relatively infrequent energization of the obstacle sensor comprises energization of the obstacle sensor using at least some power from the power supply.

29. A movable barrier operator apparatus comprising:

a power interface configured to be operably coupled to at least one source of alternating current;

a movable barrier operator configured to be operably coupled to the power interface, to receive operating power, to selectively open and close a corresponding movable barrier, and to have at least a first and a second mode of energy consumption operation, the movable barrier operator comprising:

a motor;

an obstacle detector; and

a controller configured to receive movable barrier operator system state information that indicates barrier location, the controller configured to develop an obstacle detector operating mode control signal as a function of the movable barrier operator system state information, the state information selected from the group consisting of motor state information, time information, transmission state information, voltage state information, switch state information and combinations thereof, and the obstacle detector operating mode control signal being operable to directly control the energy usage of the obstacle detector, the obstacle detector, the obstacle detector having a plurality of operating modes at least some of the operating modes having a lower energy usage than another energy usage.

30. The movable barrier operator apparatus of claim **29** wherein the state information includes motor state information and the motor state information includes information about motor RPMs, the movable barrier operator further comprising a motor RPM sensor, and wherein the state information includes motor RPMs.

31. The movable barrier operator apparatus of claim **29** wherein the state information includes time information which provides information about the barrier being stationary for a period of time.

32. The movable barrier operator apparatus of claim **29** wherein the state information includes transmission state information, the transmission state information including transmissions which effect movement of the barrier.

33. The moveable barrier operator apparatus of claim **29** wherein the state information includes switch state information which switch state information includes the identity of a switch having a status which is effected by movement of the barrier.

34. The moveable barrier operator apparatus of claim **29** wherein the state information includes voltage state information which includes information about voltage which is effected by movement of the barrier.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 7,755,223 B2
APPLICATION NO. : 10/227182
DATED : July 13, 2010
INVENTOR(S) : James J. Fitzgibbon

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

IN THE CLAIMS:

Column 11, Claim 9, Line 47: After "apparatus" delete "system";

Column 11, Claim 9, Line 48: After "second" delete "the";

Column 11, Claim 11, Line 56: After "apparatus" delete "system"; and

Column 12, Claim 19, Line 53: Change "mean" to -- means --.

Signed and Sealed this

Fifth Day of October, 2010

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office

EXHIBIT 3

US006741052B2

(12) **United States Patent**
Fitzgibbon

(10) **Patent No.: US 6,741,052 B2**
(45) **Date of Patent: May 25, 2004**

(54) **POST-AUTOMATICALLY DETERMINED USER-MODIFIABLE ACTIVITY PERFORMANCE LIMIT APPARATUS AND METHOD**

(75) Inventor: **James J. Fitzgibbon**, Batavia, IL (US)

(73) Assignee: **The Chamberlain Group, Inc.**, Elmhurst, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **10/120,756**

(22) Filed: **Apr. 11, 2002**

(65) **Prior Publication Data**

US 2003/0193304 A1 Oct. 16, 2003

(51) **Int. Cl.**[7] **H02P 7/00**

(52) **U.S. Cl.** **318/434**; 318/280; 318/282; 318/286; 318/266; 318/590; 318/591; 49/26; 49/28

(58) **Field of Search** 318/434, 266, 318/280, 282, 286, 590, 591; 49/26, 28

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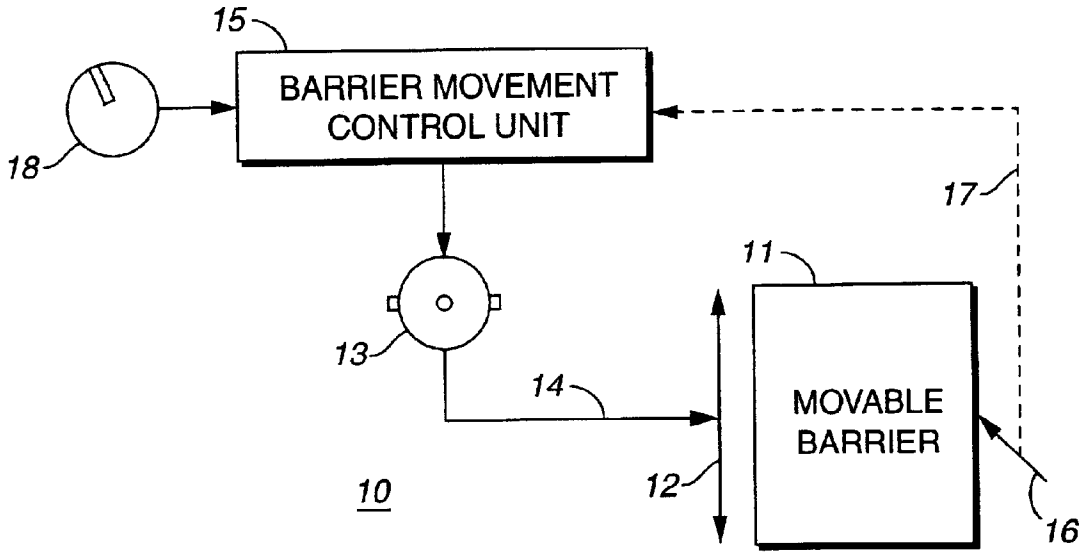
Primary Examiner—Rita Leykin
(74) *Attorney, Agent, or Firm*—Fitch, Even, Tabin & Flannery

