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सत्यमेव जयते

क्रम सं/SL No :011185655

पेटेंट कार्यालय,भारत सरकार | The Patent Office, Government Of India

पेटेंट प्रमाण पत्र | Patent Certificate

(पेटेंट नियमावली का नियम 74) | (Rule 74 of The Patents Rules)

पेटेंट सं. / Patent No.	:	484283
आवेदन सं. / Application No.	:	201911049277
फाइल करने की तारीख / Date of Filing	:	30/11/2019
पेटेंटी / Patentee	:	MARUTI SUZUKI INDIA LIMITED

प्रमाणित किया जाता है कि पेटेंटी को, उपरोक्त आवेदन में यथाप्रकटित *"MANUAL TRANSMISSION SYSTEM WITH INTEGRATED NEUTRAL CAM PROFILE ON LEVER GEAR SHIFT AND SELECT (LGSS)"* नामक आविष्कार के लिए, पेटेंट अधिनियम, 1970 के उपबंधों के अनुसार आज तारीख नवम्बर 2019 के तीसवें दिन से बीस वर्ष की अवधि के लिए पेटेंट अनुदत्त किया गया है।

It is hereby certified that a patent has been granted to the patentee for an invention entitled *"MANUAL TRANSMISSION SYSTEM WITH INTEGRATED NEUTRAL CAM PROFILE ON LEVER GEAR SHIFT AND SELECT (LGSS)"* as disclosed in the above mentioned application for the term of 20 years from the 30th day of November 2019 in accordance with the provisions of the Patents Act,1970.

अनुदान की तारीख : 18/12/2023
Date of Grant :

पेटेंट नियंत्रक
Controller of Patents

टिप्पणी - इस पेटेंट के नवीकरण के लिए फीस, यदि इसे बनाए रखा जाना है, नवम्बर 2021 के तीसवें दिन को और उसके पश्चात प्रत्येक वर्ष मे उसी दिन देय होगी।

Note. - The fees for renewal of this patent, if it is to be maintained, will fall / has fallen due on 30th day of November 2021 and on the same day in every year thereafter.

FORM 5

THE PATENTS ACT, 1970

(39 of 1970)

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THE PATENTS RULES, 2003

DECLARATION AS TO INVENTORSHIP

(See section 10(6) and rule 13(6)

1. APPLICANT(S)

~~I~~/We, **MARUTI SUZUKI INDIA LIMITED,** of **1 Nelson Mandela Road, Vasant Kunj, New Delhi-110070, India**, an Indian Company

Hereby declare that the true and first inventor(s) of the invention disclosed in the complete specification filed in pursuance of my/our application No. _____ titled **"MANUAL TRANSMISSION SYSTEM WITH INTEGRATED NEUTRAL CAM PROFILE ON LEVER GEAR SHIFT AND SELECT (LGSS)"** is/ are.

2. INVENTOR(S)

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SHIVANG SAXENA	Indian	Maruti Suzuki India Limited, Palam Gurugram Road, Gurugram, Haryana-122015, India.

3. DECLARATION TO BE GIVEN WHEN THE APPLICATION IN INDIA IS FILED BY THE APPLICANT(S) IN THE CONVENTION COUNTRY: -

~~I/We the applicant(s) in the convention country hereby declare that our right to apply for a patent in India is by way of assignment from the true and first inventor(s).~~

4. STATEMENT (to be signed by the additional inventor(s) not mentioned in the application form)

NIL

Dated this 30th day of November, 2019

To,
The Controller of Patents
The Patent Office at Delhi

FORM 2

THE PATENTS ACT 1970

39 OF 1970

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THE PATENT RULES 2003

COMPLETE SPECIFICATION

(SEE SECTIONS 10 & RULE 13)

1. TITLE OF THE INVENTION

"MANUAL TRANSMISSION SYSTEM WITH INTEGRATED NEUTRAL CAM PROFILE ON LEVER GEAR SHIFT AND SELECT (LGSS)"

2. APPLICANTS (S)

NAME	NATIONALITY	ADDRESS
MARUTI SUZUKI INDIA LIMITED	INDIA.	1 NELSON MANDELA ROAD, VASANT KUNJ, NEW DELHI-110070, INDIA.

3. PREAMBLE TO THE DESCRIPTION

COMPLETE SPECIFICATION

The following specification particularly describes the invention and the manner in which it is to be performed

FIELD OF THE INVENTION

[001] The present invention, in general, relates to manual transmission system of a vehicle and, more particularly, to manual transmission system with idle start-stop functionality with integrated neutral cam profile on LGSS (lever gear shift and select).

BACKGROUND OF THE INVENTION

[002] Background description includes information that may be useful in understanding the present invention. It is not an admission that any of the information provided herein is prior art or relevant to the presently claimed invention, or that any publication specifically or implicitly referenced is prior art.

[003] A neutral switch on a transmission system (also known as a park/neutral position switch or neutral start switch) is usually coupled with shift tower to detect selection and shifting of gears. In automobile, the neutral switch mechanism can be provided to obtain idle Start-Stop (ISS) system functionality by shut down and restart of engine based on the gear and clutch position. When the vehicle is in neutral mode, the ISS system may cut fuel supply to the engine or may supply nominal amount of fuel supply just to keep the engine in start position which is not enough for movement of the vehicle. When the clutch is pressed, the engine starts and the neutral switch is activated by selection and shifting of gears, the ISS system provides rich fuel supply to the internal combustion engine. Therefore, the ISS system is provided to reduce fuel consumption and emission by controlling supply of fuel to the internal combustion engine.

