Oct. 9, 1945. F. L. ALBEN 2,386,186

STEAM TURBINE LOCOMOTIVE

Filed June 10, 1943 3 Sheets-Sheet 1

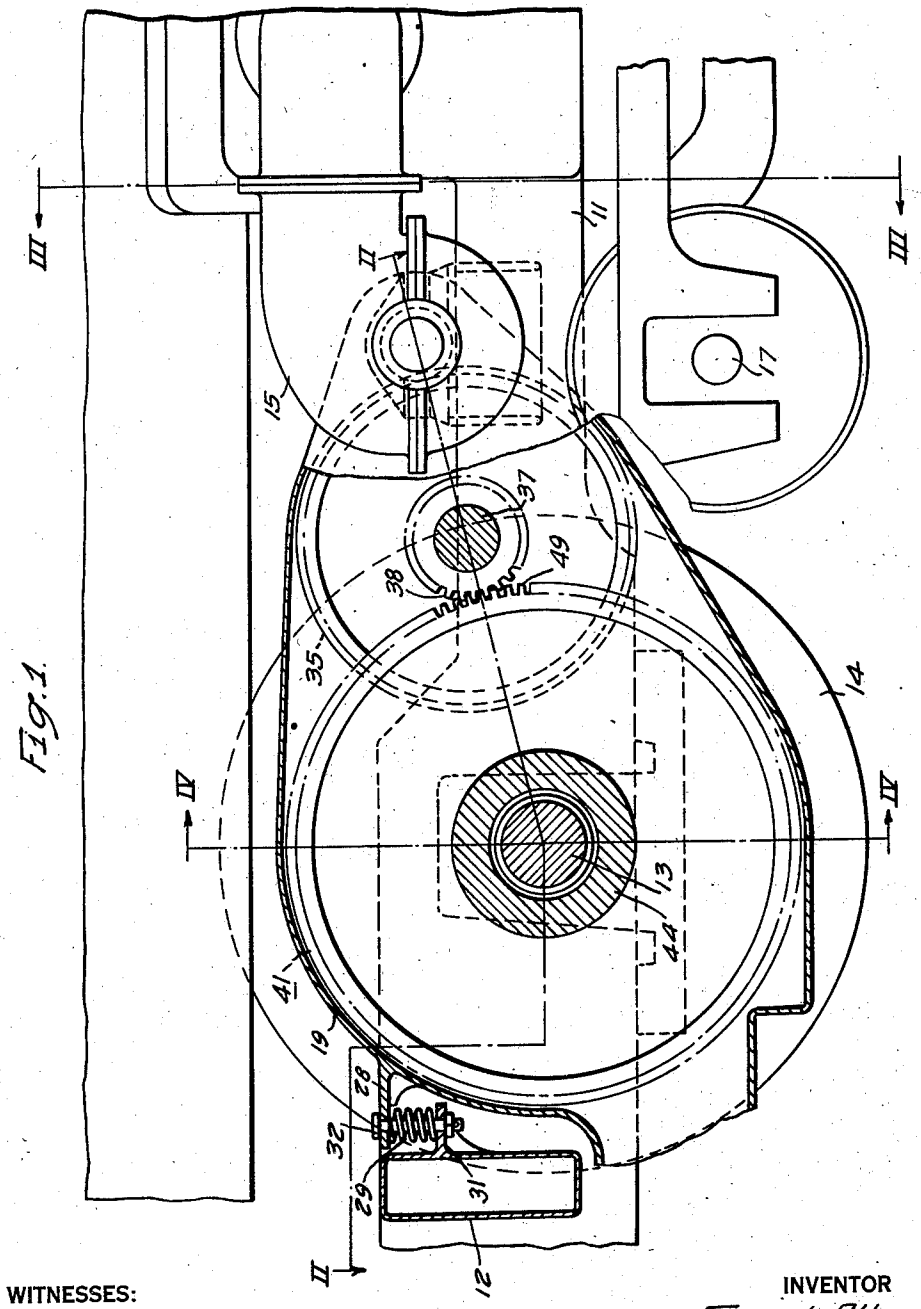

FIG. 1.