(57) **ABSTRACT**

In a control system **(10)** having a learning mode **(20)** such that performance limits can be automatically determined for subsequent use during normal operating modes **(40)**, one or more user manipulable controls **(18)** are provided to allow a user to selectively adjust the previously automatically determined performance limits. In one embodiment the range of adjustment can be limited. The user control **(18)** can be located in various positions with respect to the control unit **(15)**. In an exemplary embodiment, the control system **(10)** comprises a movable barrier operating system such as a garage door opener.

35 Claims, 3 Drawing Sheets



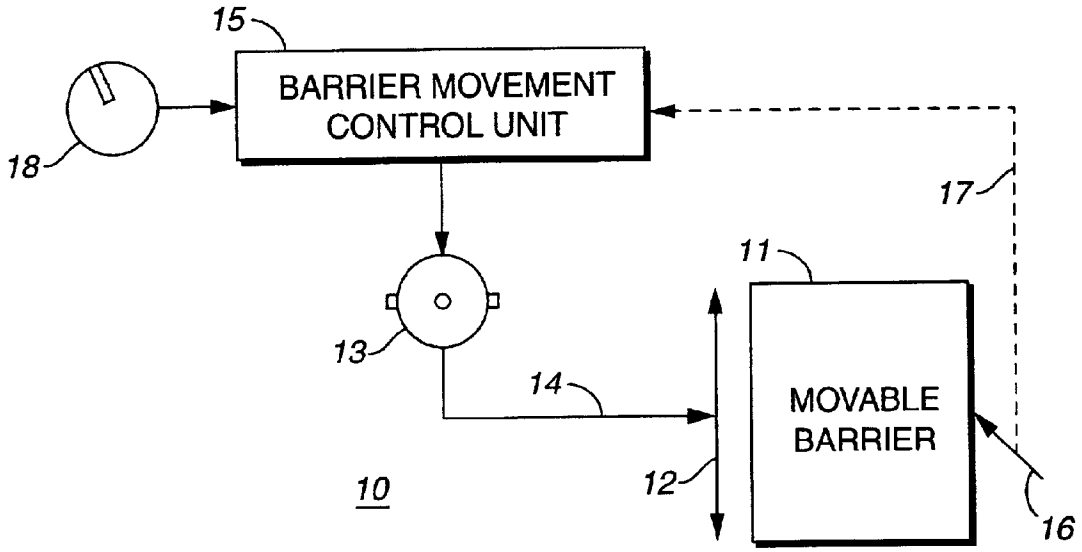


FIG. 1

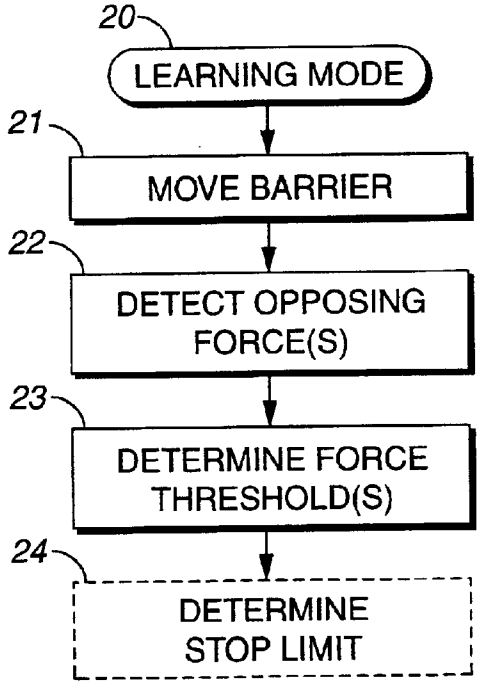


FIG. 2
(PRIOR ART)

