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(56) Documents Cited
WO 2000/073114 A1 DE 019859605 A1
JP 110321599 A US 6211590 A

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(54) Abstract Title
Electric control system for parking brake application in a moving vehicle

(57) An electric parking brake control system for dynamic vehicle operation comprises a control switch and a parking brake mechanism, application of said switch triggering a rise in park brake force with time as applied to the vehicle by the mechanism. The rise may be exponential or linear, preceded by a step increase to obtain brake contact, while the brake may be electrically powered. Thus the parking brake may be manually applied by a driver while the vehicle is moving, such as in emergency conditions. The switch may have a neutral position in which force is maintained at a steady state. Throttle depression may prevent application of the parking brake or trigger full brake release. Triggering of rear brake lamps and/or audible warnings are disclosed, and the switch may be in the form of a park brake lever with displacement sensors.

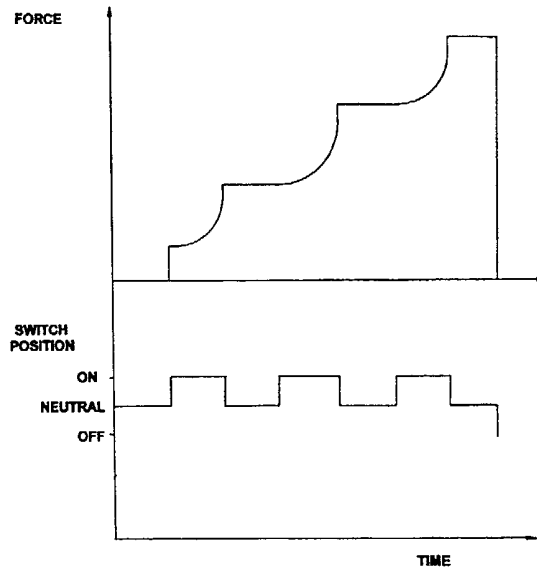


Fig. 1

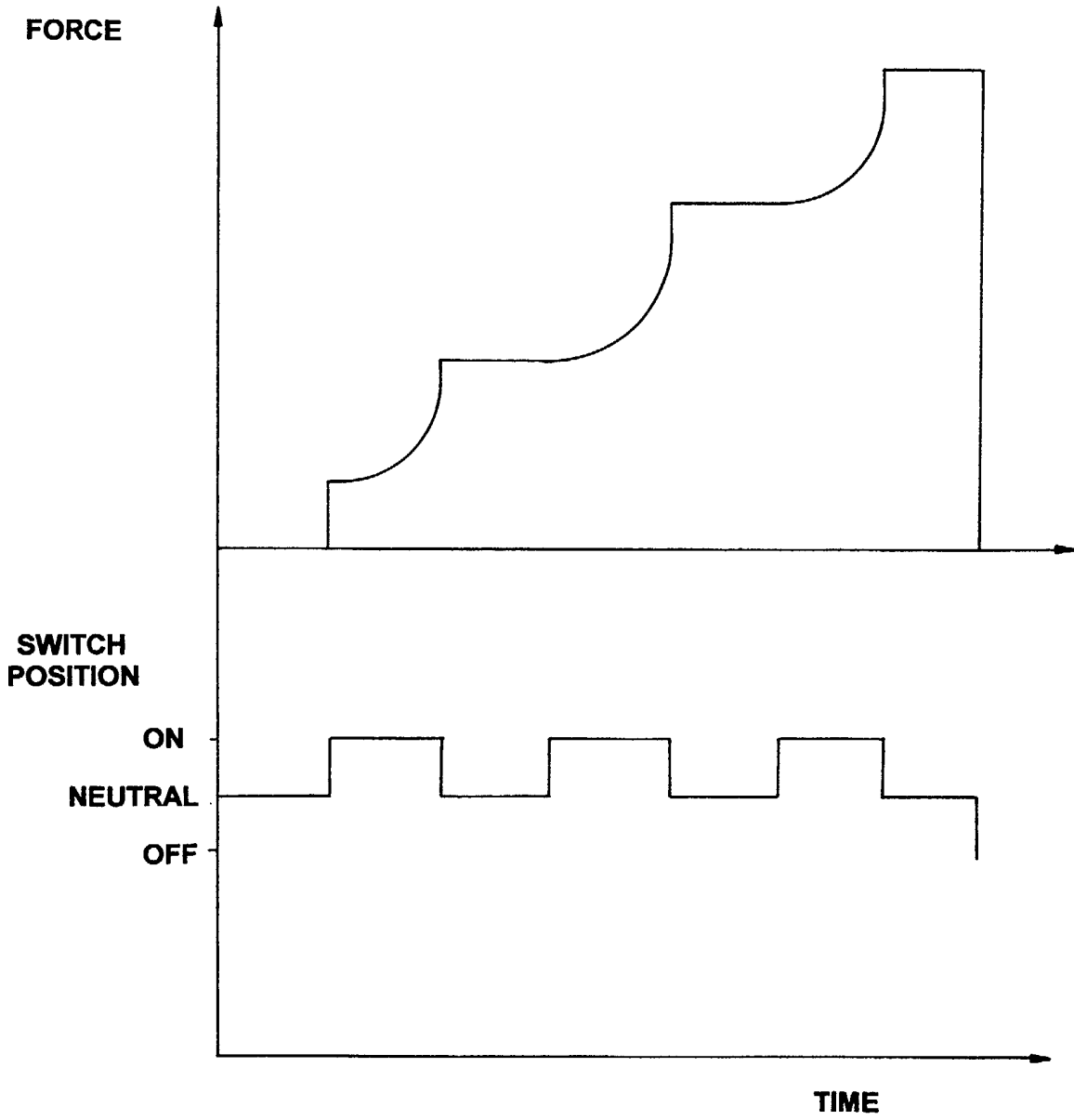


Fig. 1

ELECTRIC PARKING BRAKE

The present invention relates to an electrically powered parking brake. In particular, the present invention relates to a system and method for controlling the parking brake while a vehicle is still moving, for example, for emergency use.

Almost all vehicles have a parking brake mechanism, and most of these vehicles have a hand lever or foot activated lever for actuating the parking brake mechanism. Typically, these levers are attached to a cable that causes displacement of the cable and operation of the attached parking brake mechanism.

The mechanisms underlying vehicle technology are constantly revised and updated in the light of consumer preferences, vehicle presentation, packaging, marketing and increased safety obligations. In line with this, electric parking brake systems have been proposed as an alternative to the conventional manual parking brake mechanism. These have comprised an electric control means to signal the application and release of the parking brake mechanism in response to a predetermined combination of vehicle operating conditions.

One electric parking brake assembly as disclosed suggests a system whereby the parking brake is actuated on depression of the foot brake together with a signal that the vehicle is stationary. Another assembly as disclosed suggests a system whereby the parking brake is actuated by a combination of foot brake application and push button operation. In such disclosures the parking brake is de-actuated by accelerator depression and/or clutch depression and/or shift gear selection.

It is an important requirement with electrically operated parking brake systems with automatic functioning as described *supra*, that control over the system can be *manually* implemented by the driver of the vehicle especially when the vehicle is still moving, for example, under emergency conditions.