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Filed June 10, 1943 3 Sheets-Sheet 2

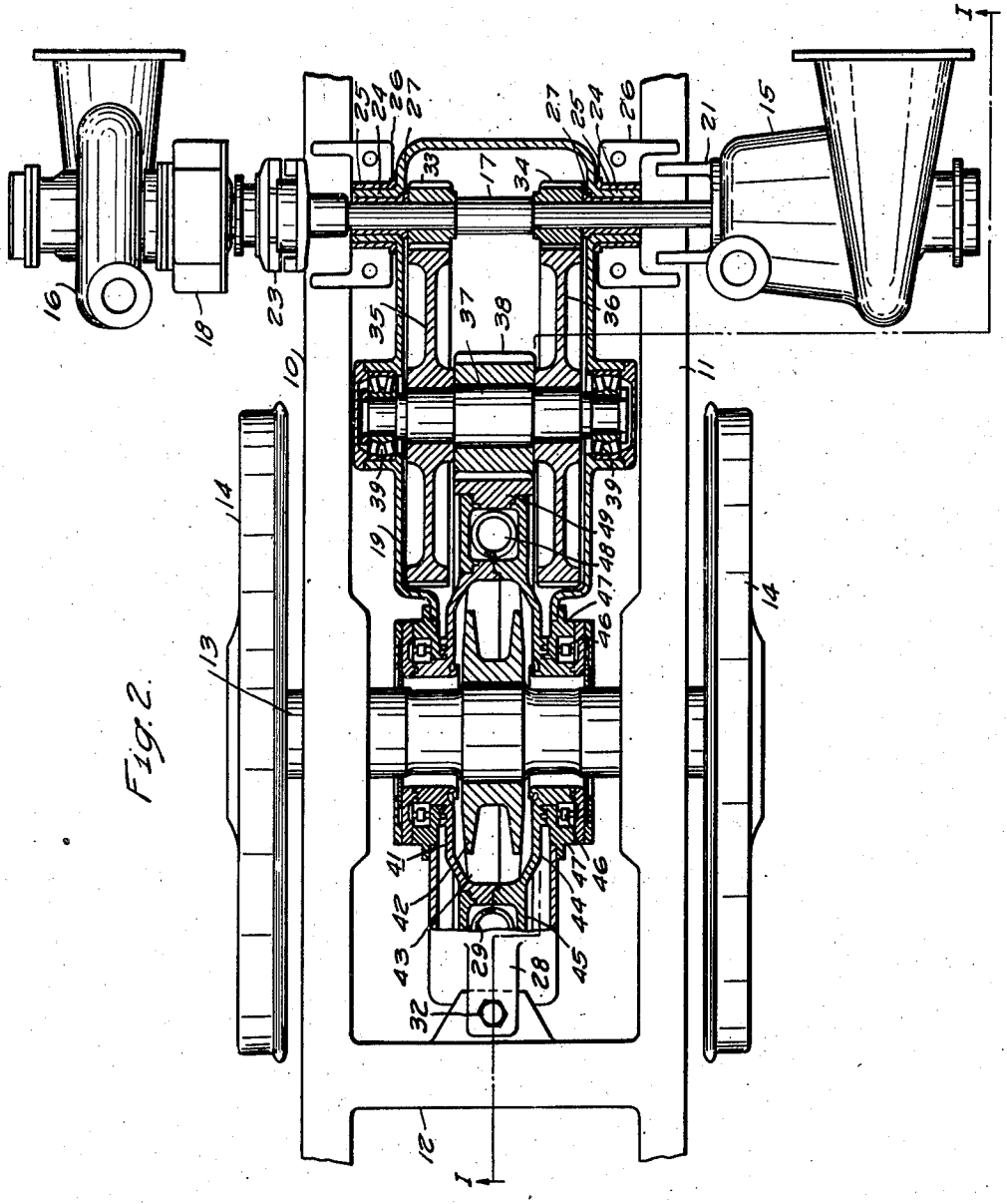

Fig. 2.

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Fig. 3.