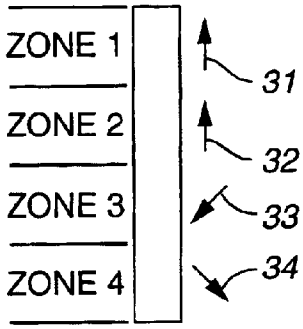

ZONE 1
ZONE 2
ZONE 3
ZONE 4
31
32
33
34

FIG. 3

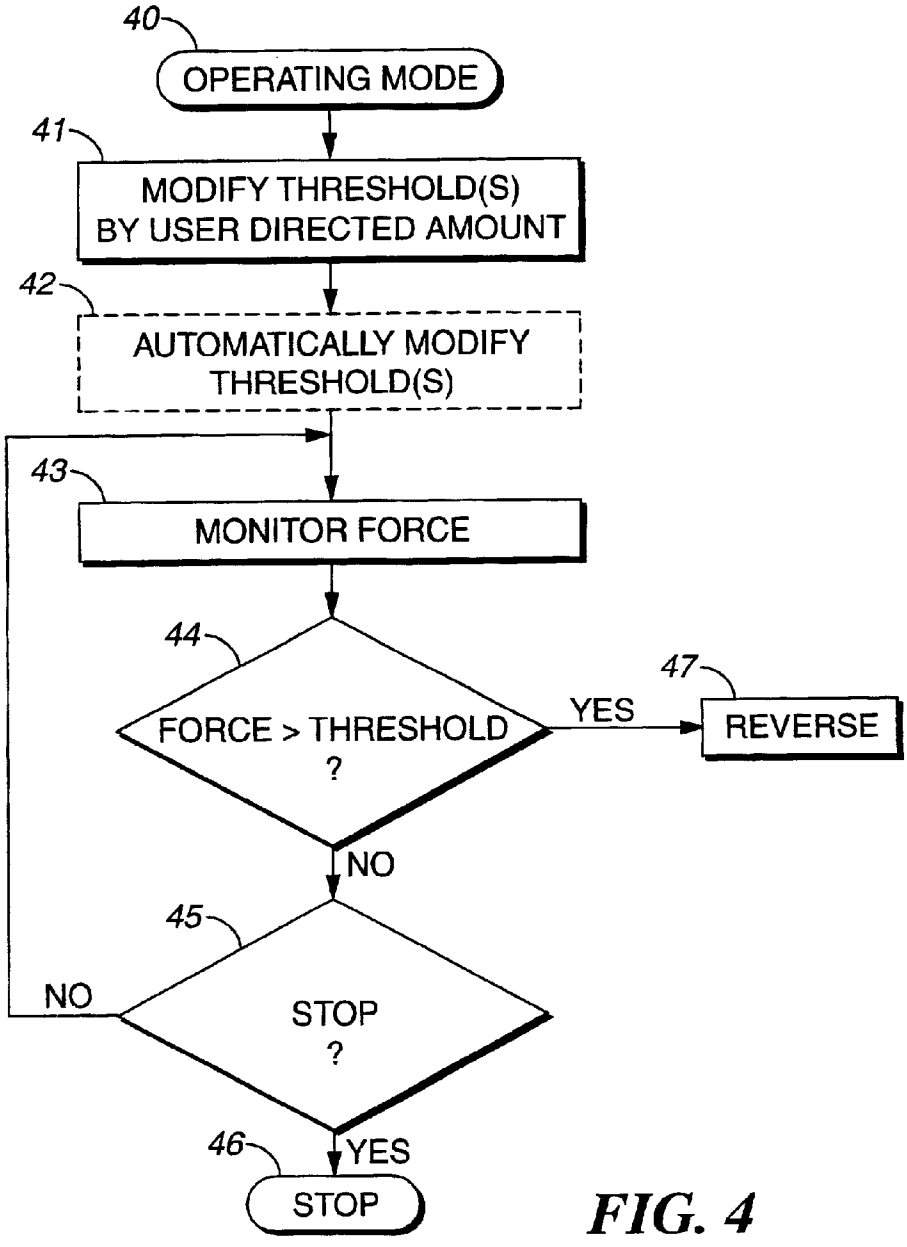

40
OPERATING MODE
41
MODIFY THRESHOLD(S) BY USER DIRECTED AMOUNT
42
AUTOMATICALLY MODIFY THRESHOLD(S)
43
MONITOR FORCE
44
FORCE > THRESHOLD ?
YES
47
REVERSE
NO
45
STOP ?
NO
YES
46
STOP

