CONVENTION
APPLICATION FOR A PATENT

We

NISSAN MOTOR COMPANY, LIMITED, of No. 2, Takara-machi,
Kanagawa-ku, Yokohama City, Japan

APPLICATION ACCEPTED AND AMENDMENT:

ALLOWED 20/12/78

hereby apply for the grant of a Patent for an invention entitled "Parking brake mechanism for motor vehicle equipped with automatic transmission"

which is described in the accompanying complete specification.

This application is made under the provisions of Part XVI of the Patents Act 1952 and is based on an application for a patent or similar protection made in Japan on 5th April 1976 (51-37063)

Our address for service is: F. B. Rice & Co., 101 Mort St., Balmain, NSW 2041

Dated this 4th day of April 1977

NISSAN MOTOR COMPANY, LIMITED

by

Patent Attorney

To: The Commissioner of Patents, Commonwealth of Australia.

DECLARATION IN SUPPORT OF
AN APPLICATION
A CONVENTION APPLICATION FOR A
PATENT OR PATENT OF ADDITION

In support of the Convention Application made by

NISSAN MOTOR COMPANY, LIMITED

for a patent for an invention entitled "Parking brake mechanism for motor vehicle equipped with automatic transmission"

I, Dr. RYOICHI NAKAGAWA, Executive Managing Director, of and on behalf of the applicant company do solemnly and sincerely declare as follows:

(1) I am authorised by NISSAN MOTOR COMPANY, LIMITED the applicant for the patent to make this declaration on its behalf.

(2) The basic application as defined by Section 141 of the Act was made in Japan on 5th April 1976 by the present applicant company

(3) TAMIO KAWAMOTO, of No. 1218-6, Fuchinobe, Sagamihara City, Japan is the actual inventor of the invention and the facts upon which the applicant company is entitled to make the application are as follows:

The applicant company is the assignee of the invention from the said actual inventors.

The basic application referred to in paragraph 2 of this Declaration is the first application made in a Convention country in respect of the invention the subject of the application.

Declared at YOKOHAMA CITY 25th day of March 1977

NISSAN MOTOR COMPANY, LIMITED

By Ryoichi Nakagawa, Eng. Dr.
Executive Managing Director

F. B. RICE & CO.,
Patent Attorneys
CLAIM 1. A parking brake mechanism for a motor vehicle transmission having a transmission output shaft, comprising a brake gear secured to said output shaft to rotate therewith, a brake pawl mounted for rotation about a first axis and carrying a tooth engageable with said brake gear, first means for biasing said brake pawl in a direction to be disengaged from said brake gear, a cam plate connected to said brake pawl for rotation therewith about said first axis and for rotation relative to said brake pawl about a second axis, a manually operable and axially movable control rod having a raised portion with a wedge surface which is engageable with said cam plate to actuate the cam plate, and a second biasing means for biasing said cam plate to rotate about said second axis in a first direction toward engagement of said cam plate with said wedge surface, which is characterised in that said wedge surface of said control rod includes first and second inclined sections which are engageable with said cam plate to cause the rotation of said cam plate about said second axis in a direction opposite to said first direction against the bias of said second biasing means and the rotation of said cam plate about said first axis in a direction to permit...
the brake pawl to be brought into engagement with said brake gear, respectively, the inclination angle of said first section with respect to the longitudinal axis of said control rod being larger than that of said second inclined section.
The following statement is a full description of this invention including the best method of performing it known to us:—
The present invention relates in general to brakes, and more particularly to a parking brake mechanism for use with an automotive automatic power transmission.

As well known in the art, motor vehicles having automatic power transmissions are usually equipped with parking brake mechanisms which are capable of anchoring output shafts of the power transmissions. However, these parking brake mechanisms are constructed bulky due to their complicated constructions thereby requiring relatively big mounting spaces in the transmissions.

Therefore, it is an object of the present invention to provide a novel and improved parking brake mechanism which is constructed compact in size thereby requiring a minimum amount of space for accommodation in a transmission housing.

It is another object of the present invention to provide an improved parking brake mechanism in which the release operation thereof allowing the free rotation of the transmission output shaft is readily made without requiring big force.

It is still another object of the present invention to provide an improved parking brake mechanism
which can maintain its braking operation against the transmission output shaft even when the output shaft is strongly urged to rotate because of standing of a vehicle equipped with the mechanism on a steep slope.

