APPLICATION FOR A STANDARD PATENT

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hereby apply for the grant of a standard patent for an invention entitled TRANSMISSION APPARATUS FOR VEHICLE

which is described in the accompanying provisional/complete specification.

Details of basic application(s):

Number of basic application Name of Convention country in which basic application was filed Date of basic application

71380/1981 Japan May 14, 1981

My/our address for service is care of CLEMENT HACK & CO., Patent Attorneys, 140 William Street, Melbourne, Victoria, 3000, Australia.

DATED this 21st day of April, 1982.

HONDA GIKEN KOGYO KABUSHIKI KAISHA

To: The Commissioner of Patents.
A transmission apparatus for a vehicle of the type that, between an input shaft and an output shaft which are provided in parallel one with another in a transmission casing and supported rotatably on a front wall and a middle wall of the casing, a first speed driving train for a low speed is provided so as to be positioned in rear of the middle wall, and a second speed driving train for a middle speed is provided between a middle position, a third speed driving train for a high speed on a front side thereof and a reverse driving train on a rear side thereof are provided so as to be disposed between the middle wall and the front wall, characterized in that a fourth speed driving train for the highest speed is provided between the input shaft and the output shaft so as to be positioned between the second speed driving train and the reverse driving train, and a double type clutch having a front clutch mechanism and a rear clutch mechanism is provided on the input shaft and the front clutch mechanism constitutes a second speed clutch for the second speed driving train and the rear clutch mechanism constitutes a fourth speed clutch for the fourth speed driving line, and a reverse driving gear for the reverse speed driving line is provided on the output shaft.
the reverse driving train is integrally connected to a fourth speed driving gear on the output side of the fourth speed clutch, and a fourth speed driven gear meshed with the fourth speed driving gear and a reverse driven gear meshed with the reverse driving gear through an idler gear are supported on the output shaft, and the two driven gears are arranged to be selectively connected to the output shaft through a selection mechanism provided between the two driven gears.
To: The Commissioner of Patents.

To be completed by Applicant:

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Complete Specification for the invention entitled: TRANSMISSION APPARATUS FOR VEHICLE

The following statement is a full description of this invention, including the best method of performing it known to me:
This invention relates to a transmission apparatus for a vehicle which is advantageous especially when applied to such a case as in a front-engine front-drive motor car in which the size of the transmission apparatus is largely restricted with relation to a layout space.

As for a transmission apparatus with parallel-two-shafts and of forward three stages and backward one stage type, there has been hitherto described in Japanese Patent Unexamined Publication Sho 54-103958, Japanese Patent Unexamined Publication Sho 55-51160, for instance, such a one that, between an input shaft and an output shaft which are provided in parallel one with another in a transmission casing and supported rotatably on a front wall and a middle wall of the casing, a first speed driving train for a low speed is provided so as to be positioned in rear of the middle wall, and a second speed driving train for a middle speed at a middle position, a third speed driving train for a high speed on a front side thereof and a reverse driving train on a rear side thereof are provided so as to be disposed between the middle wall and the front wall.

This type apparatus is advantageous in that the shafts can be made small in diameter, because the first speed driving train and the reverse driving train which have a large bending force acting on the shafts are disposed near the middle wall and in front and rear thereof.

Additionally, this type apparatus is so arranged that in order that a second speed clutch for the second speed driving train provided on the input shaft may be used also for a clutch for the reverse driving train, a reverse gear for the reverse driving train is integrally connected to the second speed driving gear on the output side of the second speed clutch, and a second speed driven gear and a reverse driven gear which are meshed with the respective driving gears are arranged to be selectively engaged with the output shaft through a selection mechanism provided.
between the two driven gears, and thereby a clutch for
exclusively using for the reverse driving is omitted so that
the axial directional dimension of the transmission apparatus
can be shortened by that extent.

