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(54) TRANSMISSION

(71) We, DEERE & COMPANY, a corporation organised and existing under the laws of the State of Delaware, United States of America, of Moline, Illinois 61265, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a planetary transmission which is capable of being shifted between three or four forward speeds.

According to the present invention a planetary transmission has: a drive shaft; a driven shaft; a planet carrier secured to the driven or drive shaft; a brakable first ring gear; a first sun gear drivingly connected or connectible to the drive or driven shaft respectively; a first planet gear mounted on the carrier and meshing with the first sun gear and the first ring gear; a second ring gear; a brakable second sun gear; and a second planet gear mounted on the carrier and meshing with the second sun gear, the second ring gear and the first planet gear; the second sun gear being connectible to the drive or driven shaft respectively.

One or two reverse speeds can be obtained by braking the second ring gear.

An embodiment of the invention will now be described with reference to the accompanying diagrammatic drawings in which:

Figure 1 is a longitudinal view, partially in section, of a planetary transmission of the present invention; and

Figure 2 is a cross-sectional view taken along the line 2—2 of Figure 1 and partly cut away.

Referring now to Figure 1, there is shown a planetary transmission generally designated by the numeral 10. The transmission 10 is driven by a drive shaft 12 which is generally connected to an internal combustion engine (not shown). The drive shaft 12

has a first sun gear 14 rigid with its rearward end. The expression "rearward end" is used on the basis of a typical fore-and-aft disposition of the transmission in a vehicle; however, it will be realized that such expressions are used solely for purposes of convenience and not by way of limitation.

The first sun gear 14 is disposed within a planet carrier 16 which has front and rear walls 18 and 20, respectively. The front wall 18 has an opening 22 and the rear wall is splined at 24 to a driven shaft 26. The carrier 16 has means rigidly interconnecting the front and rear wall 18 and 20, and this means includes several shafts, for carrying planet gears described later, together with circumferentially spaced wall portions.

The first sun gear 14 meshes with a first planet gear set which consists of three gears 28 and which is mounted on a set of three equilaterally spaced first shafts 29. The first shafts 29 are rigidly secured to the planet carrier 16 so as to allow the first planet gear set to protrude from the planet carrier 16 and mesh with a first ring gear 32. The first ring gear 32 concentrically encircles the first sun gear 14 and is floatingly carried by the first planet gear set. The first ring gear 32 is associated with a first brake 34 having conventional components which allow the first ring gear 32 to be selectively braked and released relative to a transmission housing 36.

The first planet gears 28 mesh with corresponding planet gears 35 of a second planet gear set. Each gear 35 is a part of a compound gear set which consists of three compound second planet gears 37 as shown in Figure 2. Each compound second planet gear 37 includes a further planet gear 39 which is rigid with the associated gear 35. The compound gears 37 are mounted on a set of three equilaterally spaced second shafts 41. The second shafts 41 are rigidly secured to the planet carrier 16 and positioned so as

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to allow the planet gears 39 to protrude therefrom and engage a second ring gear 38. The second ring gear 38 concentrically encircles the drive shaft 12 and is floatingly carried by the planet gears 39. A second brake 40 is associated with the second ring gear 38 and has conventional components for selectively braking and releasing the second ring gear 38 relative to the transmission housing 36.

A second sun gear 42 having an aperture 44 encircles the drive shaft 12 forwardly of the first sun gear 14 and meshes with the planet gears 39. The second sun gear 42 has a concentric plate 46 splined thereto which has a third brake 48 secured to its outer periphery for selectively braking and releasing the second sun gear 42 relative to the transmission housing 36. Medially positioned on the plate 46 is a clutch 50 for selectively coupling the second sun gear 42 to the drive shaft 12 forwardly of the planet carrier 16.

From the description thus far and noting that the drive shaft 12 may be connected to a power source such as an internal combustion engine by clutch or other torque transmitting mechanism, it will be seen that the drive shaft 12 may be regarded as a constantly rotating part.

A first forward speed is obtained by braking the first brake 34. The rotation of the drive shaft 12 is transmitted through the first sun gear 14 to the first planet gears 28 causing rotation thereof. The rotation of the first planet gear set causes translation thereof due to its meshing with the braked first ring gear 32. The translation of the first planet gear set causes rotation of the planet carrier 16 and thus of the driven shaft 26.

A second forward speed is obtained by braking the third brake 48. The rotation of the drive shaft 12 is transmitted by the first sun gear 14 to the first planet gears 28 which causes the compound second planet gears 37 to rotate. Since the planet gears 39 mesh with the braked second sun gear 42, the compound gear set 37 rotates and translates. The translation of the compound gears 37 causes rotation of the planet carrier 16 and thus the rotation of the driven shaft 26 at a second forward speed.

A third forward speed is obtained by engaging the clutch 50 to couple the second sun gear 42 to the drive shaft 12. With the second sun gear 42 held in a fixed relation to the first sun gear 14, the first planet gears 28 and the compound second planet gears 37 are prevented from rotating and thus are forced to translate due to the engagements of said gears with the first and second sun gears 14 and 42 so as to provide a direct mechanical drive from the drive shaft 12 to the driven shaft 26.