According to the present invention, there is provided a parking brake mechanism for a motor vehicle transmission having a transmission output shaft, comprising a brake gear secured to the output shaft to rotate therewith, a brake pawl mounted for rotation about a first axis and carrying a tooth engageable with the brake gear, first means for biasing the brake pawl in a direction to be disengaged from the brake gear, a cam plate connected to the brake pawl for rotation therewith about the first axis and for rotation relative to the brake pawl about a second axis, a manually operable and axially movable control rod having a raised portion with a wedge surface, which is engageable with said cam plate to actuate the cam plate, and second biasing means for biasing the cam plate to rotate about the second axis in a first direction toward engagement of the cam plate with the wedge surface, which is characterized in that the wedge surface of the manually operable control rod includes first and second inclined sections which are engageable with the cam plate to cause the rotation of the cam plate about the second axis in a direction opposite to the first direction against the bias of the second biasing means and the rotation of the cam plate about the first axis in a direction to permit the brake pawl to be brought into engagement with the brake gear, respectively, the inclination angle of the first inclined section with respect to the axis of the
control rod being larger than that of the second inclined section.

Other objects and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a partial cross sectional view of a motor vehicle automatic power transmission equipped with an improved parking brake mechanism according to the present invention;

Fig. 2 is a partial sectional view taken along the line II-II of Fig. 1, showing the parking brake mechanism;

Fig. 3 is an exploded view showing the individual components of the parking brake mechanism shown in Fig. 2;

Fig. 4 is a perspective view of a return spring employed in the parking brake mechanism;

Fig. 5 is a plan view of a cam plate employed in the parking brake mechanism of Fig. 1;

Fig. 6 is a sectional view taken along the line VI-VI of Fig. 5;

Fig. 7 is a plan view of a modified cam plate; and
Figs. 8A to 8C are views showing the relationship between the cam plate sliding on a brake pawl and a control rod under different operating conditions.

Referring to Fig. 1 of the drawings, there is illustrated an automatic power transmission which is generally designated by the numeral 10 and includes therein an improved parking brake mechanism according to the present invention.

The transmission 10 generally comprises a shift gear housing 12, a transmission proper casing 14, a transmission tailshaft extension housing 16, a transmission output shaft 18, bearings 20 and 22 for the output shaft 18, a countershaft 24 and a bearing 26 for the countershaft 24. These parts are operatively incorporated with each other as shown, in a conventional manner.

The improved parking brake mechanism of the subject invention is mounted in a portion indicated by a leading line 28 and comprises a parking gear 30 which has external teeth 32 around the periphery thereof and a hub 34 secured through keys 36 to the power shaft 18 to allow the brake gear 30 to rotate with the output shaft 18.

A brake pawl 38 is employed as part of the parking brake mechanism 28, as well seen in Fig. 2. The brake
pawl 38 has a hub (no numeral) pivotally mounted in the casing 14 by a pivot shaft 40 which is arranged parallel to the output shaft 18 and, as shown in Fig. 3, extends through a through hole 42 in the brake pawl 38, a through hole 44 in the transmission casing 14, and a blind hole 46 in the tailshaft extension housing 16. The free end of the brake pawl 38 is formed or provided with a tooth 38a which is engageable with a gap between the adjacent teeth 32 on the parking gear 30 to lock the same when urged toward the parking gear 30. As well shown in Fig. 3, the pivotal shaft 40 is formed with a flange 40a at its generally middle portion, a screw threaded portion 40b and a supporting portion 40c at left section of the shaft 40, and a supporting portion 40d, a threaded portion 40e and a supporting portion 40f at right section of the shaft 40. The connection of the pivot shaft 40 to the transmission 10 is made in such a manner, as well illustrated in Fig. 1, that the supporting portions 40d and 40f are respectively and snugly held in the blind hole 44 of the tailshaft extension housing 16 and the through hole 44 of the transmission casing 14, and a nut 48 screwing on the threaded portion 40e contributes substantially to the tight connection between the pivot shaft 40 and the through hole 44 with an
assistance of a spring washer 50. While, the pivotal connection between the pivotal shaft 40 and the brake pawl 38 is made such that the supporting portion 40c is slidably held in the through hole 42 of the brake pawl 38.

It is to be noted, as shown in Fig. 6, that an outer side opposite to the tooth 38a of the brake pawl 38 is formed with a surface 38b which is inclined slightly at θ relative to the axis of the pivot shaft 40. Preferably the angle θ is determined about 7 degrees. The reason why such inclination is required will be apparent hereinafter.

A return spring 52 encircles at its multiple turns 52a the threaded portion 40b while engaging at its one end a portion of the shift gear housing 12 and at its other end the tooth 38a of the brake pawl 38 so that the brake pawl 38 is urged radially outwardly away from the teeth 32 of the parking gear 30. A nut 54 is engaged with the threaded portion 40b of the pivot shaft 40 to hold the return spring 52 and the brake pawl 38 in place with an assistance of a spring seat 56. To prevent the nut 54 from being dismantled accidentally from the threaded portion 40b, a stop pin 58 is used passing through an opening 40g formed in a top of the threaded portion 40b.
while engaging a cut \( 54_a \) provided in the nut \( 54 \).

A cam plate \( 60 \) is pivotally mounted on the inclined surface \( 38_b \) of the brake pawl \( 38 \) by a support pin \( 62 \) which extends through a through hole \( 60_a \) in the cam plate \( 60 \) and a through hole \( 38_c \) in the brake pawl \( 38 \).

Although not well shown in the drawings, the support pin \( 62 \) is arranged perpendicularly to the inclined surface \( 38_b \) for obtaining the parallel movements of the cam plate \( 60 \) with respect to the inclined surface \( 38_b \).

For tight connection between the support pin \( 62 \) and the brake pawl \( 38 \), a stop pin \( 64 \) is used passing through a hole \( 38_d \) in the brake pawl \( 38 \) and a through hole \( 62_a \) in the support pin \( 62 \), the hole \( 38_d \) being merged with the before-mentioned through hole \( 38_c \) into which the support pin \( 62 \) is inserted. Thus, it should be noted that the cam plate \( 60 \) is not only rotatable or oscillatable about the before-mentioned pivot shaft \( 40 \) together with the brake pawl \( 38 \), but also oscillatable about the support pin \( 62 \) relative to the brake pawl \( 38 \) along a plane containing the inclined surface \( 38_b \). The support pin \( 62 \) is formed at its top end with a flange \( 62_b \) having an opening \( 62_c \). Encircling the middle portion of the support pin \( 62 \) is a coil spring \( 66 \) which has one end \( 66_a \) hooked to the opening \( 62_c \) of the flange \( 62_b \) and the other end \( 66_b \) hooked to an opening \( 60_b \).
formed in a lateral projection 60c of the cam plate 50, the detailed configuration of the cam plate 60 being shown in Figs. 5 and 6. The coil spring 66 is prestressed to urge the cam plate 60 in a clockwise direction, as viewed along the arrow A illustrated in Fig. 5. In order to limit the movement of the cam plate 60 by the force of the spring 66, a stop portion 60d is formed at one side of the cam plate 60, the stop portion 60d being engageable with the corresponding side of the brake pawl 58. For the reason as will be described hereinlater, the other side of the cam plate 60 is formed with a curved rounded shoulder 60e as shown.

As seen in Figs. 1 and 2, a cylindrical control rod 68, which is connected to any conventional driver operable transmission shift lever (not shown) located in the driver's compartment of the vehicle, axially movably extends in a direction parallel to the axis of the before-mentioned pivot shaft 40. As best seen in Fig. 8A, the control rod 68 is formed at the cylindrical portion thereof with first and second notches 70 and 72. Selectively projecting into the notches 70 and 72 in response to the axial movement of the control rod 68 is a detent ball 74 which is biased toward the control rod 68 by a compression spring 76 disposed in a hole 78 formed in the transmission casing.
14. Thus, the control rod 68 takes first and second rest positions in accordance with selective engagement of the notches 70 and 72 with the detent ball 74. The first rest position is induced by the engagement between the notch 70 and the ball 74 when the driver operable transmission shift lever is held in one of the driving positions and neutral position in which positions the rotation of the transmission output shaft 18 is needed. The second rest position is induced by the engagement between the notch 72 and the ball 74 when the shift lever is held in a parking position in which the rotation of the output shaft must be prohibited.

The control rod 68 is further formed at a cylindrical portion opposite to the first and second notches 70 and 72 with an elongate cut out portion 80 which provides a shoulder or wedge surface 82 at a portion near the notches 70 and 72, as shown. The cut out portion 80 receives therein a unit of the cam plate 60 and the brake pawl 38 when the control rod 68 takes the first rest position, as viewed in Fig. 8A, in response to positioning of the transmission shift lever in either the driving positions or the neutral position.

According to the present invention, there is further required the following consideration to configuration of the wedge surface 82.
As best seen in Fig. 8A, the wedge surface 82 includes first and second inclined sections which are respectively designated by the numerals 82a and 82b. The inclination angles of the first and second inclined sections 82a and 82b with respect to the axis of the control rod 68 are respectively designated by the references α and β. By the subject invention, the angle α is determined considerably larger than β, and preferably, the angle α is about 45 degrees, while the angle β is about 12 degrees. An edge portion formed between the first and second inclined sections 82a and 82b, which is indicated by a reference 82c, is curved at about 5 mm in radius of curvature.

