COMMONWEALTH OF AUSTRALIA

Patents Act 1952

APPLICATION FOR A STANDARD PATENT

I/WE

MITSUBISHI Jidosha Kogyo Kabushiki Kaisha,
a Japanese corporation of No. 33-8, 5-Chome, Shiba,
Minato-Ku, Tokyo, Japan

hereby apply for the grant of a Standard Patent for an
invention entitled

Electronically controlled suspension system

which is described in the accompanying complete specification.

This application is made under the provision of Part
XVI of the Patents Act 1952 and is based on an application
for a patent or similar protection made

in Japan on 19 August 1983

No. 58-127276

Our address for service is: F.B. RICE & Co.,
26A Montague Street,
Balmain, NSW 2041

Dated this 23 day of July 1984.

MITSUBISHI Jidosha Kogyo Kabushiki
Kaiisha.

By: Patent Attorney

To: The Commissioner of Patents

COMMONWEALTH OF AUSTRALIA

F.B. RICE & Co.,
Patent Attorneys,
Sydney
Commonwealth of Australia  
The Patents Act 1952  
DECLARATION IN SUPPORT  
31110/34  

In support of the (Convention) Application made by:  
MITSUBISHI JIDOSHA KOGYO  
KABUSHIKI KAISHA  

for a patent for an invention entitled:  
Electronic controlled suspension System  

I (we) Shinji Seki,  
of and care of the applicant company do solemnly and sincerely declare as follows:  

(a) I am (we are) the applicant(s) for the patent  
(b) I am (we are) authorised by the applicant(s) for the patent to make this declaration on its behalf.  

The basic application, as defined by section 141(1) of the Act was made  
in Japan  
on 19 August 1983  

by Mitsubishi Jidosha Kogyo Kabushiki Kaisha  

The basic application referred to in this paragraph is the first application made in a Convention country in respect of the invention the subject of the application.  

or  
Naotake Kumagai and Minoru Tatemoto both of C/- Mitsubishi Jidosha Kogyo Kabushiki Kaisha Joyosha Gijutsu Center, No. 1, Aza-Nakashinkiri, Hashimecho, Okazaki-Shi, Aichi-Ken, Japan  

are the actual inventor(s) of the invention and the facts upon which  
the applicant company  
is (are) entitled to make the application are as follows:  
The applicant is a person who would, if a patent were granted upon an application made by the actual inventors, be entitled to have the patent assigned to it, under the provisions of Section 34(1)(fa) of the Act  

Declared at Tokyo  
this 26th day of June 1984  

Signed  
Shinji SEKI  
Status representative vice-president  

Declarant's Name 
F.B. RICE & CO PATENT ATTORNEYS
ELECTRONICALLY CONTROLLED SUSPENSION SYSTEM

MITSUBISHI JIDOSHA KOGYO KABUSHIKI KAISHA

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NAOTAKE KUMAGAI AND MINORU TATEMOTO
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Claim

(1) In an electronically controlled suspension system equipped with a mode selection switch that permits an alternative choice between a hard mode that puts a vehicle suspension in a hard state and an automatic mode that automatically puts the suspension into a soft state or a hard state depending upon the vehicle conditions, the improvement which comprises control means putting the suspension in the automatic mode when the engine key switch of a vehicle is turned on in preference to the mode to which said mode selection switch has been set.
Complete Specification for the invention entitled:

Electronically controlled suspension system

The following statement is a full description of this invention including the best method of performing it known to us:
SPECIFICATION

Title of the Invention

Electronically Controlled Suspension System

Background of the Invention

Field of the Invention:

This invention relates to an electronically controlled suspension system which is designed to take on an automatic mode when the engine key switch is turned on.

Description of the Prior Art:

Electronically controlled automobile suspensions have been proposed that are electronically switched into a hard and a soft condition. This type of electronically controlled suspensions are equipped with a mode selection switch that permits an alternative choice between a hard mode that puts the suspension in the hard state and an automatic mode (hereinafter abbreviated as "auto mode") that automatically puts the suspension into the soft or hard state depending upon the conditions of automobile. When the auto mode is chosen, the suspension is normally in the soft state. It is only when a predetermined condition or conditions are met (for example, when the car speed exceeds a
given limit) that the suspension automatically switches into a hard state. This provides a comfortable ride. The hard mode is chosen where a hard suspension is preferred as in running over such bumpy roads as those passing over mountains or by a driver who prefers his car to run at all times on a hard suspension rather than on a soft one.

When a car having this type of electronically controlled suspension equipped with a mode selection switch is started by turning on the engine key switch (KEY-CN), however, the car will continue to run on the suspension kept in a hard state if the mode selection switch is set to the hard mode, unless or until the driver turns the switch to the auto mode. In this state, even with a driver who prefers the more comfortable auto mode to the hard mode, the car will run on the hard suspension even under such road conditions as might probably be run with the soft suspension if the switch were set to the auto mode, unless the driver notices that the switch is at the hard mode, putting the driver to great discomfort.

Summary of the Invention

This invention has been made to obviate the aforementioned problems with the conventional electron-
ically controlled suspensions. The object of this invention is to provide an electronically controlled suspension system that assures improved riding comfort by making provision to make sure that the suspension is held in the auto mode, in which the suspension is normally kept in a soft state except under some predetermined conditions, when the engine key switch is turned on.