A reverse speed is obtained by braking the second brake 40. The rotation of the drive

shaft 12 is transmitted through the first sun gear 14 to the first planet gears 28 to cause rotation of the compound second planet gears 37. Since the planet gears 39 of the compound second planet gears 37 engage the braked second ring gear 38 the compound second planet gears 37 are forced to translate in a direction exactly the opposite from the drive direction. A reverse translation of the compound second planet gears 37 is transmitted to the planet carrier 16 and thus to the driven shaft 26 to provide the reverse speed.

Thus the planetary transmission 10 is capable of providing three forward speed ratios and reverse. The number of teeth for each of the gears is, of course, chosen so as to provide three different, appropriate forward speed ratios.

The first sun gear 14 can be connected to the drive shaft 12 by a clutch to provide an additional forward and reverse speed ratio.

WHAT WE CLAIM IS:—

1. A planetary transmission having: a drive shaft; a driven shaft; a planet carrier secured to the driven or drive shaft; a brakable first ring gear; a first sun gear drivingly connected or connectible to the drive or driven shaft respectively; a first planet gear mounted on the carrier and meshing with the first sun gear and the first ring gear; a second ring gear; a brakable second sun gear, and a second planet gear mounted on the carrier and meshing with the second sun gear, the second ring gear and the first planet gear; the second sun gear being connectible to the drive or driven shaft respectively.
2. A planetary transmission according to claim 1 in which the second ring gear is brakable.
3. A planetary transmission according to claim 1 or 2 in which the second planet gear comprises a pair of gears rigid one with the other, one gear of the pair meshing with the first planet gear and the other meshing with the second sun gear.
4. A planetary transmission substantially as described herein with reference to, and as illustrated in, the accompanying diagrammatic drawings.

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FIG. 1

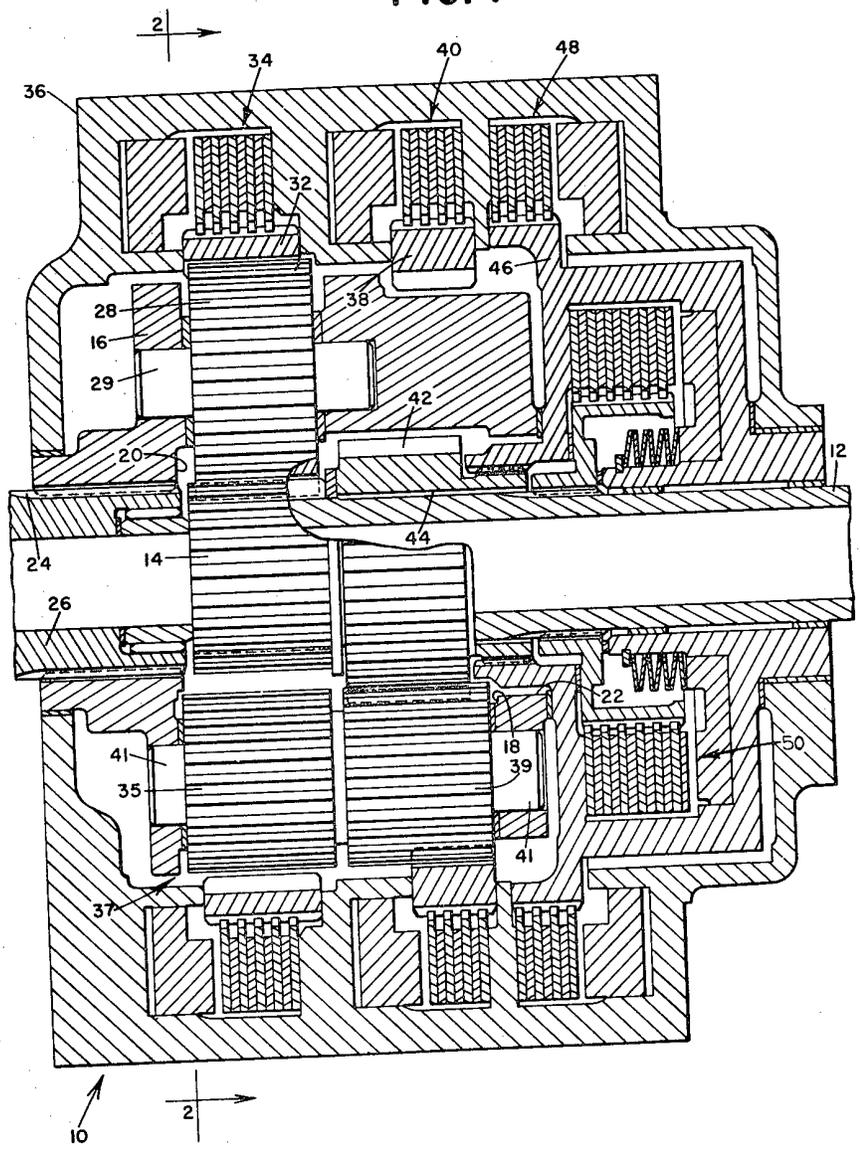


FIG. 2