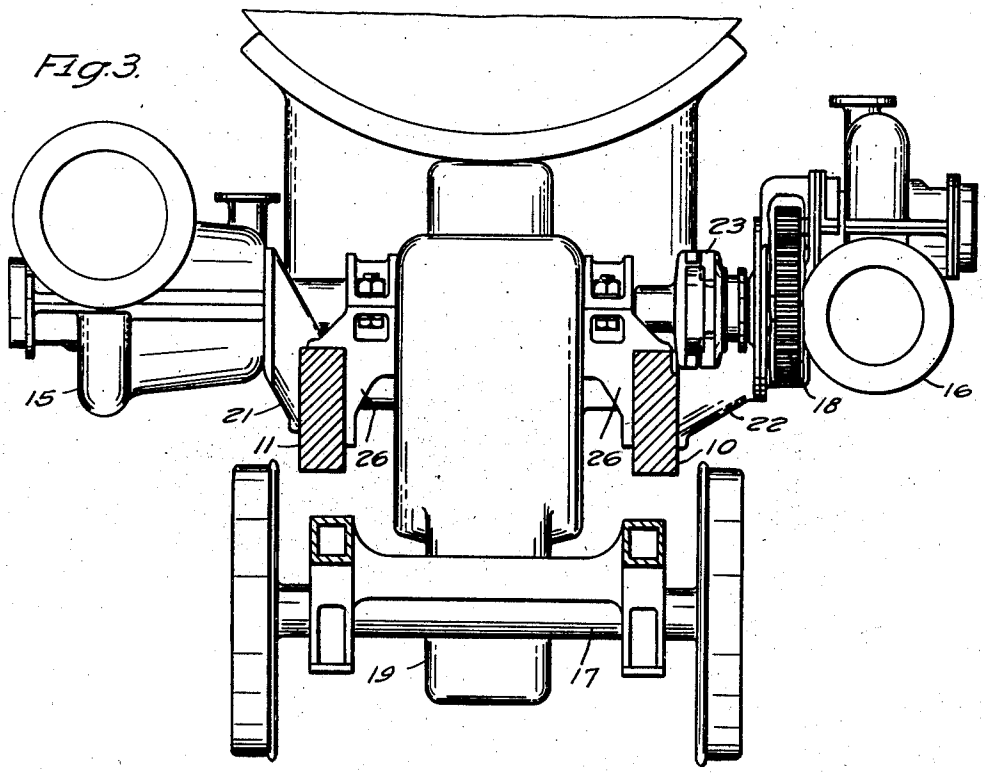
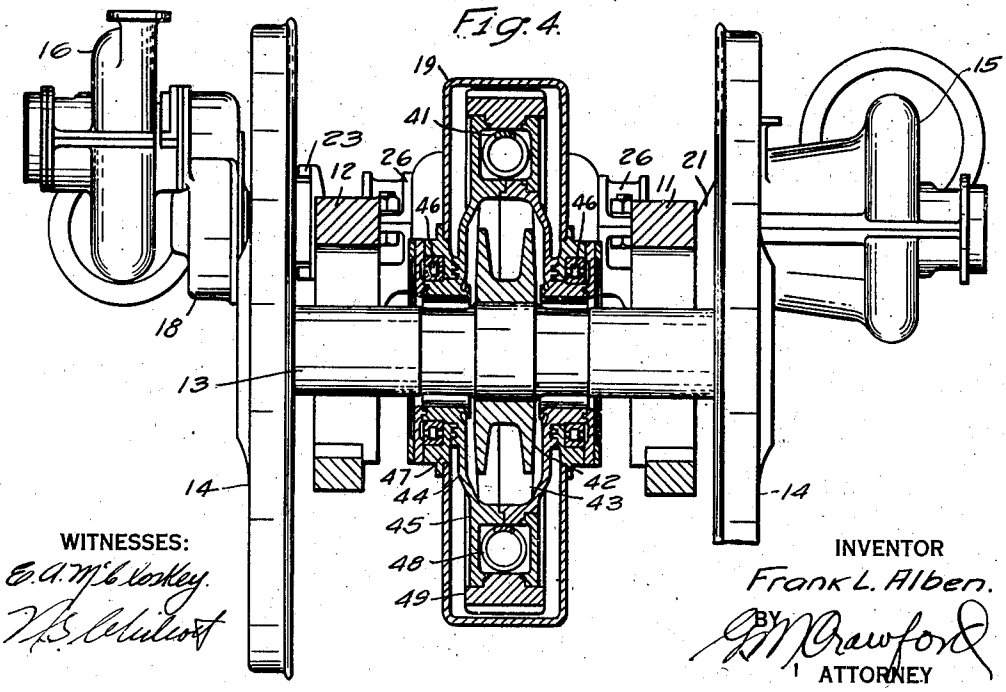


Fig. 4.



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2,386,186

STEAM-TURBINE LOCOMOTIVE

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Application June 10, 1943, Serial No. 490,312

7 Claims. (Cl. 105—38)

My invention relates, generally, to locomotives and, more particularly, to turbine-driven locomotives.

A steam-turbine locomotive has the following advantages over a steam locomotive of the conventional type:

1. Greater horsepower output at higher speeds.
2. Elimination of reciprocating parts, thereby permitting higher operating speeds.
3. Economy of fuel and water.

Therefore, under certain conditions, it may be desirable to convert a locomotive of the conventional type to a turbine locomotive by the application of a suitable turbine drive.

An object of my invention, generally stated, is to provide a turbine drive for a locomotive which shall be simple and efficient in operation and which may be economically manufactured and installed.