[004] In the existing system, as shown in figure-1, the neutral switch mechanism comprises a neutral switch (102), and a neutral cam (105) attached on lever gear shift and select (LGSS) (104) via a neutral cam pin (106). The neutral switch (102) is ball plunger type switch that comprises a ball and spring. The ball of the neutral

switch (102) moves on the neutral cam (105) having a neutral cam profile (401) of circular arc shape, as shown in figure-4a.

[005] When the ball of the neutral switch (102) lies at a lowest point (401a) or middle point of the neutral cam profile (401) of circular arc shape, the neutral switch (102) detects transmission is not in gear (i.e., no gear is engaged, vehicle is in neutral mode) and sends signal to control unit of vehicle to cut supply of fuel. When the ball of the neutral switch (102) lies at any elevated position (401b) [as shown in figure-4a] of the neutral cam profile (401) of circular arc shape, the neutral switch (102) detects transmission is in gear (i.e., gears are engaged) and sends corresponding signal to control unit of vehicle to supply fuel.

[006] Graph shown in figure-4b indicates, cam rotation angle (on X-axis) vs. switch stroke (on Y-axis) for the existing neutral cam profile (401). 'No actuation zone' for switch stroke lies in very small zone, i.e.- at cam rotation angle of 0º. Clearly, the existing systems are highly sensitive to free play rotation of the shift tower. There is only one point (401a) for 'No actuation zone' of switch stroke, i.e.- at which the neutral switch (102) detects transmission is not in gear. Rest of the curvature (401b) of existing neutral cam profile (401), at both side of the point (401a) is switching zone, i.e.- at which the neutral switch (102) detects transmission is in gear. Therefore, allowing any amount of free play rotation of the shift tower may result in false signal to control unit, causing inconvenience to the user.

[007] Therefore, in existing transmission systems, a detent pin (103) to move inside a detent cam (104a) provided on the shift tower, is also mounted beside the neutral switch (102). The detent pin (103) has majorly two functions- remove free-play rotation of the shift tower and to provide gearshift feel to user at the time of gear shifting. Alternatively, in addition to the detent pin (103) mounted adjacent to the neutral switch (102), in some of the models a ball-spring system is assembled on each of the shifting rod to provide better gearshift feel to user at the time of gear shifting.

[008] Technical problem: In the absence of the detent pin, a free play rotation is generated in the shift tower that will falsely activate the neutral switch. Accordingly, for properly working of the neutral switch and to avoid false activation due to the free-play rotation, the detent pin is required. Addition of the detent pin adds extra cost and complexity to the transmission system.

[009] Therefore, there is a need to avoid implementation of detent pin in the transmission system and to avoid false activation of the neutral switch in the absence of the detent pin.

OBJECTIVES OF THE INVENTION

[0010] It is therefore the object of the invention to overcome the aforementioned and other drawbacks existing in prior systems.

[0011] Another object of the present invention is to provide idle start-stop system for manual transmission that overcomes the problem of the prior art.

[0012] Another object of the present invention is to provide manual transmission system with integrated neutral cam profile on LGSS (lever gear shift and select).

[0013] Another object of the present invention is to provide manual transmission system without a detent pin mechanism.

[0014] Yet another object of the present invention is to provide idle start-stop system for manual transmission with less components in the assembly.

[0015] These and other objects and advantages of the present invention will be apparent to those skilled in the art after a consideration of the following detailed description.

SUMMARY OF THE INVENTION

[0016] To attain the above objects, the present invention provides a manual transmission system with idle start-stop functionality for in a vehicle. The manual

transmission system comprises a shift tower having an LGSS (lever gear shift and select). The shift tower engages with a plurality of shifting rods by the LGSS. The manual transmission system further comprises a neutral cam profiled that is integrated with the LGSS. The neutral cam profiled is coupled with a neutral switch comprising an assembly of a spring and a ball to detect whether the shift tower is engaged or dis-engaged with the shifting rod.

[0017] The ball of the neutral switch moves on the integrated neutral cam profile provided on the LGSS. Sensitivity to free-play rotation of a gearshift lever is reduced by the integrated neutral cam profile provided.

[0018] The neutral cam profile defines a C-type structure with a flat base and two of a curved wall to engage with the neutral switch. The shift tower is detected to be engaged with the shifting rod when the plunger ball of the neutral switch lies on the curved wall of the neutral cam profile. The shift tower is detected to be not engaged with the shifting rod when the plunger ball of the neutral switch lies on the flat base of the neutral cam profile.

[0019] A spring-ball arrangement is provided on the shifting rod to generate gearshift feeling.

[0020] Various objects, features, aspects, and advantages of the inventive subject matter will become more apparent from the following detailed description of preferred embodiments.

[0021] It is to be understood that the aspects and embodiments of the disclosure described above may be used in any combination with each other. Several of the aspects and embodiments may be combined to form a further embodiment of the disclosure.

[0022] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features

described above, further aspects, embodiments, and features will become apparent by the following detailed description.

