ABSTRACT

Between the motor and the bowl is a transmission and speed control shifter. The shifter is a two position shifter in which the bowl can be driven at either high or low speed depending upon charging, discharging and transit conditions. The transmission consists of three stages each comprised of a planetary gear system.

The shifter in one position utilizes only a portion of the first stage and then transmits further power through the entirety of the second and third stages. In a second position the shifter utilizes the entirety of the planetary gear systems of the first, second and third stages to achieve lower speed mix rate of the bowl. The two advantages sought and obtained are that presently installed and used transmission systems can be modified to secure two speed control and the additional transmission elements are all of standard size and construction.

9 Claims, 4 Drawing Figures
TRANSMISSION FOR CONCRETE MIXERS

BACKGROUND OF THE INVENTION

It is advisable to provide the user of a self-propelled transit concrete mixer with a two speed transmission system since the bowl should be rotated rapidly during the period in which the bowl is charged with concrete mixture ingredients and should again be rotated rapidly during the time of discharge.

During transit, however, it is only necessary that the bowl turn over slowly, just sufficiently to prevent setting up of the interior contents of the bowl. In fact, the problem of the art is how to achieve a sufficiently low rate of rotation of the bowl so that it is not "overmixed." If, during transit, the bowl should rotate an excessive amount the bowl wears excessively and the overmixture aggregate (or mixture) is less fit for its intended purpose and is therefore rejectable. What is needed, is a new and improved transmission, preferably one which can be made of standard parts and utilizing readily available planetary gear components and which can be produced from an existing transmission which does not have the advantages of the present invention. In other words, existing self-propelled concrete mixtures which do not have the features of the present invention can be readily modified by incorporating conventional or readily available components which will basically alter the transmission to incorporate the advantages of a two speed transmission drive between the motor and the bowl.

OBJECTS OF THE INVENTION

It is a principal object of the present invention to provide a transmission consisting of first, second and third stages each comprising planetary gear members which in combination are capable of driving a bowl at two distinct speeds; a fast speed during loading and unloading, and a slow speed during transit.

A second object of the present invention is to provide a new and improved operator mechanism which is manually controlled and includes two drive members one of which utilizes only a portion of the first stage of a three stage planetary gear system and thereby achieves a fast rate of bowl rotation and a second operator mechanism which utilizes the entirety of the first, second and third planetary gear systems to achieve a slower rotation of the bowl during transit.

A further object of the present invention is to utilize a transmission system consisting of uniform components making up a planetary gear system wherein a first stage planetary gear system is interfaced with a second planetary gear system which in turn is interfaced with a planetary gear system of a third stage. These three stages are interconnected in either one of two manners, through the first stage, to effect high and low speeds of rotation of a bowl.

Other objects and features of the present invention will become apparent from a consideration of the following description which proceeds with reference to the accompanying drawings.

DRAWINGS

FIG. 1 is a section view of a transmission system and shifter mechanism and illustrating the direction of movements of the shifter mechanism to achieve the selected rate of rotation of the bowl;

FIGS. 2 and 3 are detailed views illustrating the two positions for the shifter mechanism the high speed shifter position being illustrated in FIG. 2 and the low speed being illustrated in FIG. 3; and,

FIG. 4 is an exploded view illustrating the shifter mechanism and the first, second and third stages of planetary gears which are interfaced to produce the desired speed of bowl rotation.

SPECIFIC WORKING EXAMPLE OF THE INVENTION

Referring to FIG. 1, a shifter mechanism designated generally by reference numeral 10 is effective for coupling a motor or engine 12 and a sprocket 14 having a chain connection (not shown) with a mixer bowl (also not shown).

The shifter mechanism 10 determines the path of force as it moves through a first stage 16, a second stage 18 and a third stage 20, each stage consisting of a planetary gear arrangement prior to ultimate coupling of the engine 12 with the sprocket 14 which is mounted on drive shaft 22.

The shifter mechanism consists of a shifter plate 24 and shifter plate 26 the positions of which determine the rate of speed at which the bowl will rotate. During charging and discharging of the bowl, the bowl speed should be at a high rate, and during transit the bowl should rotate at a relatively slow rate so as not to exceed a predetermined total number of revolutions from the time of initial charging of the bowl with the concrete mixture ingredients to the time of discharging such mixture ingredients at the construction site. The shifter plates 24, 26 have associated operator rods 30, 32 that determine the coupling of gears through the first stage 16 (FIG. 4) previously pointed out to be a planetary gear system. When it is desired to rotate the bowl at a high speed, the rod 30 associated with plate 24 is moved toward the right (FIG. 2) and the rod 32, together with plate 26 is moved to the left (FIG. 2) thus disengaging the splined end 40 of rod 42 from sun gear 44 and engaging the gear member 46 with a sleeve 48 having internal gear teeth 50. The sleeve 48 has a flange 54 which is connected with a housing 56 and the housing is coupled through rods 58 to a backing member 60 having internal gear teeth 62 which mesh with the gear teeth 64 of a transfer rod 66.

The transfer gear rod 66 has gear teeth 68 which operates first the sun gear 70 of the second stage planetary gear system 18. The second stage planetary gear system 18 and the third stage planetary gear system 20 (FIG. 4) are operatively connected together so that they in turn will operate the shaft 22 and rotate the sprocket wheel 14 at a relatively high rate of speed as for example 18-20 revolutions per minute. But once the bowl is fully loaded it is then desired to reduce the rate of mixing of the ingredients within the bowl and at that point the shifter is again operated and at this time the rod 30 is moved to the left "A" (FIG. 1) disengaging the gear 46 from the associated gear teeth 50 of sleeve 48 and the rod 32 connected with plate 26 is moved toward the right, in the direction indicated by the letter "B" in FIG. 1, engaging the gear teeth 40 of rod 42 with sun gear 44 so that the first stage planetary gear system 16 is connected with the second stage 18 through the backing member 60 thence through transfer gear rod 66 and then to the second and third stage gear mechanisms 18 and 20.
Referring to FIG. 4, the first stage 16 is housed in part by an end cover 80 which is secured to a casing 82 (FIG. 1) which in turn is fastened to a chain housing 84.

Each of the first, second and third stages is essentially identical in the respective gear arrangement other than the arrangement that the first stage 16 has its initial motor input through gear 40 or gear 46. Since the various planetary gear arrangements are identical except as noted; only one will be described being understood that the gear parts are for the most part interchangeable thus making for economy of manufacture and service. The planetary reducer is standard and is obtained from either Blaw Knox or Funk.

Referring to the planetary gear arrangement in the first stage 16 (FIG. 4) there is a ring gear 78 with an O-ring seals 92 and 94 one on each side thereof. The ring gear has meshed therewith three planetary gears 76 which are supported by associated pivot pins 98, plates 100 and bearings 102.

As shown in the first stage, each planetary gear is supported on planetary gear plates 104 and 106 and the planetary gears are operated by sun gear 44 which is directly drivable by the splined end 40 of shaft 42.

Force is transmitted from one stage to the next by means of connecting shafts 66 which couple the first stage 16 to the second stage 18 and there is a corresponding second shaft 66 connecting the second stage 18 to the third stage 20 (FIG. 1).

All that is required to change bowl speed is to move the rods 30, 32 in some suitable mechanical manner thus effecting either a connection from the motor 12 through the motor shaft 110 through gear 40 (note operational position in FIG. 1) and establishing a slow bowl rotational speed wherein the shifter elements are disposed as in FIG. 3; or, the shifter elements are moved to the positions shown in FIG. 2 wherein 40 is disengaged from the sun gear 44 of the first stage 16 and instead gear 46 is connected with sleeve 48 which in turn is connected to the casing 56 to effect a bypass of a portion of the gear arrangement in the first stage 16 and produces through the second 18 and third 20 stages a faster rate of speed of the bowl.

The output shaft 22 is mounted on roller bearings 120 and 122 spaced one at each end of the shaft 22 and the sprocket 14 has a chain connection with the bowl. The sprocket wheel 14 is positioned by a spring 128 and it can float on the shaft 22 through a splined connection 129 so as to remain mounted in a proper relative position in relation to the bowl in spite of its inevitable shifting movements by means of a spring 128. Details of the mounting of the sprocket wheel 14 may be obtained by reference to copending application Ser. No. 348,209 filed Apr. 5, 1973 entitled "CHAIN TENSIONING DEVICE."

OPERATION

In operation, it is a relatively simple matter to change the bowl rotational speed by means of the actuating mechanism which mechanically operates one or the other of the plates 24 or 26, positioning them either in the position shown in FIG. 2 or FIG. 3.

When it is desired to rotate the bowl at a fast rate of speed which is the case during charging and discharging, the plates 24 and 26 are positioned as shown in FIG. 2 in which the gear member 46 is engaged with the coacting gear teeth of sleeve 48 and the motor shaft 110 and gear member 46 to sleeve 48, flange 54, housing 56, rod 58, backing member 60 and thus through the first stage 16 to the second stage 18 through a transfer rod 66 which effects the transfer through gear teeth 64 and gear teeth 68. Force then moves through the second and third stages 18 and 20 in a conventional planetary gear fashion to drive shaft 22 having splined connection 129 with sprocket wheel 14. The sprocket 14 has a chain drive connection (not shown) with the bowl (not shown). When the shifter mechanism is positioned as shown in FIG. 2 the bowl rotates at a high rate of rotation.

During transit, when the speed of rotation should be relatively slow, just sufficient to prevent the aggregate from "setting up," the bowl rotates, just turning over, in order that the aggregate is not overmixed and to prevent excessive wear of the interior components of the bowl. In this case, the shifter mechanism is changed from the position shown in FIG. 2 to that of FIG. 3 in which the plate 24 is moved to the left disengaging gear member 46 from sleeve 48 and the plate 26 is moved to the right engaging gear end 40 with sun gear 44.

In this case, the motor 12 is coupled through the output shaft 110 through gear end 40 with sun gear 44, planetary gears 76 and backing member 60 to transfer rod 66 thus transferring motive force from the first stage 16 to the second stage 18. Motive force is transferred from second stage 18 to third stage 20 as previously described and thus the entirety of the planetary gear systems of the first, second and third stages is utilized between the motor 12 and the output shaft 22. The output shaft and splined sprocket 14 are thus rotated at a relatively slow speed in the order of only one or two revolutions per minute thus preventing the aggregate from overmixing during transit.

One of the major advantages of the present invention is that it is so simple to adapt conventional transmissions by simply adding the shifter mechanism, and adding the first stage support plate and the additional transfer gear rod. These are relatively easy operations to perform and the entirety of the gear system is made up of uniform sized components.

The gear system is lubricated by incorporating the entirety of the first, second and third stages and shifter mechanism within a sealed system wherein all of the gears and shifter mechanism are sealed and are lubricated.

What the new development consists then is an increase in gear reduction from a typical present reduction ratio of 15:1 to 45:1 so that the bowl can be rotated at whatever speed is desired as for example 23 to 24 rpm in the high range to enable faster charge time and discharge time whereby less material is spilled and the bowl is cleaner; and, at the lower range of bowl speed, the aggregate is protected from overmixing and excessive bowl wear. Because of the improved bowl gear reduction, ample power is available at the lower range of bowl rotation so that the bowl can always or nearly always be rotated and after it has been stopped for excessive periods thus preventing set up of the aggregate in the bowl resulting in catastrophic loss of the bowl.

Also, the low range bowl drive speed results in a power saving in the hydraulic unit (since the hydraulic motor is driven from the prime mover) and the additional power available contributes to increased power.
for the vehicle drive train. Thus, the vehicle can move over steeper grades and at faster speeds than heretofore.

The operating mechanisms for shifting the plates 24, 26 can be either manual, hydraulic or pneumatic according to desired preference.

Although the present invention has been illustrated and described in connection with a few selected example embodiments, it will be understood that these are illustrative of the invention and are by means restrictive thereof. It is reasonably to be expected that those skilled in this art can make numerous revisions and adaptations of the invention and it is intended that such revisions and adaptations will be included within the scope of the following claims as equivalents of the invention.

What I claim is:

1. An improved transmission for concrete mixers comprising a shifter mechanism having two independently movable and relatively laterally displaceable first and second drive members, said first drive member being selectively movably into engagement with a sun gear of the first of three intermittently engageable planetary gear assemblies, said second and third planetary gear assemblies being connected serially together and to a preselected portion of said first planetary gear system to effect a drivable connection between a prime mover and a mixing bowl, said second independently movable drive member being selectively engageable with a second portion of said first planetary gear assembly when said first drive member is disengaged to provide a second drive connection effecting a different speed between said prime mover and bowl and consisting of a gear member which forms a direct drive with a different portion of said first planetary gear assembly than said first drive and bypassing the sun and planetary gear portion of said first planetary assembly but utilizing the interfaced second and third planetary gear assemblies.

2. The improved transmission in accordance with claim 1 wherein the planetary gear arrangements are disposed in series and are selectively coupled to effect, in accordance with the gear train, a selected bowl speed control.

3. The improved transmission in accordance with claim 1 including operating means which are splined together to provide co-rotating first and second gear means selectively engageable with a predetermined portion of the adjacent planetary gear of the first of three in-series planetary gear systems.

4. The improved transmission in accordance with claim 1 wherein the first, second and third stage planetary gears are connected in series and means for acting only through a portion of the first stage, and means for acting through the entirety of said first stage whereby the output of said first stage to the combination of the successively connected second and third stages determine the bowl speed.

5. The improved transmission in accordance with claim 1 wherein each of the sun, planetary and ring gears of the three stages is of standard size and construction.

6. The improved transmission in accordance with claim 1 including mechanically operable means for laterally shifting on spline connections, a first and second gear operator which determines the operative portion of the first planetary gear stage operated thereby.

7. A process for transmitting rotational energy to a mixing bowl at one of two preselected speeds comprising the steps of selectively engaging independently movable and relatively displaceable first and second drive gear members of a first stage planetary gear system, coupling said first stage with a combination of in-series second and third stage planetary gears and connecting the output of said third stage to a bowl for effectively driving said bowl at a predetermined speed.

8. The process in accordance with claim 7 including the step of mechanically shifting relatively to each other one of two gear operators to effectively determine the rate of bowl speed.

9. The process in accordance with claim 7 wherein said first stage planetary gear includes sun, planetary and ring gear portions which are predeterminately operated and transmitting force from said first stage to successive second stage and third stage planetary gear systems, wherein that portion of said first stage is operated to effectively determine bowl speed.