It is therefore an object of the present invention to provide an electric parking brake control system that specifically operates under dynamic vehicle operation. As used herein, dynamic vehicle operation (or dynamic vehicle conditions) means when the vehicle is still moving, i.e. the velocity of the vehicle is greater than zero. It is another object of the present invention to provide an electric parking brake control system that ensures maximised safety for the driver. It is yet another object of the invention to provide an electric parking brake control system that provides a sensitive braking response to the driver's requirements. It is yet still another object of the invention to provide an electric parking brake control system wherein the braking force applied can be easily and carefully controlled by the driver.

Accordingly, in one aspect the invention provides an electric parking brake control system for dynamic vehicle operation comprising a control switch and a parking brake mechanism, application of said switch triggering a rise in park brake force with time as applied to the vehicle from said parking brake mechanism.

Preferably, the rise in force is exponential.

In one embodiment the rise in force is linear.

Preferably, the application of said switch triggers an initial step in park brake force prior to the exponential or linear rise. The initial step in force is preferential to obtain brake pad/brake disk contact.

In one embodiment, sustained application of the switch triggers a progressive stepping of force at a predetermined time interval. This affords the driver easy (intuitive) switch operation with the stepping in force creating a feedback to the driver that the system is applying increased braking.

Preferably, the control switch has a neutral position and movement of said switch from the applied position to the neutral position maintains the park brake force at a steady state level.

Suitably, re-application of the switch from the neutral position triggers a linear or an exponential rise in force from said steady state level.

In one embodiment, re-application of the switch from the neutral position triggers an initial step in force from said steady state level prior to a linear or an exponential rise with time.

Thus, the control system affords a driver fine force control is required. Figure 1 illustrates a graph showing the brake force applied over time as the switch is applied, moved to a neutral position, and re-applied. In this example, the rise in force after the initial immediate increase, is exponential. If the switch is moved to the off position, the parking brake force is fully released.

Preferably, the electric parking brake control system is linked to the throttle of the vehicle.

Thus in one embodiment, any depression (or positive application) of the throttle prevents the application of said switch from triggering a park brake force.

Preferably, depression of the throttle while a park brake force is applied triggers full release of the park brake force.

In one embodiment, triggering of the brake park force actuates rear brake lamps on the vehicle as a warning to other vehicles.