FIG. 4

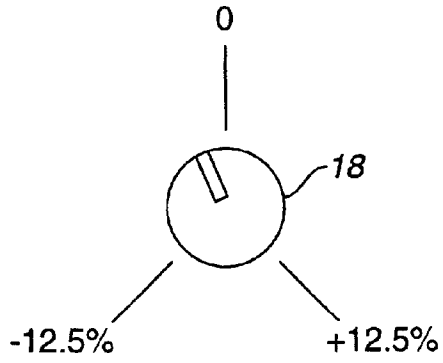


FIG. 5

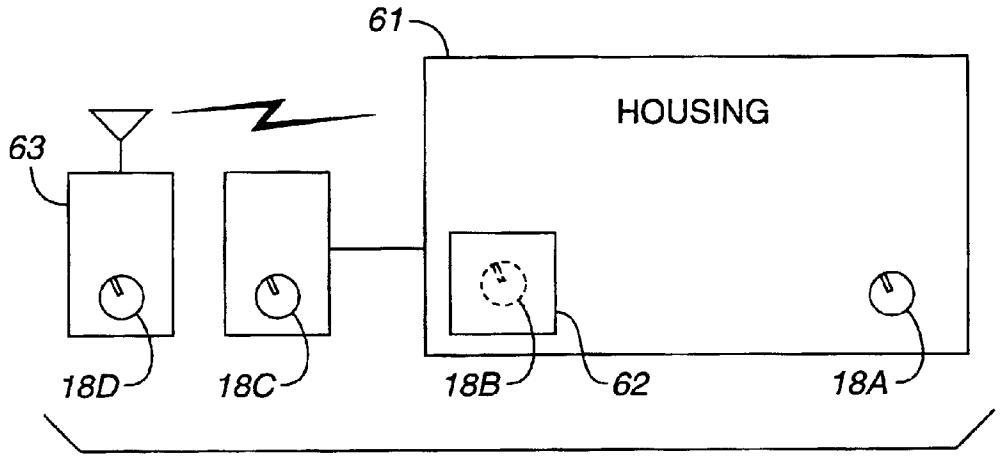


FIG. 6

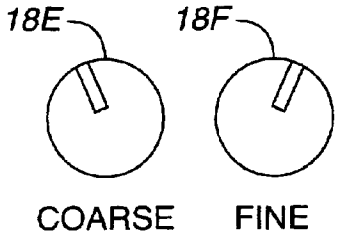


FIG. 7

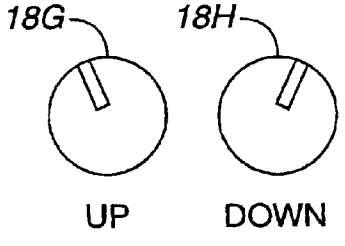


FIG. 8

POST-AUTOMATICALLY DETERMINED USER-MODIFIABLE ACTIVITY PERFORMANCE LIMIT APPARATUS AND METHOD

TECHNICAL FIELD

This invention relates generally to control systems and more particularly to movable barrier control systems.

BACKGROUND

Many control systems are known in the art, including control systems for use with movable barriers such as, for example, garage doors. Many such control systems must be calibrated to a given installed setting in order to better accommodate physical influences that can vary from installation to installation. Some control systems provide a human interface to allow an operator to make the appropriate calibration settings. Other systems utilize sensors and/or processing capability to automatically sense the relevant physical influences and then use such information to automatically calibrate the control system to the particular setting.

Automatic calibration can greatly facilitate ease of installation and operation, contributing to cost effective efficiency, efficacy, and safety. Unfortunately, at least for some applications (such as, for example, moveable barrier operators), automatic calibration often does not provide the calibration most suited to a particular setting. Furthermore, even if properly calibrated in the first instance, the appropriate calibration settings may change over time as the physical conditions change (due to, for example, friction and wear, age, temperature, maintenance, temporary (or permanent) physical impingements, and so forth).

BRIEF DESCRIPTION OF THE DRAWINGS

The above needs are at least partially met through provision of the post-automatically determined user-modifiable activity performance limit apparatus and method described in the following detailed description, particularly when studied in conjunction with the drawings, wherein:

FIG. **1** comprises a block diagram depiction of a control unit embodiment configured in accordance with the invention;

FIG. **2** comprises a flow diagram of a learning mode embodiment configured in accordance with prior art practice;

FIG. **3** comprises an illustrative depiction of zones of travel and corresponding oppositional forces;

FIG. **4** comprises a flow diagram of operating mode embodiments configured in accordance with the invention;

FIG. **5** comprises a detail view of a user interface that illustrates a range of control;

FIG. **6** comprises a block diagram depiction of various embodiments in accordance with the invention;

FIG. **7** comprises a detail view of an alternative embodiment of a user interface in accordance with the invention; and

FIG. **8** comprises a detail view of yet another alternative embodiment of a user interface in accordance with the invention.

Skilled artisans will appreciate that elements in the figures are illustrated for simplicity and clarity and have not necessarily been drawn to scale. For example, the dimensions of some of the elements in the figures may be exaggerated relative to other elements to help to improve understanding of various embodiments of the present invention. Also, many common elements that are not important to an understanding of the invention are not shown for purposes of clarity.

DETAILED DESCRIPTION

Generally speaking, pursuant to these various embodiments, at least one performance limit that corresponds to a particular activity is automatically determined. A human interface is then provided to allow a subsequent post-determination non-automatic adjustment to be made to the automatically determined performance limit by a user. That automatically determined performance limit as subsequently adjusted is then used when later facilitating the particular activity. To provide a more specific illustrative example of the above, the particular activity can be controlled movement of a movable barrier, such as a garage door, by a motor that is itself controlled by a barrier movement control unit. During a learning mode of operation, one or more force thresholds are automatically determined by the barrier movement control unit. A user manipulable force threshold modification control allows a user to adjust the automatically determined force thresholds, which adjusted thresholds are then subsequently used by the barrier movement control unit during a normal mode of operation when moving the barrier.