[0023] Various objects, features, aspects, and advantages of the inventive subject matter will become more apparent from the following detailed description of preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWING

[0024] The illustrated embodiments of the subject matter will be best understood by reference to the drawings, wherein like parts are designated by like numerals throughout. The following description is intended only by way of example, and simply illustrates certain selected embodiments of devices, systems, and processes that are consistent with the subject matter as claimed herein, wherein:

[0025] **Figure-1A and 1B** illustrates manual transmission system with idle start-stop functionality, having neutral pin and detent pin, according to an embodiment of the prior art.

[0026] **Figure-2A and 2B** illustrates manual transmission system with idle start-stop functionality having an integrated neutral cam on LGSS (lever gear shift and select), according to an embodiment of the present invention.

[0027] **Figure-3** illustrates structure of an integrated neutral cam on LGSS according to an embodiment of the present invention.

[0028] **Figure-4A** illustrates geometrical details of the neutral cam profile, according to the embodiment of the prior art.

[0029] **Figure-4B** illustrates graph of cam rotation angle (on X-axis) vs. switch stroke (on Y-axis), according to the embodiment of the prior art.

[0030] **Figure-5A** illustrates actuation zone, free-play rotation zone and switching zone of a gearshift lever, according to an embodiment of the present invention, respectively.

[0031] **Figure-5B** illustrates cam rotation angle (on X-axis) vs. switch stroke (on Y-axis), according to the embodiment of the present invention.

[0032] The figures depict embodiments of the disclosure for purposes of illustration only. One skilled in the art will readily recognize from the following description that alternative embodiments of the structures and methods illustrated herein may be employed without departing from the principles of the disclosure described herein.

DETAILED DESCRIPTION OF THE INVENTION

[0033] While the embodiments of the disclosure are subject to various modifications and alternative forms, specific embodiment thereof have been shown by way of example in the figures and will be described below. It should be understood, however, that it is not intended to limit the disclosure to the particular forms disclosed, but on the contrary, the disclosure is to cover all modifications, equivalents, and alterative falling within the scope of the disclosure.

[0034] As used in the description herein and throughout the claims that follow, the meaning of "a," "an," and "the" includes plural reference unless the context clearly dictates otherwise. Also, as used in the description herein, the meaning of "in" includes "in" and "on" unless the context clearly dictates otherwise.

[0035] The terms "comprises", "comprising", or any other variations thereof used in the disclosure, are intended to cover a non-exclusive inclusion, such that a device, system, assembly that comprises a list of components does not include only those components but may include other components not expressly listed or inherent to the system, or assembly, or device. In other words, one or more elements in a system or device proceeded by "comprises... a" does not, without more constraints, preclude the existence of other elements or additional elements in the system, apparatus or device.

[0036] Hereinafter an idle start-stop system for manual transmission, having an integrated neutral cam on LGSS will be explained in detail.

[0037] **Referring to figure 2A and 2B,** which illustrates structure of manual transmission for idle start-stop of vehicle, having an integrated neutral cam profile (300) on LGSS (lever gear shift and select) (302), according to an embodiment of the present invention.

[0038] The manual transmission system comprises a shift tower (201), a lever gear shift and select (LGSS) (302) with an integrated neutral cam profile (301); and a neutral switch (202). The shift tower (201) provides select and shift of gears which are coupled to a plurality of shifting rods. The neutral switch (202) is a ball plunger type switch having an assembly of a spring and a ball to detect whether the shift tower (201) is in gear engaged mode or dis-engaged. During selection of gear, the LGSS (302) position to corresponding yoke of the shift rod from the plurality of shift rods. During shifting of gear, the LGSS (302) moves yoke of the selected gear of the shift rod. The LGSS (302) has a lever finger that is used for shifting of gears.

[0039] The ball of the neutral switch (202) moves on a neutral cam profile (301) provided integrally on the LGSS (302). The sensitivity to free-play rotation of the shift tower (201) for the neutral switch (202) is reduced by design modification of the integrated neutral cam profile (301) [shown in figure-3], provided as an integral portion of the LGSS. The shift tower (201) is detected to be engaged with the gear shifting rod, till the ball of the neutral switch (202) lies on a curved wall (301b) of the integrated neutral cam profile (301) [shown in figure-3]. The shift tower (201) is detected to be not engaged with the shifting rod till the ball of the neutral switch (202) lies on the flat base (301a) of the neutral cam profile (301) [shown in figure-3]. Further, a conventional spring-ball arrangement may be provided on the shifting rods to generate gear-shift feeling.

[0040] The assembly of detent pin mechanism in the prior arts precisely remove free-play rotation of a gearshift lever and the shift tower (201). As sensitivity to free-play rotation of the shift tower for the neutral switch (202) is reduced by the integrated neutral cam profile (301) provided in present invention, assembly of detent pin mechanism is not required in the assembly. Further, the gearshift feel to

user at the time of gear shifting can be provided by assembly of the spring-ball arrangement on each of the shifting rod.

[0041] **Referring to figure 3,** which illustrates structure of an integrated neutral cam profile on LGSS according to an embodiment of the present invention.