With the above-described construction of the parking brake mechanism 28, the operation thereof is as follows.

While the shift lever is positioned at either the driving positions or the neutral position, the control rod 68 stays in the first rest position, illustrated in Fig. 8A. Under this, the unit of the cam plate 60 and the brake pawl 38 is settled in the cut out portion 80 by the urging force of the return spring 52. (In Fig. 8A, it is shown that the curved rounded shoulder 60e of the cam plate 60 is engaged with the first inclined section 82a of the wedge surface 82 under the first rest
position of the control rod 68). Thus, the tooth 38a of the brake pawl 38 is kept separated from the teeth 32 of the parking gear 30 thus permitting the free rotation of the output shaft 19 of the transmission 10.

Under this condition permitting the rotation of the output shaft 18, when the shift lever is moved by the driver to a parking position, the control rod 68 is moved leftwardly of the drawing (Fig. 8) into the second rest position in which the detent ball 74 is projected into the notch 72. During this, if the tooth 38a of the brake pawl 38 is now in alignment with the gap between the corresponding adjacent teeth 32 of the parking gear 30, the second inclined section 82b of the wedge surface 82 rides upon the cam plate 60, as shown in Fig. 8c, thereby urging the brake pawl 38 into engagement with the parking gear 30. While, if the tooth 38a is misaligned with the gap between the teeth 32, the first inclined section 82a remains in abutment against the curved rounded shoulder 60c of the cam plate 60 so that the control rod 68 urges the cam plate 60 to rotate in the leftward direction as indicated by an arrow B, overcoming the biasing action of the spring 66. By this leftward movement of the cam plate 60, the tooth 38a of the brake pawl 38 is tightly engaged with an outer surface portion of one
of the teeth 32 of the brake gear 30 due to the inclined con-
tact between them 60 and 38. As soon as the tooth 38a of the
brake pawl 38 and the gap between the teeth 32 of the parking
gear 30 come into alignment upon slight rotation of the park-
ing gear 30, the cam plate 60 is oscillated back in the
opposite direction, sliding upon the first and second inclined
sections 82a and 82b, until the stop portion 60a of the cam
plate 60 abuts against the corresponding one side of the brake
pawl 38. By this rightward movement of the cam plate 60, the
brake pawl 38 is urged to swing or move in the downward
direction, indicated by an arrow C in Fig. 8C, and finally
to engage with the parking gear 30. It should be noted that
the downward movement or rotation of the brake pawl 38 is made
by the force of the spring 66 but against the bias of the return
spring 52.

If the vehicle equipped with the subject parking brake
mechanism should tend to move or roll forward or backward due
to being parked on a slope and the brake pawl 38 is then
engaged with the parking gear 30, the rotation of the parking
gear 30 will generate a force tending to urge the brake pawl
38 radially outwardly away from the parking gear 30. Due to
the angular construction of the upper surface of the brake
pawl 38, the cam plate 60 is biased downwardly and to the
right, as viewed in Fig. 8C, forcing it directly against the
inclined surface 38b whereby the cam plate 60 is prevented
from sliding up the inclined surface 38b. This phenomenon
will prevent the subject parking braking mechanism from being
accidentally inoperative.

Although in the previous description, the control rod
68 is shown to be formed with the cut out portion 80 to form
the wedge surface 82, it is also possible to use a relatively small diameter rod with a raised portion as the control rod. In this case, one side of the raised portion is formed similar to the wedge surface 82, shown in Fig. 8A, including the first and second inclined sections 82a and 82b.

Furthermore, instead of the previously described cam plate 60, another type cam plate 61 may be employed, which is shown in Fig. 7. The cam plate 61 is formed to have a through hole 61a for the support pin 62, a first lateral projection 61c for engaging the coil spring 66, a second lateral projection 61d engageable with a shoulder portion 38c (see Fig. 3) to limit the movement of the cam plate 61, and a curved edge 61e engageable with the wedge surface 82 of the control rod 68.

It will now be appreciated from the preceding description that the improved parking brake mechanism according to the present invention can be easily mounted in a conventional transmission by slightly rearranging the gear train of the same, since the subject mechanism is made considerably compact and simple in construction. This makes it possible that the parking gear can have a relatively large size thus providing the subject mechanism with big braking performance.
According to the present invention can be easily mounted in a conventional transmission by slightly rearranging the gear train of the same, since the subject mechanism is made considerably compact and simple in construction. This induces that the parking gear can have a relatively large size thus providing the subject mechanism with big braking performance.