So configured, the benefits of automatically calibrating the control unit are realized with all of the usual attendant benefits of safety, efficacy, and efficiency. At the same time, a simple relatively intuitive mechanism is provided to allow a user to compensate for physical circumstances that the automatic calibration process cannot otherwise capture (both during initial installation and subsequently). In one embodiment, to prevent a user from inappropriately adjusting the automatically determined calibration value too far, the range of adjustment for the adjustment mechanism is limited. This aids in assuring that the benefits of automatic calibration, including safety benefits, are not defeated by the post-determination adjustment opportunity.

Referring now to the drawings, and particularly to FIG. **1**, various embodiments of a barrier movement control system **10** for use with a movable barrier **11** will be presented to further illustrate these and other inventive concepts. The movable barrier **11** itself can be, for example, a garage door. Such garage doors usually move vertically **12** between opened and closed positions and the examples presented below are based upon such a configuration. It should be understood, though, that these teachings are equally applicable to other activities, including but not limited to horizontally-moving and pivoting movable barriers. A motor **13**, coupled to the movable barrier **11** by a drive apparatus **14** in accordance with well understood prior art technique, effects desired movement of the movable barrier **11** (the drive apparatus **14** can be, for example, a chain or screw driven mechanism or any other drive mechanism as may be appropriate to a given application).

A barrier movement control unit **15** controls operation of the motor **13**. Such a control unit **15** typically includes a processor that constitutes a programmable platform that can be suitably programmed to function in accordance with the embodiments presented herein. In the alternative, additional processing capability and/or dedicated circuitry can be added to known controllers to achieve the desired operability. The barrier movement control unit **15** includes an input,

in this embodiment, for receiving data **17** that reflects sensed forces **16** acting in opposition to powered movement of the movable barrier **11**. Various sensors, including magnetic and optically based sensors, exist to facilitate such sensing and the application of such sensors for these purposes is also well understood in the art. Therefore, additional details will not be presented here for the sake of clarity and brevity. The barrier movement control unit **15** also couples to a user manipulable force threshold modification control **18**. This user control **18** can be, for example, a potentiometer as well understood in the art or, if desired, any other analog or digital input mechanism, including but not limited to DIP switches, analog-to-digital switch interfaces, touch screens, cursor controls, voice actuated mechanisms, and so forth.

Such a control system **10** will also usually have wall mounted switches and/or remote control switches to allow a user to use the control system **10** to control operation of the barrier **11**. Such controls are not shown as they are not especially relevant to the concepts being presented. Similarly, the barrier movement control unit **15** will itself often include other elements, including a radio receiver or transceiver, which elements are again not illustrated for purposes of clarity and brevity.

So configured, such a control system **10** can effect a variety of activities including, pertinent to these teachings, a learning mode and a normal operational mode. The learning mode can be an ordinary prior art approach. Since understanding the learning mode can aid in an understanding of these embodiments, at least parts of an exemplary learning mode **20** will be briefly described with respect to FIG. **2**. During the learning mode **20**, the barrier movement control unit **15** moves **21** the movable barrier **11**, typically from a first position to a second position (for example, from a closed position to an open position). While moving the movable barrier **11**, the barrier movement control unit **15** detects 22 forces that work in opposition to the movement of the movable barrier **11**. This force (or these forces) are quantified and the results are then used to determine 23 one or more force thresholds for subsequent use during normal operations.

Referring momentarily to FIG. **3**, if desired, a plurality of force thresholds can be determined, wherein each force threshold corresponds to a particular zone that the movable barrier **11** traverses during controlled movement. Four such zones are shown for purposes of clarity, though usually more zones than this will be defined for a given garage door setting. As the movable barrier **11** moves through each zone, different forces can and will typically act upon the barrier **11** in full or partial opposition to the intended direction of movement and/or in correspondence with the intended direction of movement. As depicted in FIG. **3**, each of the four zones has a corresponding external force **31**–**34** acting upon the movable barrier **11**. By sensing each force for each zone, a corresponding force threshold can be determined that better corresponds to each zone of movement. Also, separate force thresholds can be determined for each zone to accommodate movement of the movable barrier **11** in both directions of movement (in the case of a typical garage door, these directions of movement being up and down).

Referring again to FIG. **2**, many control systems such as these also optionally determine **24**, during a learning mode **20**, one or more stop limits (that is, movable barrier positions that correspond to an open position and a closed position) that can be subsequently used to inform and facilitate the process of stopping the movable barrier **11** when moving the movable barrier to a desired position. Such stop limits, then, also constitute an example of an automatically determined performance limit that can benefit from the invention.