[0042] The integrated neutral cam profile (301) is provided as an integral portion of the LGSS, instead of being a separate component. The ball of the neutral switch (202) moves on the integrated neutral cam profile (301) provided on the LGSS (302). The integrated neutral cam profile (301) comprises a C-type structure with a flat base (301a) and two of a curved wall (301b) to engage with the neutral switch (202). Further, the flat base (301a) is defined in between the two curved wall (301b). A predefined range for free-play rotation of a shift tower is provided by provision of the flat base (301a) on the integrated neutral cam profile (301). The shift tower (201) is detected to be not engaged with the shifting rod till the ball of the neutral switch (202) lies on the flat base of the neutral cam profile (301). When the ball of the neutral switch (202) lies on a curved wall (301b) of the integrated neutral cam profile (301), the shift tower (201) is detected to be engaged with the gear shifting rod for shifting of gears. Further, while selecting of gears by the shift tower allows, the ball of the neutral switch (202) moves on the curved wall (301b) of the neutral cam profile (301).

[0043] **Referring to figure 5A**, which illustrates actuation zone, free-play rotation zone and switching zone of the gearshift lever, according to an embodiment of the present invention, respectively.

[0044] Figure 5A illustrates geometrical details of the neutral cam profile, according to an embodiment of the present invention. The integrated neutral cam profile (301) comprises a C-type structure with the flat base (301a) and the two of a curved wall (301b). The curved wall (301b) makes an interior angle ‘α’ with the flat base (301a). The interior angle ‘α’ is an obtuse angle. In an exemplary embodiment of present invention, the interior angle ‘α’ may remain in the range of 110º-160º. The shift tower (201) is detected to be engaged with the gear shifting

rod, till the ball of the neutral switch (202) lies on a curved wall (301b) of the integrated neutral cam profile (301). The shift tower (201) is detected to be not engaged with the shifting rod till the ball of the neutral switch (202) lies on the flat base (301a) of the neutral cam profile (301) [shown in figure-3].

[0045] **Referring to figure-5B,** which illustrates graph of cam rotation angle (on X-axis) vs. switch stroke (on Y-axis) for the neutral cam profile (301), according to the embodiment of the present invention. 'No actuation zone' for switch stroke lies in a flat zone. Clearly, the neutral switch, according to present invention is less sensitive to free play rotation of the shift tower. There is a flat surface (301a) for 'No actuation zone' of switch stroke, i.e.- at which the neutral switch (202) detects transmission is not in gear. Rest of the curvature define by the curved walls (301b) of the neutral cam profile (301), at both side of the flat base (301a) is switching zone, i.e.- at which the neutral switch (202) detects transmission is in gear. During free play, the ball of the neutral switch (202) maintains a gap with the curved walls (301b). Therefore, allowing a free play rotation of the shift tower within predetermined range of 'No actuation zone' will not result in false signal to control unit. Therefore, including expensive mechanism of detent pin in the system to curb free play rotation of the shift tower is not required.

[0046] With the present invention, a requirement for detent pin mechanism in the manual transmission system can be avoided and actuation of the neutral switch can be optimized by changing the profile of the neutral cam profile. With the present neutral cam profile, the neutral switch will not actuate during free-play rotation of the shift tower as the ball of the neutral switch remains in flat portion to avoid actuation.

[0047] In another aspect, the present neutral cam profile is integrated with LGSS, therefore, there is no need to mount the neutral cam profile separately on the shift tower that reduces cost and number of parts on the shift tower.

[0048] The present integrated neutral cam profile eliminates requirement of neutral cam pin in the system by shifting neutral cam to LGSS. Further, it eliminates detent

pin and detent cam from the existing systems. Thereby, the hole drill on case guide for detent pin as well as the hole drill on shaft for neutral cam pin are also eliminated. Thus, elimination of detent pin assembly and neutral cam assembly from the system results in compact and less expensive manual transmission system for a vehicle.

[0049] Each of the appended claims defines a separate invention, which for infringement purposes are recognized as including equivalents to the various elements or limitations specified in the claims. Depending on the context, all references below to the "invention" may in some cases refer to certain specific embodiments only. In other cases, it will be recognized that references to the "invention" will refer to subject matter recited in one or more, but not necessarily all, of the claims

[0050] With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity.

[0051] It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as "open" terms (e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.). It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite

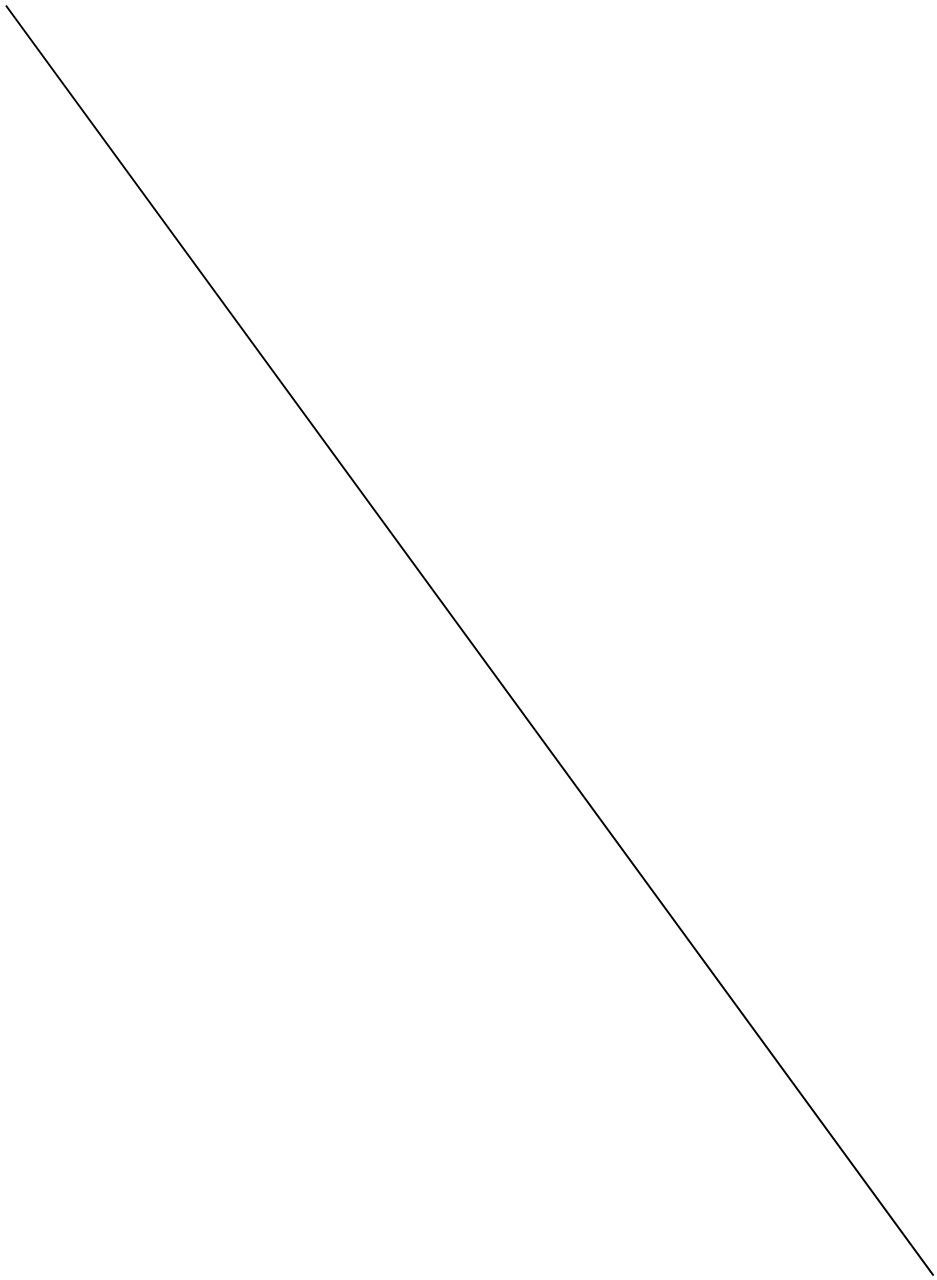
articles, ‘a', or "an" limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (e.g., "a" and/or "an" should typically be interpreted to mean "at least one" or "one or more"); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation is explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean at least the recited number (e.g., the bare recitation of "two recitations," without other modifiers, typically means at least two recitations, or two or more recitations).

[0052] The above description does not provide specific details of manufacture or design of the various components. Those of skill in the art are familiar with such details, and unless departures from those techniques are set out, techniques, known, related art or later developed designs and materials should be employed. Those in the art are capable of choosing suitable manufacturing and design details.

[0053] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the present disclosure. It will be appreciated that several of the above-disclosed and other features and functions, or alternatives thereof, may be combined into other systems or applications. Various presently unforeseen or unanticipated alternatives, modifications, variations, or improvements therein may subsequently be made by those skilled in the art without departing from the scope of the present disclosure as encompassed by the following claims.

[0054] The claims, as originally presented and as they may be amended, encompass variations, alternatives, modifications, improvements, equivalents, and substantial equivalents of the embodiments and teachings disclosed herein, including those that are presently unforeseen or unappreciated, and that, for example, may arise from applicants/patentees and others.

[0055] While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope being indicated by the following claims.



We claim:

1. A manual transmission system with an idle start stop functionality for a vehicle, the manual transmission system comprising:

- a shift tower (201);
- a lever gear shift and select (LGSS) (302) mounted on the shift tower (201) for selecting and shifting of gears provided on a plurality of shifting rods; and

characterized in that

a neutral cam profile (301) is integrated with the LGSS (302).

2. The manual transmission system as claimed in claim 1, wherein the integrated neutral cam profile (301) comprises a flat base (301a) and two of a curved wall (301b).

3. The manual transmission system as claimed in claim 2, wherein the transmission system comprising:

a neutral switch (202) comprising an assembly of a spring and a ball to detect the shift tower (201) is engaged or not engaged with a plurality of shifting rods,

wherein the ball of the neutral switch (202) moves on the integrated neutral cam profile (301) to detect the shift tower (201) is engaged or not engaged.

4. The manual transmission system as claimed in claim 3, wherein, during free play slide, the ball of the neutral switch (202) maintains a gap with the curved walls (301b) of the integrated neutral cam profile (301).

5. The manual transmission system as claimed in claim 2, wherein the shift tower (201) is detected to be engaged with the plurality of shifting rods (201) when the ball of the neutral switch (202) lies on the curved wall (301b) of the neutral cam profile (301).

6. The manual transmission system as claimed in claim 2, wherein the shift tower (201) is detected to be not engaged with the plurality of shifting rods when the ball of the neutral switch (202) lies on the flat base (301a) of the neutral cam profile (301).