It is also to be noted that, because of provision of the second inclined section 82b with a small inclination, the release action of the control rod 68 from the cam plate 60 which is then in a condition to urge the brake pawl 30 into engagement with the parking gear 30 is readily made without requiring a considerable force.

By the provision of the first inclined section 82a with a large inclination, the leftward rotation of the cam plate 60 is securely occurred when the control rod 68 is moved leftward under a condition in which the tooth 38a of the brake pawl 38 is misaligned with the gap between the teeth 32. Thus, unwanted violently hard engagement between the tooth 38a of the brake pawl 38 and one of the teeth 32 of the parking gear 30 due to failure of the leftward rotation of the cam plate 60 under such condition is suppressed. Indeed, such drawback has been encountered in the conventional parking brake mechanism.
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:--

1. A parking brake mechanism for a motor vehicle transmission having a transmission output shaft, comprising a brake gear secured to said output shaft to rotate therewith, a brake pawl mounted for rotation about a first axis and carrying a tooth engageable with said brake gear, first means for biasing said brake pawl in a direction to be disengaged from said brake gear, a cam plate connected to said brake pawl for rotation therewith about said first axis and for rotation relative to said brake pawl about a second axis, a manually operable and axially movable control rod having a raised portion with a wedge surface which is engageable with said cam plate to actuate the cam plate, and a second biasing means for biasing said cam plate to rotate about said second axis in a first direction toward engagement of said cam plate with said wedge surface, which is characterised in that said wedge surface of said control rod includes first and second inclined sections which are engageable with said cam plate to cause the rotation of said cam plate about said second axis in a direction opposite to said first direction against the bias of said second biasing means and the rotation of said cam plate about said first axis in a direction to permit the brake pawl to be brought into engagement with said brake gear, respectively, the inclination angle of said first section with respect to the longitudinal axis of said control rod being larger than that of said second inclined section.
The claims defining the invention are as follows:

1. A parking brake mechanism for a motor vehicle transmission having a transmission output shaft, comprising a brake gear secured to said output shaft to rotate therewith, a brake pawl mounted for rotation about a first axis and carrying a tooth engageable with said brake gear, first means for biasing said brake pawl in a direction to be disengaged from said brake gear, a cam plate connected to said brake pawl for rotation therewith about said first axis and for rotation relative to said brake pawl about a second axis, a manually operable and axially movable control rod having a raised portion with a wedge surface which is engageable with said cam plate to actuate the cam plate, and a second biasing means for biasing said cam plate to rotate about said second axis in a first direction toward engagement of said cam plate with said wedge surface, which is characterized in that said wedge surface of said control rod includes first and second inclined sections which are engageable with said cam plate to cause the rotation of said cam plate about said second cam plate about said second axis in a direction opposite to said first direction against the bias of said second biasing means and the rotation of said cam plate about said first axis in a direction to permit the brake pawl to be brought into engagement with said brake gear, respectively, the inclination angle of said first and second inclined sections with respect to the longitudinal axis of said control rod being larger than that of said second inclined section.

2. A parking brake mechanism as claimed in Claim 1, which is further characterized in that said brake pawl has an inclined surface on which said cam plate is connected, said cam plate being rotatable about said second axis along a plane containing said inclined surface of said brake pawl.

3. A parking brake mechanism as claimed in Claim 2, which is further characterized in that said cam plate has a curved rounded shoulder which is engageable with said first and second inclined sections of said control rod upon the axial displacement of said control rod.

4. A parking brake mechanism as claimed in Claim 1, which is further characterized in that said cam plate is formed with
a stop portion which abuts against a portion of said brake pawl upon rotation of said cam plate in said first direction.

5. A parking brake mechanism as claimed in Claim 1, further comprising means for allowing said control rod to take first and second rest position, said first position inducing condition in which said tooth of said brake pawl is disengaged from said brake gear, and said second position inducing either a condition in which said tooth is engaged with said brake gear to prohibit the rotation of said transmission output shaft, or a condition in which said tooth is tightly engaged with an outer surface portion of one of the teeth of said brake gear.

6. A parking brake mechanism constructed and arranged substantially as described herein with reference to the accompanying drawings.

DATED this 18th day of July, 1978.

NISSAN MOTOR COMPANY, LIMITED
Patent Attorneys for the Applicant:

F.B. RICE & CO.