So configured, in addition to such other calibration events as may be supported during a learning mode of operation, such a control system **10** will automatically empirically determine one or more force thresholds to be used during normal operation of the corresponding movable barrier **11**. As will be shown below, such force thresholds are typically used to ensure that sufficient force is available to move the movable barrier to a desired position, while simultaneously ensuring that movement of the movable barrier **11** will be reversed in the event that the movable barrier **11** comes into contact with an obstacle (such as a person or item of personal property) during movement to a desired position. As noted earlier, these automatically determined force thresholds may, or may not, be appropriate and effective when initially determined. Regardless, over time, physical conditions as impact upon movement of the movable barrier **11** will virtually ensure that these initially determined force thresholds become, permanently or temporarily, inappropriate. When inappropriate, this can result in either incomplete movement of the movable barrier **11** to a desired position and/or in an unsafe operational potential to not reverse when the movable barrier **11** impacts an object.

Referring now to FIG. **4**, an operating mode **40** for such a barrier movement control unit **15** can beneficially include the following embodiments. The thresholds (both force thresholds and stop limits, if desired) as automatically determined during the learning mode **20** are modified **41** by a user directed amount. This modification can occur immediately after the thresholds are initially determined during the learning process or anytime thereafter. Similarly, the modified threshold value(s) can be determined once, stored, and used thereafter during the operating mode **40** or calculated anew (using the previously automatically determined values and the present settings of the user interface **18** as briefly mentioned above and as described in more detail below) as needed.

Optionally, if desired, these modified thresholds can be automatically modified **42** still further. For example, if correct settings for the thresholds are known to vary in a particular way with respect to some physical parameter, such as temperature, then the adjusted automatically determined threshold can be further modified automatically as a function of that parameter. Such automatic dynamic threshold modifications are known in the art and hence additional detail will not be presented here.

During the operating mode **40** the relevant parameters are monitored **43** (either continuously, from time to time, or in response to whatever other trigger event might be used in a given application). In this exemplary embodiment utilizing a barrier movement control unit **11**, forces acting in opposition to the controlled movement of the barrier **11** are monitored **43** (in addition, or in the alternative, stop limits as mentioned above can be monitored). The forces (and/or stop limit indicia) as monitored are compared **44** against the relevant threshold(s) to determine if the threshold has been exceeded. If not, movement of the barrier **11** continues until eventually stop conditions are satisfied **45** and the barrier **11** comes to a controlled stop **46**. When a monitored force level does exceed **44** the adjusted force threshold level, however, movement of the barrier **11** is reversed **47** since this condition likely indicates that an obstacle exists in the pathway of the movable barrier **11**.

As noted above, multiple force thresholds can be used in conjunction with multiple corresponding zones of movement for the movable barrier **11**. In such a system, as the opposing force is monitored **43**, the threshold value that is compared **44** against the monitored force will change from

zone to zone. Again, as is the case with a single threshold value, these original automatically determined threshold values are all post-determination adjustable by a user using the user control **18**.

Notwithstanding the fact that automatically determined threshold values of various kinds are often not optimally determined (either initially or over time due to changing circumstances), such automatically determined values are usually nevertheless relatively accurate. Modifying such values greatly can potentially jeopardize effective and/or safe operation of the controlled device or object. Therefore, pursuant to one embodiment, the range of adjustment as provided to the user via the user control **18** is limited. For example, with reference to FIG. **5**, the total range of adjustment can be limited to some predetermined value, such as, for example, no more than 25% of the total potential applicable force that is available. In the example depicted, such a range is split equally on either side of a zero setting. With such a limit, a user can increase, or decrease, a force threshold setting by up to 12.5%, but no further. This allows a user to fine tune operation of a given controlled activity while also substantially preventing the user from creating an unsafe or significantly inappropriate setting and corresponding operating condition. Other ratios are possible, of course, including apportioning all of the range to either increases or decreases of the force threshold value.

There are various ways to present such a user interface **18**, both to suit differing placement preferences and to accommodate various features and alternatives. For example, referring now to FIG. **6**, the barrier movement control unit **15** (and the motor **13** as well, if desired) can be fully or partially disposed within a housing **61**. The user manipulable threshold modification control **18** can be a potentiometer or other user mechanism mounted on the housing **61** as indicated at reference numeral **18**A, or within the housing **61** as indicated at reference numeral **18**B (when located internally, a door **62** can be provided to protect the control **18**B from being moved or otherwise readjusted inadvertently). The control unit **18** can also be located in a separate unit as indicated by reference numeral **18**C that mounts apart from the housing **61** and that communicates with the barrier movement control unit **15** through, for example, a wired connection. The control unit **18** can also be located in a wireless unit **63** as indicated by reference numeral **18**D (such as, for example, a garage door opener remote control unit). In all of these embodiments, regardless of whether the user control unit **18** is positioned proximal or distal to the barrier movement control unit **15**, a user can readily adjust already automatically determined thresholds that control or influence the operation of the barrier movement control unit **15**.