It is also possible in this arrangement to add a
fourth speed driving train thereto for increasing the number
of change speed stages, but if the fourth speed driving
train is simply added thereto, the axial directional size
or dimension of the apparatus becomes too long, and also for
it is so arranged that at the time of the forward driving,
the second speed driven gear, accordingly, the second speed
driving gear meshed therewith is always connected to the
output shaft through the selection mechanism and the gear
ratio between the two gears is so set that the second speed
driven gear is rotated at a reduction speed, it is so
inconvenient that at the time of high speed rotation of the
output shaft by the fourth speed driving train, the second
speed driving gear rotates through the second speed driven
gear at a higher speed than of the output shaft, and the
reverse driving train is given a high speed rotation
through the reverse driving gear which is integral therewith,
and for especially in the reverse driving train there is
interposed the idler between the driving gear and the
driven gear, there is generated a large noise caused by the
engaged gears at the time of high speed rotation thereof,
and also when these gears are immersed in a lubrication oil,
there is a large power loss caused by agitation resistance
of the lubrication oil.

This invention has for its object to provide a
forward four stages and backward one stage type of transmission
apparatus free from those inconveniences, and one example of
this invention will be explained with reference to the
accompanying drawings, in which:-

FIG. 1 is a sectional side view of one example of
this invention apparatus, and
FIG. 2 is a sectional view taken along the line II-II in Fig. 1.

Referring to the drawings, numeral 1 denotes a transmission casing having a front wall la, a middle wall lb and a rear wall lc. and numerals 2 and 3 denote an input shaft and an output shaft which are provided in parallel one with another in the casing 1 so as to be supported rotatably on the front wall la and the middle wall lb of the casing 1. The input shaft 2 is connected to an internal combustion engine and the output shaft 3 is connected to driving wheels of a vehicle. Between the two shafts 2, 3, a first speed driving train 4-1 for a low speed is provided so as to be positioned in rear of the middle wall lb, and a second speed driving train 4-2 for a middle speed at a middle position, a third speed driving train 4-3 for a high speed on a front side thereof and a reverse driving train 4-R on a rear side thereof are provided so as to be disposed between the middle wall lb and the front wall la. Additionally, a fourth speed driving train 4-4 for the highest speed is provided so as to be positioned between the second speed driving train 4-2 and the reverse driving train 4-R.

The first speed driving train 4-1 comprises a first speed clutch 5 on the input shaft 2, a first speed driving gear 6 on the output side thereof and a first speed driven gear 7 meshed therewith and mounted on the output shaft 3. The third speed driving train 4-3 comprises a third speed driving gear 8 fixed to the input shaft 2, a third speed driven gear 9 meshed therewith and a third speed clutch 10 mounted on the output shaft 3 for connecting the gear 9 to the output shaft 3. The above arrangement is not especially different from the conventional one. According to this invention, a double type clutch 11 having a front clutch mechanism and a rear clutch mechanism is provided on the input shaft 2, and the front clutch mechanism is used as a
second speed clutch 12, and thus the second speed driving train 4-2 comprises the second speed clutch 12, a second speed driving gear 13 on the output side thereof and a second speed driven gear 14 meshed therewith and mounted on the output shaft 3. The rear clutch mechanism of the double type clutch 11 is used as a fourth speed clutch 15, and the fourth speed driving train 4-4 comprises the fourth speed clutch 15, a fourth speed driving gear 16 on the output side thereof and a fourth speed driven gear meshed therewith and mounted on the output shaft 3.

The construction of the double type clutch 11 itself is known, for instance, in USP 2,943,503, USP 3,017,006, USP 3,098,549.