7. The manual transmission system as claimed in claim 1, wherein a spring-ball arrangement is provided on the plurality of shifting rods to provide gearshift feel.

Dated this 30th day of November 2019

ABSTRACT

MANUAL TRANSMISSION SYSTEM WITH INTEGRATED NEUTRAL CAM PROFILE ON LEVER GEAR SHIFT AND SELECT (LGSS)

The present subject matter relates to a manual transmission system with idle start-stop functionality in a vehicle. The manual transmission system comprising a shift tower (201) having an LGSS (302) (lever gear shift and select) to shift gears provided on shifting rods. The LGSS has an integrated neutral cam profile (301) over which ball of a neutral switch moves. The neutral cam profile (301) comprises a C-type structure with a flat base (301a) and two of a curved wall (301b) to engage with the neutral switch (202).

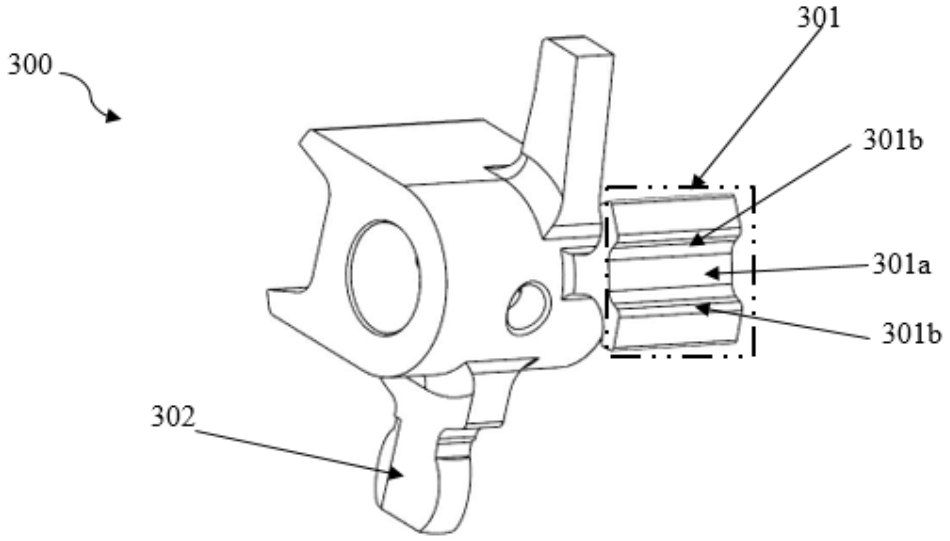


Figure-3

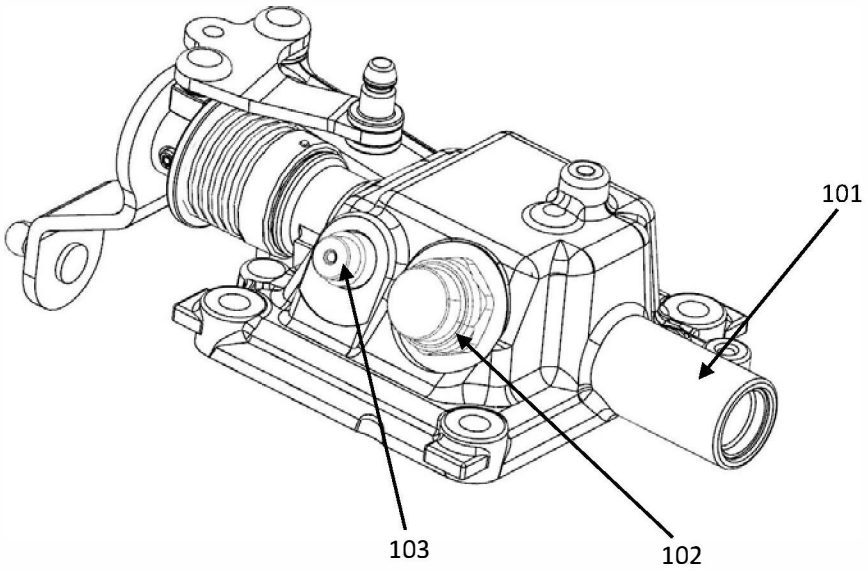