Those skilled in the art will recognize that a wide variety of modifications, alterations, and combinations can be made with respect to the above described embodiments without departing from the spirit and scope of the invention. For example, with reference to FIG. **7**, two such user control units **18**E and **18**F can be provided. With such a configuration, for example, both course and fine adjustments can be made by the user as described above with respect to the automatically determined threshold values. As another example, and with reference to FIG. **8**, separate control units **18**G and **18**H can be provided to allow individual adjustment of multiple parameters. In the example depicted, one control unit **18**G allows user adjustment of a previously automatically determined force threshold for a movable barrier moving upwardly and a second control unit **18**H allows user adjustment of a previously automatically determined force threshold for a movable barrier moving downwardly. Such modifications, alterations, and combinations are to be viewed as being within the ambit of the inventive concept.

What is claimed is:

1. An apparatus for use with a movable barrier comprising:

at least one motor operably coupleable to the movable barrier;

a barrier movement control unit operably coupled to the at least one motor, which barrier movement control unit includes:

a processor operably coupled to receive information regarding at least some forces acting upon the movable barrier when the movable barrier is moving and being arranged and configured to automatically determine at least one force threshold during a first mode of operation for use by the barrier movement control unit when controlling the motor in a second mode of operation; and

a user manipulable force threshold modification control having an output that provides force threshold modification information for use by the barrier movement control unit when controlling the motor in the second mode of operation.

2. The apparatus of claim **1** wherein the user manipulable force threshold modification control comprises at least one potentiometer.

3. The apparatus of claim **2** wherein the user manipulable force threshold modification control comprises at least two potentiometers.

4. The apparatus of claim **2** and further comprising a housing to at least partially house the at least one motor and the barrier movement control unit.

5. The apparatus of claim **4** wherein the user manipulable force threshold modification control is disposed proximal to the housing.

6. The apparatus of claim **4** wherein a portion of the user manipulable force threshold modification control is disposed distal to the housing.

7. The apparatus of claim **6** wherein a portion of the user manipulable force threshold modification control is disposed proximal to a portable remote control device, which remote control device communicates with the barrier movement control unit.

8. The apparatus of claim **1** wherein the processor is further arranged and configured to automatically determine a plurality of the force thresholds during the first mode of operation.

9. The apparatus of claim **1** wherein the first mode of operation comprises a learning mode of operation.

10. The apparatus of claim **1** wherein the second mode of operation comprises moving the movable barrier from an open position to a closed position.

11. The apparatus of claim **1** wherein the second mode of operation comprises moving the movable barrier from a closed position to an open position.

12. The apparatus of claim **1** wherein the second mode of operation comprises moving the movable barrier from a first position to a second position.

13. The apparatus of claim **12** wherein the second mode of operation includes using the at least one force threshold to determine whether the movable barrier should be moved in a reverse direction.

14. The apparatus of claim **1** wherein the processor includes learning means for sensing the at least some forces acting upon the movable barrier when the movable barrier

moves during a learning mode of operation to provide sensed forces information and utilizes at least some of the sensed forces information to determine the at least one force threshold.

15. The apparatus of claim **14** wherein the learning means senses at least one force acting in opposition to controlled movement of the movable barrier.

16. The apparatus of claim **15** wherein the learning means senses the at least one force acting in opposition to controlled movement of the movable barrier a plurality of times during the controlled movement of the movable barrier.

17. The apparatus of claim **1** wherein the user manipulable force threshold modification control is limited such that a range of force threshold modification information as provided at the output of the user manipulable force threshold modification control comprises less than 25 percent of total potential applicable force.

18. The apparatus of claim **1** wherein the processor is further arranged and configured to automatically determine a plurality of force thresholds during the first mode of operation with each of the plurality of force thresholds corresponding to at least partially discrete sections of barrier movement, and wherein the user manipulable force threshold modification control has an output that provides force threshold modification information for use by the barrier movement control unit with at least some of the plurality of force thresholds when controlling the motor in the second mode of operation.

19. A movable barrier control system for use with a barrier that is movable between a first position and a second position, the movable barrier control system comprising:

a motor operably coupleable to the movable barrier;

a sensor having an output that provides data that corresponds to at least some forces acting upon the movable barrier when the movable barrier is moving;

a barrier movement control unit operably coupled to the motor, which barrier movement control unit includes:

a processor operably coupled to the sensor output and being arranged and configured to automatically determine at least one force threshold during a learning operating mode for use by the barrier movement control unit when controlling the motor in a subsequent barrier movement mode of operation; and

a user manipulable force threshold modification control having an output that provides force threshold modification information for use by the barrier movement control unit when controlling the motor in the subsequent barrier movement mode of operation, wherein the user manipulable force threshold modification control is limited such that a range of force threshold modification information as provided at the output of the user manipulable force threshold modification control comprises less than 25 percent of total potential applicable force.

20. The movable barrier control system of claim **19** wherein the barrier comprises a garage door.

21. The movable barrier control system of claim **19** wherein the sensor comprises at least one of an optical sensor and a magnetic sensor.