Additionally, according to this invention, a reverse driving gear 18 is integrally connected to the fourth speed driving gear 16, and the reverse driving gear train 4-R comprises the reverse driving gear 18, a reverse driven gear 19 which is meshed therewith through an idler gear not illustrated and which is mounted on the output shaft 3. In this case, the foregoing fourth speed driven gear 17 and the reverse driven gear 19 are supported rotatably on the output shaft 3, and it is so arranged that, through a selection mechanism 20 provided to be movable between the two driven gears 17, 19, it is selectable that the fourth speed driven gear 17 is connected to the output shaft 3 in an ordinary case or that the reverse driven gear 19 is connected to the output shaft 3 (the condition shown by dotted lines in Fig. 1) only in the case of the reverse driving.

In the illustrated example, a one-way clutch 21 is interposed in the first speed driving train 4-1 so as to be positioned between the first speed driven gear 7 and the output shaft 3 the first speed driving train 4-1 for absorbing a shock given by a change-speed between the first speed and the second speed. Further, a one-way
clutch 22 is interposed in the third driving train 4-3 so as to be positioned between the third speed driven gear 9 and the third speed clutch 10, for absorbing a shock given by a change-speed between the second speed - the third speed - the fourth speed.

Further, in the illustrated example, a pair of inner and outer concentric first and second oil supply pipes 23, 24 inserted in an axial opening of the input shaft 2 and a third oil supply pipe 25 inserted in an axial opening of the output shaft 3 are provided to extend through the rear wall 1c of the transmission casing 1 so that the respective clutches 5, 15, 10 for the first, fourth and third speeds may be supplied with pressure oil through these oil supply pipes 23, 24, 25, and accordingly the axial directional length of the oil supply means can become shorter than that of a seal ring type one. For the second speed clutch 12, a seal ring type oil supply means using a seal ring 26 mounted on the input shaft 2 at its portion facing the third speed clutch 10 is adopted so that a pressure oil may be supplied thereinto from an oil supply opening 27 made in the input shaft 2, and thus the oil passage length can be shortened and thereby the second speed clutch 12 can be tightened promptly when the oil is supplied thereinto, and an engine brake effect caused by establishment of the second speed driving train 4-2 can be improved.

Referring to the drawings, numeral 28 denotes a block member attached to the front wall 1a, and a gear pump 29 serving as an oil pressure source and respective control valves 30 for change speed control are disposed thereon for constituting an oil supply means 31, and thereby a pressure oil may be supplied selectively therefrom to any of the foregoing oil supply pipes 23, 24, 25 and the oil supply opening 27.

Referring to the drawings, numeral 32 denotes a
torque converter which is provided on such a portion of the input shaft 2 that protrudes forwards from the front wall la so as to be interposed between the wall la and the engine, numeral 33 denotes a direct-coupling clutch 33 built in the same, numerals 34, 35 denote an oil charge passage and an oil discharge passage which connect between the interior space of the torque converter 32 and the oil supply means 31, numeral 36 denotes an oil passage for the direct coupling clutch which is formed of an axial opening made in the input shaft 2 for connecting between a control chamber 33a of the direct coupling clutch 33 and the oil supply means 31, and numeral 37 denotes a lubrication oil passage made in the input passage 2 for the foregoing double type clutch 11, and the lubrication oil passage 37 is connected to the oil discharge passage 35 from the torque converter 32 through an orifice member 38 so that lubrication of the double type clutch 11 may be effected by the discharge oil from the torque converter 32.

Now, the operation of the apparatus will be explained as follows:-

If the respective clutches 5, 12, 10, 15 for the first speed to the fourth speed are selectively supplied with oil, the respective driving trains for the first to the fourth speed are selectively established, and a forward driving at a speed selected from the first to the fourth speed can be effected. Additionally, if the fourth speed clutch 15 is supplied with oil and the selection mechanism 20 is changed over to the reverse side, the reverse driving train 4-R is established and a reverse driving can be obtained.