In another embodiment, triggering of the park brake force actuates an audible warning signal. The audible warning signal may take the form of a beep or chime

which may be repetitive; the frequency of the beeps or chimes may be proportional to the force applied.

An audible warning may also be actuated if the switch is applied but the brake force is prevented because the throttle is depressed, or the park brake force is released as a result of throttle depression.

In another embodiment, the control switch may take the form of a park brake *lever* comprising an analogue sensor such that park brake force and/or the rate of application of said force is controlled by the extent of lever displacement.

Typically, said lever comprises discrete switch sensors at the extremes of lever displacement to indicate full apply/release of brake force.

In another aspect, the invention provides a vehicle comprising an electric parking brake control system as defined *supra*.

In still another embodiment the invention provides a method of applying a park brake force to a vehicle comprising the use of an electric park brake system as defined *supra*.

It will be understood that the present disclosure is for the purpose of illustration only and the invention extends to modifications, variations and improvements thereto.

The application of which this description and claims form part may be used as a basis for priority in respect of any subsequent application. The claims of such subsequent application may be directed to any feature or combination of features described therein. They may take the form of product, method or use claims and may include, by way of example and without limitation, one or more of the following claims:

Claims:-

1. An electric parking brake control system for dynamic vehicle operation comprising a control switch and a parking brake mechanism, application of said switch triggering a rise in park brake force with time as applied to the vehicle from said parking brake mechanism.
2. An electric parking brake control system according to claim 1 wherein the rise is exponential.
3. An electric parking brake control system according to claim 1 wherein the rise in force is linear.
4. An electric parking brake control system according to any one of claims 1 to 3 wherein application of said switch triggers an initial step in park brake force prior to the rise.
5. An electric parking brake control system according to any one of the preceding claims wherein sustained application of the switch triggers a progressive stepping of force at a predetermined time interval.
6. An electric parking brake control system according to any one of the preceding claims wherein said switch has a neutral position and movement of said switch from the applied position to the neutral position maintains the park brake force at a steady state level.
7. An electric parking brake control system according to claim 6 wherein re-application of switch from the neutral position triggers a linear or an exponential rise in force from said steady state level with time.

8. An electric parking brake control system according to claim 6 wherein re-application of the switch from the neutral position triggers an initial step in force from said steady state level prior to a linear or an exponential with time.
9. An electric parking brake control system according to any one of the preceding claims which is linked to the throttle of the vehicle.
10. An electric parking brake control system according to claim 8 wherein any depression of the throttle prevents the application of said switch from triggering a park brake force.
11. An electric parking brake control system according to claim 9 or claim 10 wherein depression of the throttle while a park brake force is applied triggers full release of the park brake force.
12. An electric parking brake control system according to any one of the preceding claims wherein the switch takes the form of a park brake lever comprising an analogue sensor such that park brake force and/or the rate of application of said force is controlled by the extent of lever displacement.
13. An electric parking brake control system according to claim 12 wherein said lever comprises discrete switch sensors at the extremes of lever displacement to indicate full apply/release of brake force.
14. An electric parking brake control system substantially as described hereinabove.
15. A vehicle comprising an electric parking brake control system according to any one of the preceding claims.

16. A method of applying a park brake force to a vehicle comprising the use of an electric park brake system according to any one of claims 1 to 14.

17. A method of applying a park brake force to a vehicle substantially as described hereinabove.



INVESTOR IN PEOPLE

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Claims searched: 1-13, 15, 16

Examiner: Terence Newhouse
Date of search: 10 September 2001

Patents Act 1977 Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): F2E(EQ); F2F(FA,FC)

Int Cl (Ed.7): B60T 7/08 7/12 13/74

Other: ONLINE: EPODOC, JAPIO, WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	WO 00/73114 A1 (CONTINENTAL TEVES), see also WPI abstract Accession No. 2001-049919[06], first paragraph on page 8 and figs 2 & 3 noting rise in target brake force FS_soll over time when switch S1 is applied	1 at least
X	US 6211590 B1 (STROMAG), see col 3 line 51 to col 4 line 6 and switch in fig 3	1 at least
X	DE 19859605 A1 (CONTINENTAL TEVES), see also WPI abstract Accession No. 2000-466915[41] and fig 2 noting brake force curve passing through F ₁ & F ₂ increasing with time	1 at least
X	JP 110321599 A (SUMITOMO), see fig 1 noting parking switch 5 and also WPI abstract Accession No. 2000-068239[06] noting increasing brake force	1 at least

X Document indicating lack of novelty or inventive step

Y Document indicating lack of inventive step if combined with one or more other documents of same category.

& Member of the same patent family

A Document indicating technological background and/or state of the art.

P Document published on or after the declared priority date but before the filing date of this invention.

E Patent document published on or after, but with priority date earlier than, the filing date of this application.