Accordingly, the suspension system according to this invention is designed to assume the auto mode in which the suspension is held in a soft state except under some predetermined conditions to ensure a comfortable ride, irrespective of the mode to which the mode selection switch has been set, when the key switch is turned on.

Brief Description of the Drawings

The accompanying drawings illustrate a preferred embodiment of the electronically controlled suspension system according to this invention. Fig. 1 is a schematic illustration of a suspension system according to this invention. Fig. 2 shows a control circuit of the suspension system. Fig. 3 is a flow chart illustrating how the suspension system is controlled.
Detailed Description of the Preferred Embodiment

In the following is described a preferred embodiment of the electronically controlled suspension system according to this invention by reference to the accompanying drawings.

In Fig. 1, reference numeral 1 designates a suspension positioned between a wheel 2 and a car body 3. The suspension 1 consists of a cylinder 4 supporting the wheel 2, a piston rod 6 having a piston 5 fitted in the cylinder 4, a control rod 8 that actuates a valve 7 to open and close an orifice 5a in the piston 5, and a drive mechanism 9 that puts the control rod 8 into action. When the drive mechanism 9 causes the valve 7 to close the orifice 5a in the piston 5, the suspension 1 goes into a hard state. When the orifice 5a is open, the suspension 1 goes into a soft state. The suspension 1 is of the known type.

In Fig. 2, reference numeral 11 denotes a hard/auto (H/A) changeover switch functioning as a mode selection switch that makes an alternative choice between a hard and auto mode to put the suspension in the desired condition. The hard mode is chosen when the H/A changeover switch 11 is turned on, and the auto mode when the switch 11 is off. The state of the H/A changeover switch is inputted in a microcom-
puter 12 that serves as a means to control the drive mechanism 9. Also inputted in the microcomputer 12 is a KEY-ON signal that is outputted when the engine key switch (not shown) is turned on.

A hard-mode indicating lamp 13 and an auto-mode indicating lamp 14 are provided under the control of the microcomputer 12 to indicate when the turn signal auto motor is shown by the H/W control unit 12.

Here, Q_H designates a transistor that turns on and off the hard-mode indicating lamp 13, Q_A a transistor turning on and off the auto-mode indicating lamp 14, R_1 and R_2 resistors, and reference numeral 15 indicates an inverter.

That is, when the output line A goes low (or is at logic 0), the transistor Q_H turns off to turn off the hard-mode indicating lamp 13.

On the other hand, when the output line A goes high (or is at logic 1), the transistor Q_A turns off to turn on the auto-mode indicating lamp 14.

As the electronically controlled suspension system of this invention is constructed as described above, turning on the A/C engine switch (not shown) turns the KEY-ON signal is inputted in the microcomputer 12, whereupon the processing steps shown in the flowchart of Fig. 3, which are stored in the micro-
computer 12, are carried out.

To be more specific, step S₁ sets the suspension to the auto mode or puts the suspension into a soft condition. At the same time, the logic level of the output line A becomes "1" to put on the auto-mode indicating lamp 14.

As a consequence, the suspension is in the soft state when the car is started, assuring a smooth and comfortable start.

At step S₂, the operation signal of the H/A changeover switch 11 is fed to the microcomputer 12 to check the condition of the switch 11. Then at step S₃, it is determined if the operation signal of the H/A changeover switch 11 has changed from logic 0 (the auto mode) to logic 1 (the hard mode). If it is found here that the operation signal has changed (i.e., when the check result is affirmative or "YES") or, in other words, the hard mode was chosen by the actuation of the H/A changeover switch 11 after the engine key switch had been turned on, the processing proceeds to step S₄ to put the suspension into a hard state. Then, the logic level of the output line A becomes "0" to put on the hard-mode indicating lamp 13.

Meanwhile, if the result obtained at step S₃ is negative ("NO"), indicating that no change has taken place, the operation loops back to step S₂ to repeat the operation.
CLAIMS
THE CLAIMS FOR THE INVENTION ARE AS FOLLOWS:

(1) In an electronically controlled suspension system equipped with a load cell, a control system that permits an alternative selection between a hard mode and an automatic mode, and automatically permits the suspension into a soft mode when it is determined by a sensor in the vehicle's condition, and improvement which suspends a rear wheel of said vehicle in the automatic mode by pressing a button on a control panel, and permits controlling the vehicle's condition.
indicating lamp that lights on when the suspension is in the hard mode.

(5) The improvement according to claim 3, in which said mode indicating lamp is an automatic-mode indicating lamp that lights on when the suspension is in the automatic mode.

Dated this 23 day of July 1984.

MITSUBISHI Jidosha Kogyo Kabushiki Kaisha,

Patent Attorneys for the Applicant:

F.H. RICE & Co.
FIG. 3

START

SET TO AUTO MODE

CHECK H/A CHANGEOVER SWITCH

HAS OUTPUT LINE LOGIC CHANGED FROM "0" TO "1"?

YES

SWITCH TO HARD MODE

NO

S1

S2

S3

S4