22. A garage door control system for use with a garage door that is movable between a first position and a second position, the garage door control system comprising:

a motor and drive apparatus operably coupleable to the garage door;

sensing means for sensing movement of at least part of the motor and drive apparatus;

user input means for providing force modification information;

control means operably coupled to the motor and drive apparatus, the sensing means, and the user input means for;

in a first mode of operation:

causing the motor and drive apparatus to move the garage door from the first position to the second position;

automatically measuring at least one force acting in opposition to the garage door when the garage door is moving from the first position to the second position to provide measured force information;

automatically using the measured force information to establish at least one maximum force threshold; and

in a second mode of operation;

modifying the at least one maximum force threshold in response to the force modification information to provide at least one modified maximum force threshold;

automatically using the at least one modified maximum force threshold when moving the garage door between the first position and the second position.

23. The garage door control system of claim **22** wherein the control means, in the first mode of operation, further automatically measures at least one distance as traversed by the garage door when moving from the first position and the second position to provide measured distance information and uses the measured distance information to establish a stop limit.

24. The garage door control system of claim **23** wherein the control means, in the second mode of operation, further automatically uses the stop limit to stop movement of the garage door when moving the garage door between the first position and the second position.

25. The garage door control system of claim **24** and further comprising second user input means for providing stop limit modification information and wherein the control means, in the second mode of operation, modifies the stop limit in response to the stop limit modification information to provide a modified stop limit and then automatically uses the modified stop limit when moving the garage door between the first position and the second position.

26. The garage door control system of claim **22** wherein the control means will only modify the at least one maximum force threshold in response to the force modification information by an amount that does not exceed 25 percent of the available potential force.

27. A method comprising:

moving a movable barrier from a first position to a second position;

automatically sensing at least one force acting in opposition to movement of the movable barrier when the movable barrier is moving from the first position to the second position to provide sensed force information;

automatically using the sensed force information to determine a maximum force threshold for subsequent use when moving the movable barrier;

sensing user input comprising a maximum force threshold modification;

using the maximum force threshold modification to modify the maximum force threshold for subsequent use in place of the maximum force threshold when moving the movable barrier.

28. The method of claim **27** wherein automatically sensing at least one force acting in opposition to movement of the movable barrier includes automatically sensing at least

one force acting in opposition to movement of the movable barrier a plurality of times when the movable barrier is moving from the first position to the second position to provide a plurality of discrete sensed force information items.

29. The method of claim **28** wherein automatically using the sensed force information to determine a maximum force threshold includes automatically using at least some of the plurality of discrete sensed force information items to determine a plurality of maximum force thresholds for subsequent use when moving the movable barrier.

30. The method of claim **29** wherein using the maximum force threshold modification to modify the maximum force threshold includes using the maximum force threshold modification to modify at least one of the plurality of maximum force thresholds for subsequent use in place of the plurality of maximum force thresholds when moving the movable barrier.

31. A method comprising:

moving a movable barrier from a first position to a second position;

automatically sensing at least one force acting in opposition to movement of the movable barrier when the movable barrier is moving from the first position to the second position to provide first sensed force information;

automatically using the first sensed force information to determine a first maximum force threshold for subsequent use when moving the movable barrier to the second position;

sensing first user input comprising a first maximum force threshold modification;

using the first maximum force threshold modification to modify the first maximum force threshold for subsequent use in place of the first maximum force threshold when moving the movable barrier to the second position;

moving a movable barrier from the second position to the first position;

automatically sensing at least one force acting in opposition to movement of the movable barrier when the movable barrier is moving from the second position to the first position to provide second sensed force information;

automatically using the second sensed force information to determine a second maximum force threshold for subsequent use when moving the movable barrier to the first position;

sensing second user input comprising a second maximum force threshold modification;

using the second maximum force threshold modification to modify the second maximum force threshold for subsequent use in place of the second maximum force threshold when moving the movable barrier to the first position.

32. A method comprising:

automatically determining at least one performance limit that corresponds to a particular activity;

providing a post-determination human interface to permit non-automatic adjustment, within a limited range, of the at least one performance limit;

providing an adjusted at least one performance limit in response to a post-determination non-automatic adjustment of the at least one performance limit;

automatically using the adjusted at least one performance limit when facilitating the particular activity.

33. A method for use with movable barrier operators, comprising:

automatically determining at least one performance limit that corresponds to a particular movable barrier operator activity;

providing a post-determination human interface to permit non-automatic adjustment, within a limited range, of the at least one performance limit;

providing an adjusted at least one performance limit in response to a post-determination non-automatic adjustment of the at least one performance limit;

automatically using the adjusted at least one performance limit when facilitating the particular movable barrier operator activity.

34. The method of claim **33** wherein automatically determining at least one performance limit that corresponds to a particular movable barrier operator activity includes automatically determining at least one performance limit that corresponds to a stop limit for a movable barrier.

35. The method of claim **33** wherein automatically determining at least one performance limit that corresponds to a particular movable barrier operator activity includes automatically determining at least one performance limit that corresponds to a force limit for a movable barrier.

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