Figure-1A

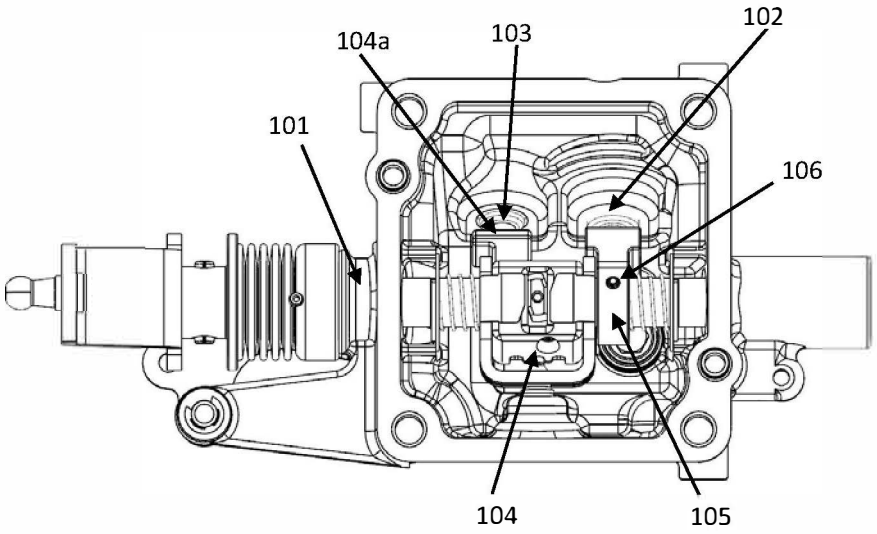


Figure-1B

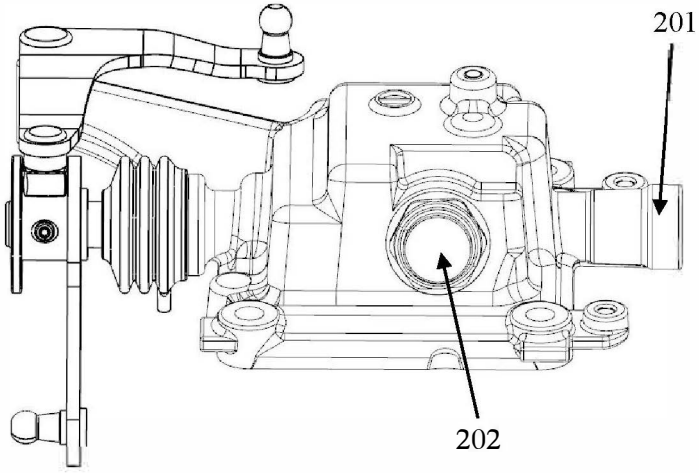


Figure-2A

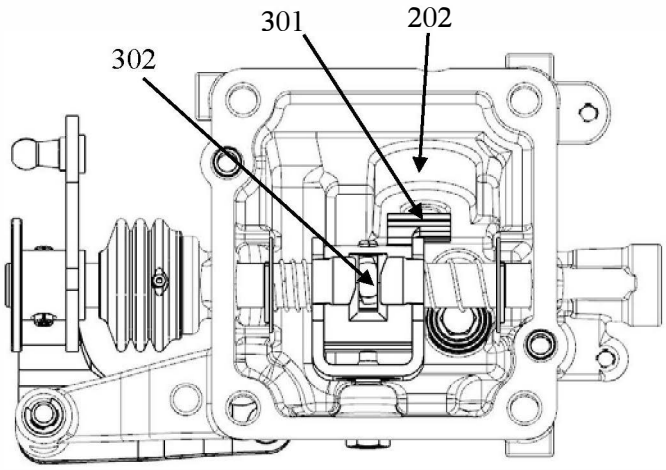


Figure-2B

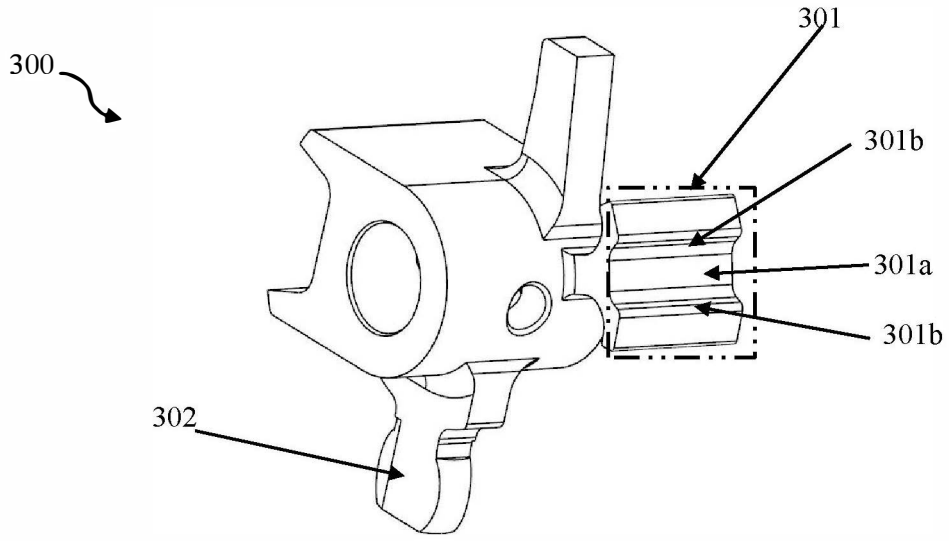


Figure-3

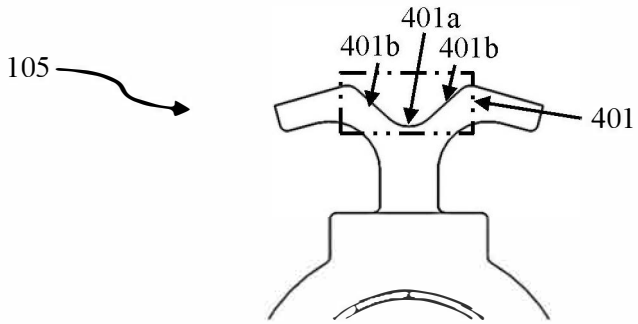


Figure-4A

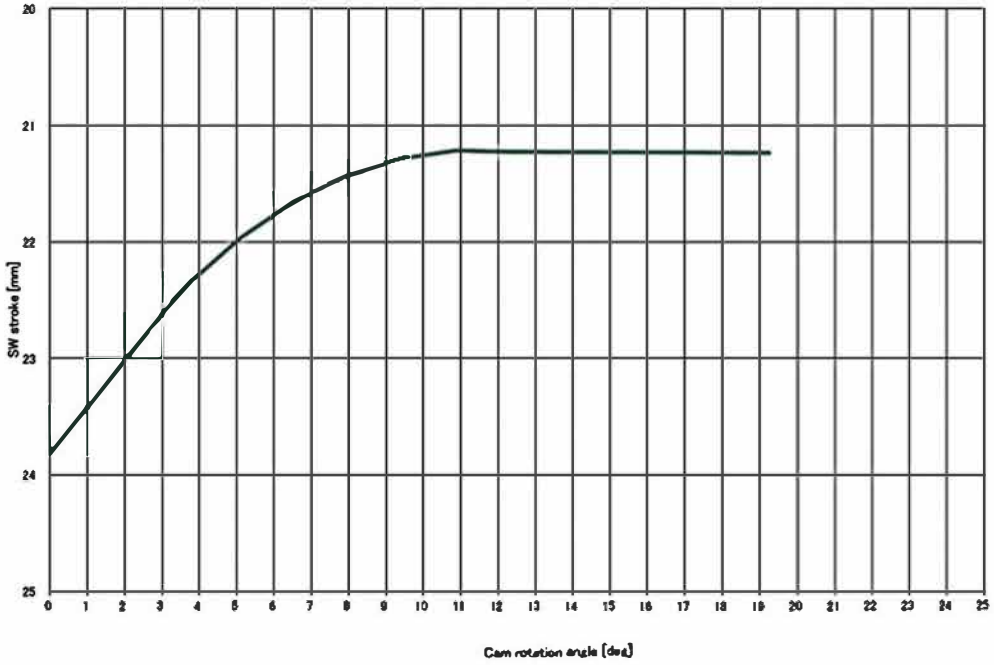


Figure-4B

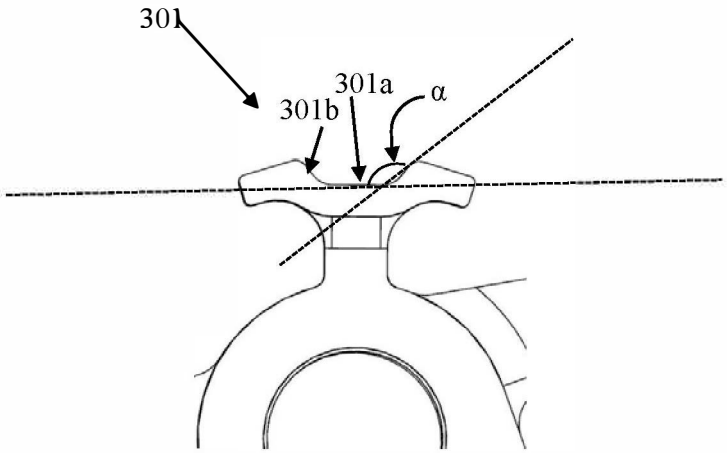


Figure-5A

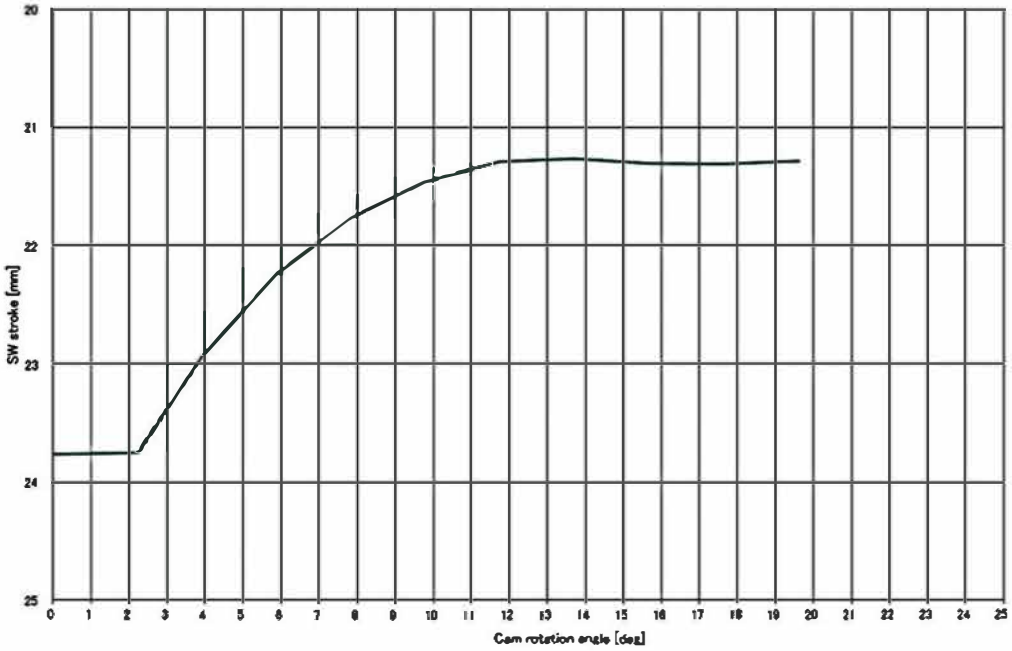


Figure-5B