In this case, the driving gear 18, the idler gear and the driven gear 19 of the reverse driving train 4-R are rotated even at the time of establishment of the fourth speed driving train 4-4, but the rotation speed of the reverse driving gear 18 is limited to the rotation speed of
the fourth speed driving gear 16 which is integral therewith, that is, the rotation speed of the input shaft 2. Additionally, in the case of establishment of any of the driving trains 4-1, 4-2, 4-3 for the first speed to the third speed, the reverse driving gear 18 is rotated by the rotation of the output shaft 3 through the fourth speed driven gear 17 and the fourth speed driving gear 16, but the rotation speed thereof is always limited to a speed lower than the rotation speed of the input shaft 2 owing to the relation between the gear ratio of the fourth speed driving trains 4-4 and that of any of the other driving trains 4-1, 4-2, 4-3 for the first speed to the third speed.

According to the foregoing conventional transmission apparatus, the reverse driving gear 18 is integrally connected to the second speed driving gear 13 in order that the second speed clutch 12 may be used also as the clutch for the reverse driving train 4-R, and in this case at the time of the high speed driving caused by the establishment of the driving trains 4-3, 4-4 of the third speed or the fourth speed, the reverse driving gear 18 rotates at a higher speed than such a rotation speed of the output shaft 3 that is higher than that of the input shaft 2. According to this invention, however, the rotation speed of the reverse driving gear 18 can be always limited to that lower than the rotation speed of the input shaft 2, and generation of engaging noises between the respective gears caused by a high speed rotation of the reverse driving train 4-R and a power loss caused by agitation resistance of the lubrication oil can be decreased as much as possible.

Thus, according to this invention, the double type clutch is used to constitute the respective clutches for the second speed and the fourth speed, so that the transmission apparatus can become shorter in its axial directional length than such a type one that a clutch for
the fourt speed is independently provided, and additionally, according to this invention, the fourth speed clutch is used also for the clutch for the reverse driving train and the reverse driving gear is combined integrally with the fourth speed driving gear on the output side of the fourth speed clutch, so that shortening of the axial directional length caused by omitting of the clutch used exclusively for the reverse driving can be achieved and any disadvantage caused by a high speed rotation of the reverse driving train at the time of high speed driving can be removed.
CLAIMS
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A transmission apparatus for a vehicle of the type that, between an input shaft and an output shaft which are provided in parallel one with another in a transmission casing and supported rotatably on a front wall and a middle wall of the casing, a first speed driving train for a low speed is provided so as to be positioned in rear of the middle wall, and a second speed driving train for a middle speed at a middle position, a third speed driving train for a high speed on a front side thereof and a reverse driving train on a rear side thereof are provided so as to be disposed between the middle wall and the front wall, characterized in that a fourth speed driving train for the highest speed is provided between the input shaft and the output shaft so as to be positioned between the second speed driving train and the reverse driving train, and a double type clutch having a front clutch mechanism and a rear clutch mechanism is provided on the input shaft and the front clutch mechanism constitutes a second speed clutch for the second speed driving train and the rear clutch mechanism constitutes a fourth speed clutch for the fourth speed driving line, and a reverse driving gear for the reverse driving train is integrally connected to a fourth speed driving gear on the output side of the fourth speed clutch, and a fourth speed driven gear meshed with the fourth speed driving gear and a reverse driven gear meshed with the reverse driving gear through an idler gear are supported on the output shaft, and the two driven gears are arranged to be selectively connected to the output shaft through a selection mechanism provided between the two driven gears.

2. A transmission apparatus as claimed in claim 1, wherein a torque convertor and a direct coupling clutch are provided in front of the front wall.

3. A transmission apparatus as claimed in claim 1,
wherein the double type clutch is arranged to be supplied with operation oil directly and through an end of the shaft from an oil supply means provided on the front wall.

DATED this 21st day of April, 1982.

HONDA GIKEN KOGYO KABUSHIKI KAISHA
By its Patent Attorneys
CLEMENT HACK & CO.,
Fellows Institute of Patent
Attorneys of Australia
DRAWINGS
The following statement is a full description of this invention, including the best method of performing it known to me: