

April 7, 1953

A. J. WARSAW

2,633,759

TRACTOR OVERDRIVE ASSEMBLY

Filed Nov. 5, 1948

2 SHEETS—SHEET 1

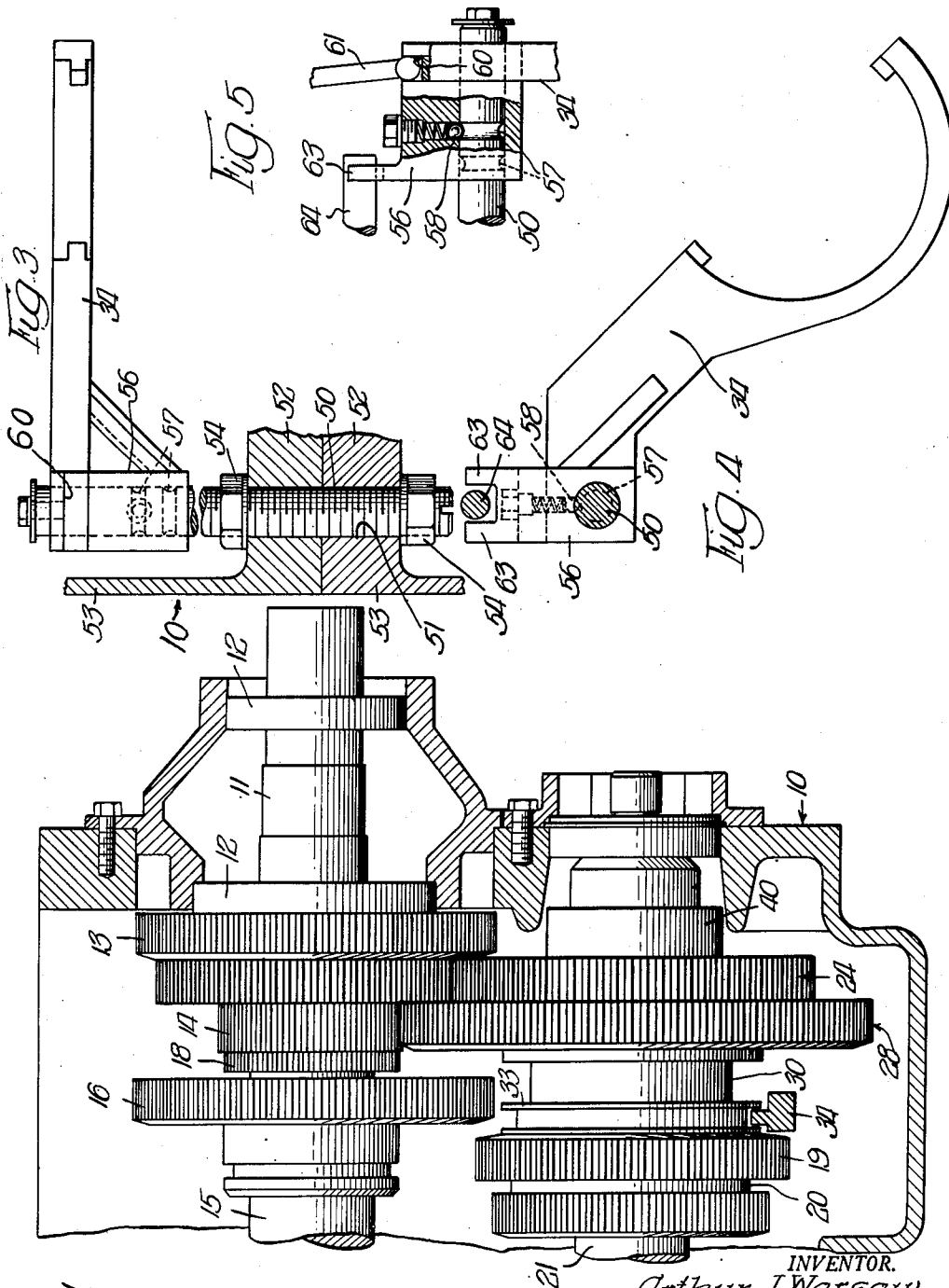


Fig. 1

Fig. 5

Fig. 4

INVENTOR.
Arthur J. Warsaw
BY
Cromwell, Trust & Warden
attys

April 7, 1953

A. J. WARSAW

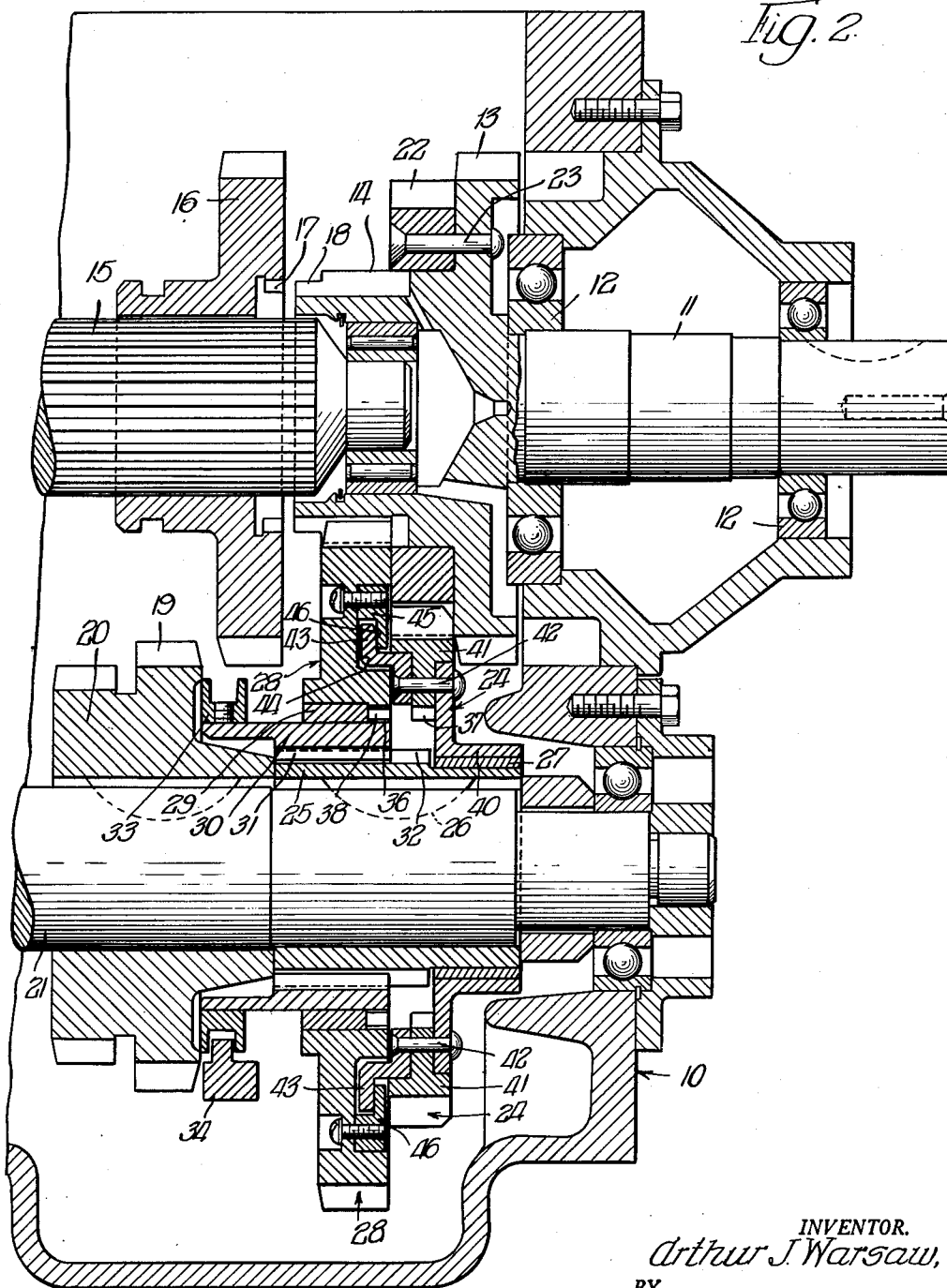
2,633,759

TRACTOR OVERDRIVE ASSEMBLY

Filed Nov. 5, 1948

2 SHEETS—SHEET 2

Fig. 2



INVENTOR.
Arthur J. Warsaw,
BY
Cromwell, Trust & Warden
attys.

UNITED STATES PATENT OFFICE

2,633,759

TRACTOR OVERDRIVE ASSEMBLY

Arthur J. Warsaw, Minier, Ill.

Application November 5, 1948, Serial No. 58,488

1 Claim. (Cl. 74-745)

1

This invention relates to an overdrive assembly for a well known type of tractor transmission which is adapted to afford an additional complete set of field or working speed ratios, over and above the usual set of forward field speed ratios characterizing present, standard types of tractor transmission. In particular, the invention pertains to an overdrive assembly which is devised in such manner to enable its installation on an existing tractor transmission in practically the only possible way, under the circumstance of available space, without re-designing of the standard transmission housing.

The assembly of the present invention has been specially evolved for application, either as an auxiliary installation to be built into an existing tractor structure or as a component of an original article of manufacture, in a more or less particular and predetermined type of tractor transmission, i. e., the types designated as model "H" or model "M" and manufactured by International Harvester Company. The construction and mode of operation of the transmissions of these vehicles are familiar to all those skilled in the art; hence, in the specification to follow, reference to standard well known details and functioning thereof will be kept at a minimum. Notwithstanding the aforesaid special adaptability of the present assembly to the transmission types referred to above (either as what may be designated an adapter unit for existing transmissions or as a concept to be embodied in the original manufacture of the transmission), it is to be understood that the principles of the invention may well be adapted for the corresponding modification, original or adaptive, of other generally similar types of transmission. This is particularly so in cases where the limitation on available space is such as to rule out the application of various overdrive theories or constructions heretofore proposed by others.

Although standard transmissions of the type referred to in the preceding paragraph normally present four optionally available forward work or field speeds, plus a road speed and a reverse ratio it is well known that the road speed affords limited and usually insufficient tractive power for field operation under any appreciable load. Even when unloaded the high, road speed ratio is unable to pull the tractor itself in certain kinds of wet terrain.

In a standard, model "M" International tractor transmission, the first four field speeds range in graduated steps from a low of about $2\frac{3}{8}$ M. P. H. to a fourth speed of about $5\frac{1}{2}$ M. P. H. Follow-

2

ing this maximum field or work speed the transmission affords a fifth, road speed of about $16\frac{1}{4}$ M. P. H., which is sufficient for all road purposes. When the present overdrive assembly is installed, a further range of auxiliary speeds is provided, intermediate the above mentioned, conventional fourth working speed and fifth road speed ranging about as follows:

6 M. P. H.
8 M. P. H.
 $9\frac{3}{4}$ M. P. H.
 $11\frac{3}{4}$ M. P. H.

Inasmuch as in the fifth, road speed position of the usual transmission the drive is transmitted directly from the power shaft to the driven shaft, the present assembly does not increase the available road speed.

Thus it will be seen to be a general object of the present invention to afford an overdrive assembly which operates to provide a set relatively high field speeds, over and above the available field speeds of the standard transmission to which the assembly is applied, actually doubling the number of such field ratios, and thereby adapting the tractor to a substantially increased number of uses and types of work, as well as greatly enhancing its flexibility or versatility of operation.

A further primary object of the invention is to provide an overdrive tractor transmission assembly or unit which is essentially characterized by its extreme compactness and by its association in operative relation to the component parts of a standard tractor transmission in such manner that it is accommodated by the space actually available in the standard housings, hence does not acquire redesign or modification of the existing housing.

A further object is to provide a transmission structure of the foregoing character which may be readily installed on well known tractor models, either in the field or at the factory during original production.

A more specific object of the invention is to provide a special overdrive assembly for tractor transmissions of the particular type embodying an auxiliary, belt pulley drive gear on the transmission drive shaft at the forward, power input side of the transmission, through which gear various types of external mechanisms such as grinders, saws, dumps, etc., are driven as desired, said assembly including a driving gear which is operatively installed directly on said auxiliary, belt pulley gear and a countershaft

3

mounted gear in constant mesh with said drive gear, said last named gear being controlled as to its driving relation to the standard transmission countershaft by means of a special overdrive selector slidable on said countershaft.

Yet another specific object is to provide a transmission overdrive assembly for a transmission of the general type characterized by a main driving gear adapted to be direct-coupled to a driven shaft and by an auxiliary belt pulley gear or the like rigidly connected to said main driving gear, in which an overdrive gear is fixedly associated with said drive shaft between said main drive and said auxiliary gear, together with a countershaft carried gear which is in constant mesh with said overdrive gear and is controlled for optional driving or non-driving relation to said countershaft by a sleeve-like, jaw clutch selector mounted for axial shifting on said countershaft.

A still further specific object is to provide an assembly of the type referred to in the preceding paragraph, in which said selector is non-rotatively connected to the countershaft by a tubular support and in which said selector and support also serve as idler bushings for gears on said countershaft which are optionally clutch-coupled to said countershaft by said selector in accordance with the axial position of the latter.

The foregoing statements are indicative in a general way of the nature of the invention, but other and more specific objects will be apparent to those skilled in the art upon a full understanding of the construction and operation of the device.

A single embodiment of the invention is presented herein for purpose of exemplification, but it will be appreciated that the invention is susceptible of incorporation in other modified forms coming equally within the scope of the appended claim.

In the drawings,

Fig. 1 is a fragmentary view in elevation, being partially sectioned vertically through the transmission casing, illustrating the improved overdrive assembly in this invention as operatively installed on a standard tractor transmission of well known type;

Fig. 2 is a somewhat enlarged fragmentary view in axial section through the driving shaft, driven shaft and countershaft of the transmission assembly, more clearly illustrating the relationship and operation of the parts, in which figure the essential parts of the assembly, as distinguished from standard transmission components, have been outlined in relatively bold lines;

Fig. 3 is an enlarged fragmentary view, partially in horizontal section, illustrating a detail of the mounting of the shifter fork for the overdrive selector; and

Fig. 4 is a view in side elevation, further illustrating said shifting structure; and

Fig. 5 is a further fragmentary view of the shifter arrangement, partially broken away and in vertical longitudinal section.

Referring to Figs. 1 and 2 of the drawing, the reference numeral 10 generally designates the housing or casing of a standard, well known type of tractor transmission, exemplified by that embodied in the type "M" or type "H" International tractor, for installation in which the assembly of the present invention was specially devised. However, as pointed out above, the transmission to which the present assembly is applied may be of any related type which, by reason of the rela-

4

tionship and functioning of its component parts and the important factor of available internal housing space, is the equivalent, for the purpose of the description to follow, of the particular transmission construction mentioned above.

This housing has the main driving shaft 11 appropriately mounted therein by means of anti-friction bearings 12 and, characteristically, is provided with an auxiliary belt drive gear 13 fixed on shaft 11 immediately within the forward side of the housing. Gear 13 is located forwardly of the main transmission driving gear 14, which is also fixed to the shaft 11, and is employed commonly as a source of power for driving various types of external equipment, such as grinders, saws, etc.

The driven shaft of the transmission is aligned with drive shaft 11, being designated 15, and, in accordance with the conventional arrangement of tractor transmissions of the type referred to, has a selector gear 16 splined thereon for axial sliding movement. This gear is operated by the usual hand shift lever of the tractor. When shifted to the right, as viewed in Figs. 1 and 2, it is direct coupled with the main drive shaft 11, through coacting, internal and external jaw clutch teeth 17, 18 on the gears 16 and 14, respectively. The shaft 15 is driven at maximum speed to operate the tractor for road work, as distinguished from field work. The present invention does not alter this road speed arrangement. When shifted to the left, the gear 16 meshes with the gear 19 of a conventional double gear 20 keyed to the usual countershaft 21, thereby to effect a drive through the transmission at a standard, reduced speed ratio, in a manner which is well known in the art.

The aforesaid structural features are characteristic of the tractor transmissions of the type in which the present overdrive assembly is to be installed. With regard to the International type "M" transmission the only modifications necessary in installing the present assembly are a slight change in the selector gear 16 to make room for a countershaft gear, to be described, and application of the gear 22 to auxiliary gear 13. The transmission shafting is unchanged. In short, alteration of the existing transmission is held at an absolute minimum and the only real changes are dictated by the space factor.

In carrying the present invention into practice, a drive gear 22 for the overdrive assembly is mounted coaxially of the shaft 11 in rotatively fixed relation to the same. This gear is located immediately to the rear of the auxiliary belt pulley gear 13, between the latter and the main transmission drive gear 14. In the illustrated embodiment, gear 22 is shown as a ring gear secured by rivets 23 to the flange of the gear 13 in immediate abutting engagement thereof. However, gear 22 may also be provided by sweating the same in place on gear 13, or by fabricating the same as one part of multiple gear, case or forged integrally with the auxiliary gear 13 and/or main drive gear 14.

Drive gear 22 is in constant mesh with a driven gear of the overdrive assembly, generally designated 24, which is adapted to idle on or to be drivingly connected to the countershaft 21. In the specific embodiment illustrated, said countershaft has an elongated tubular hub member 25 pressed thereon and non-rotatively secured thereto by a key 26, the driven gear 24 being mounted to idle on the forward end of said hub 25, when the overdrive is inoperative, through the agency

5

of a bushing 27. A standard speed reduction gear, generally designated 28, is disposed concentrically with gear 24 on countershaft 21. Gear 28 is in constant mesh with the main drive 14 gear and is intended to idle relative to the countershaft 21 when the overdrive assembly is in operation. To this end, the gear 28 is mounted by a bushing 29 on a tubular selector sleeve 30, which sleeve is in turn non-rotatively secured to hub 25, by means of elongated internal splines 31 thereon and corresponding splines 32 on the exterior of said hub. Gear 28 is restrained from axial movement and the sleeve 30 is adapted to be shifted internally thereof in the axial direction by means of an annular grooved shipper ring 33 secured thereon, said ring being operated by the sliding fork 34 from the exterior of the transmission housing.

Selector sleeve 30 is thus drivingly connected with the tubular hub 25 through the coacting splines 30, 31 during its axial, selecting movement to the right or left on said hub, and is thereby non-rotatively connected with the countershaft 21, to which hub 25 is keyed.

Sleeve 30 is provided on its forward external periphery with a set of jaw clutch teeth 36. These are selectively engageable with like internal clutch teeth 37 on the driven gear 24 of the overdrive assembly, or with similar internal teeth 38 on the countershaft reduction gear 28, in accordance with the respective selected position of selector 30 to the left (for standard transmission ratios, as illustrated in Fig. 2) or to the right (for overdrive ratios). In the latter position, said selector sleeve drivingly couples gear 24 to the countershaft 21 and in the former position the sleeve correspondingly couples reduction gear 28 to said countershaft.

The tooth ratio of the gear 22 and driven gear 24, when the overdrive assembly is in operation, is so related to the ratio between the standard drive gear 14 and reduction gear 28 of the conventional transmission that said overdrive assembly affords an entire graduated set of speeds, higher than the standard field speeds and lower than the direct-drive road speed, the number of speeds in said additional set equalling the number of conventional working or field ratios. This greatly increases the flexibility of operation of the transmission for any given positioning of the gearing of the standard transmission, as determined by the positioning of the usual selector gear 16 or other selective transmission gears. A tractor possessing the present overdrive unit is adapted for certain types of work which it was previously incapable of performing, or performed with limited success, and can handle practically any type of load or work that exists, within its rated capacity.

Preferably, and as a practically desirable matter, in any given standard, selected gear ratio, the corresponding speed ratio produced by the overdrive assembly is 2.3 times the normal speed, i. e., when said assembly is out of operation. I find that further enlargement of the drive gear 22 of overdrive assembly will result in interference with the usual belt pulley driven gear (not shown) which is mounted directly above it. Reduction of the diameter of gear 22 merely results in an undesirable duplication or closer approximation of a speed made possible by the existing transmission. Consequently, the proportioning of the gears 22, 24 to produce the aforesaid 2.3 multiplication of normal field speeds is important, since it is closely concerned with the

6

problem of presenting a desirable range of over-speeds, while still enabling the assembly necessary for that purpose to be introduced in the definitely limited spaced available within the standard transmission housing.

It will be noted that certain of the component gears of the subject overdrive assembly are of multiple-part built-up construction. This is the result of the need to provide adequate and necessary gearing in close axial proximity and in an installation space which is extremely limited, as well as to facilitate assembly. As illustrated, the gear 24 comprises a flanged hub 40 associated with the idler bushing 27 to which the ring gear element 41 is fixedly secured by rivets 42. The same rivets serve to hold an annular, angled retainer ring 43 in fixed relationship to said gear ring. The other countershaft gear 28 is recessed at 44 for the reception of retainer 43 and has screwed thereon a coacting annular retainer 45. This member is provided with an annular lip 46 which overlaps the retainer ring 43, thus serving to restrain gears 24, 28 from substantial axial separation, while permitting non-friction rotation thereof relative to one another.

The mounting for the shifter fork 34 by which selector sleeve 30 is actuated is worthy of note, being illustrated in Figs. 3, 4 and 5. An elongated, rigid rod 50 is disposed in a bore 51 through the bosses 52 of the two component sections 53 of the composite clutch housing and transmission case 10, said rod being secured in the rigid, distortion resistant support afforded by said bosses by means of a pair of nuts 54 applied thereto on opposite sides of said walls. The rod is applied to the existing tapped cap screw bore which ordinarily receives a cap screw serving to hold the clutch housing and transmission case together. The object of adapting the present assembly to the existing transmission structure with a minimum of change in the latter is furthered by this expedient. Rod 50 extends a predetermined distance into one of the housing sections 53 in which fork 34 is disposed and has slidably mounted thereon, adjacent its extremity, a block 56.

The fork 34 extends angularly downwardly from block 56, being appropriately secured to and braced on said block. The rod 50 has a pair of axially spaced annular detent grooves 57 and the block is provided with a transverse recess in which a spring urged ball detent pawl 58 is disposed, said detent being adapted to engage in one or the other of said grooves 57, depending upon the longitudinal position of the block 56 with relation to rod 50. In one of these positions the fork 34 is effective to engage the jaws 36 of selector sleeve 30 with the coacting jaws 37 of auxiliary overdrive gear 24, while in the other position said jaws 36 are engaged with the coacting jaws 38 of the countershaft reduction gear 28, as illustrated in Fig. 2. Block 56 is provided with a recess 60 in an outer surface thereof for the reception of a shifter arm 61 carried by a suitable rock shaft (not shown) operatively connected to an external operating lever for the overdrive assembly, in a well known manner. Rotation of block 56 relative to the rod 50 is prevented by the provision of a pair of spaced, upwardly extending lugs 63 thereon, which lugs are disposed on either side of a rigid dowel pin 64 paralleling rod 50 and appropriately fixed to the transmission housing.

The arrangement of the rod 50 and pin or

stud 64 is of importance in the present invention for the reason that the installation of the present unit is greatly facilitated thereby. As stated above, the rod 50 simply replaces a cap screw which ordinarily holds the clutch housing and transmission case together. It is received in the already tapped bore 51, and in order to properly adjust the position of the detent grooves 57 with reference to the proper shift positions of the sleeve 30, it is only necessary to loosen the nuts 54, thread the rod in one direction or another, and retighten the nuts. Thus the structure performs the usual function of the cap screws which it replaces, and additionally affords an adjustable lock for the rod 50.

The pin 64 likewise replaces one of the standard dowel pins that hold the transmission case in proper relation to the adjoining clutch housing. The only difference is that the pin 64 is sufficiently reduced in its diameter at the free end thereof to accommodate the forked lugs 63, as shown in Fig. 4.

The above provisions of rod and dowel pin permit the shifter assembly to be aligned with previous machine work on the transmission case, enabling assembly of the shifter and its mounting and guiding provisions without special fitting and adjusting operations. This is possibly one of the very few ways in which this can be accomplished since there are no machined surfaces within the interior of the case.

The above described selector operating structure may be readily mounted on the housing of a standard transmission of the type contemplated by the invention and is so designed as to accommodate itself to the space available within said housing, in consonance with the underlying purpose of this invention.

I claim:

An overdrive assembly for a tractor transmission of the type characterized by a housing having therein a driving shaft, a main driving gear fixed on the end of said shaft and within a wall of said housing, an auxiliary gear for an external mechanism secured to said driving shaft on the side of said driving gear adjacent said wall, and a countershaft paralleling said

driving shaft, said assembly comprising an overdrive drive gear fixedly secured to said auxiliary gear immediately adjacent said transmission driving gear and between the latter and said auxiliary gear, an overdrive driven gear mounted coaxially of said countershaft in permanent mesh with said overdrive drive gear, a selector mounted coaxially of said countershaft in non-rotative, axially slidable relation thereto, said selector and overdrive driven gear having coaxing drive means adapted for operative driving engagement and disengagement in accordance with the relative axial position of said selector and countershaft, a further driven gear rotatably mounted coaxially of said countershaft in constant mesh with said main transmission driving gear and provided with means drivingly engageable with said selector drive means when said selector and overdrive driven gear are drivingly disengaged, and means to shift said selector axially relative to said countershaft, comprising a fork axially engaging said selector, a guide rod rigidly secured to said housing to extend inwardly of a side wall thereof, means to mount said fork for sliding movement along said rod in non-rotative engagement therewith, and means to actuate said fork for said sliding movement from the exterior of said housing.

ARTHUR J. WARSAW.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,027,608	Jackson	May 28, 1912
1,731,151	Royce	Oct. 8, 1929
1,831,195	Radford	Nov. 10, 1931
2,300,502	Haltenberger	Nov. 3, 1942
2,464,479	Avila	Mar. 15, 1949
2,535,388	Burks et al.	Dec. 26, 1950

FOREIGN PATENTS

Number	Country	Date
372,978	Great Britain	May 19, 1932