A more specific object of my invention is to provide a turbine drive which may be mounted in the space available on a steam locomotive of the conventional type.

Another object of my invention is to provide a flexible drive for transmitting the power of a turbine to the axles of a locomotive.

A further object of my invention is to provide for supporting the gear unit for a turbine-driven locomotive.

Still another object of my invention is to provide for connecting a reverse turbine to the gear unit of a turbine-driven locomotive.

Other objects of my invention will be explained fully hereinafter or will be apparent to those skilled in the art.

In accordance with one embodiment of my invention, a forward and a reverse turbine are mounted on opposite sides of a locomotive frame and the reverse turbine may be connected to the shaft of the forward turbine by means of a clutch. Two drive pinions are mounted on the turbine shaft which goes through the trunnions for a gear case, thereby providing two points of support for the gear case. The drive pinions mesh with two intermediate gears mounted on an intermediate shaft which is supported in the gear case by means of self-aligning roller bearings. A low speed pinion is mounted on the intermediate shaft between the intermediate gears and meshes with a low speed gear disposed about an axle midway between the side frames of the locomotive. The low speed gear is of a hollow type and houses a resilient drive for the axle. The rear end of the gear case is connected to the frame by a resilient spring support.

For a fuller understanding of the nature and objects of my invention, reference may be had to the following detailed description, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a view, partially in side elevation and partially in section, of a portion of a locomotive structure embodying my invention, the section being taken along the line I—I of Fig. 2;

Fig. 2 is a view, partially in plan and partially in section, the section being taken along the line II—II of Fig. 1;

Fig. 3 is a view partially in front elevation and partially in section, the section being taken along the line III—III of Fig. 1; and

Fig. 4 is a view, partially in elevation, and partially in section, the section being taken along the line IV—IV of Fig. 1.

Referring to the drawings, and particularly to Fig. 2, the portion of a locomotive structure shown therein comprises a pair of side frame members 10 and 11 joined by a cross tie 12, an axle 13 having wheels 14 disposed thereon for supporting the frame members 10 and 11, a forward drive turbine 15, a reverse drive turbine 16, a driving shaft 17, a reduction gear unit 18 for the reverse drive turbine 16 and a gear case 19 for enclosing gears for transmitting the torque of the turbine to the axle 13.

As shown most clearly in Fig. 3, the forward drive turbine 15 is mounted on the side frame member 11 by means of a bracket 21 and the reverse drive turbine 16 and its reduction gear unit 18 are mounted on the side frame member 10 by means of a bracket 22. The shaft 17 is directly connected to the forward drive turbine 15 and a clutch 23 is provided for releasably connecting the reverse drive turbine 16 and its reduction gear unit 18 to the shaft 17.

The gear case 19 is provided with trunnions 24 disposed on opposite sides of the gear case near its front end. The trunnions 24 are mounted in bearings 25 which are disposed in brackets 26 secured to the side frame members of the locomotive. As shown, the shaft 17 extends through the trunnions 24, thereby providing a two-point support for the gear case 19 which is rotatably mounted on the shaft 17. Suitable bearings 27 are provided in the trunnions 24 for the shaft 17.

As shown in Fig. 1, the rear end of the gear case 19 is supported at a single point by means of a bracket 28 which is secured to the gear case 19 and rests on a helical spring 29 which, in turn,

rests on a bracket 31 secured to the cross tie 12 of the locomotive frame. A bolt 32 extends through the brackets 28 and 31 and the spring 29. In this manner, the rear end of the gear case 19 is resiliently mounted in the locomotive frame and the rear support, together with the trunnion supports previously described, provide a three-point support for the gear case.

In order to transmit torque from the turbines to the axle 13, two pinions 33 and 34 are disposed on the shaft 17 in spaced relation. The pinions 33 and 34 mesh with intermediate gears 35 and 36, respectively, which are disposed on an intermediate gear shaft 37 having a pinion 38 disposed thereon between the gears 35 and 36. The intermediate shaft 37 is rotatably mounted in the gear case 19 by means of self-aligning roller bearings 39. The pinion 38 meshes with a low speed gear 41 which surrounds the axle 13.

The low speed gear 41 may be of the type described and claimed in my copending application Serial No. 490,311, filed June 10, 1943, and assigned to the Westinghouse Electric & Manufacturing Company, and comprises a spider hub 42 secured to the axle 13 and having a plurality of radially extending arms 43, and a gear rim center 44 which surrounds the axle 13 and is spaced therefrom. The gear rim center 44 is provided with a hollow central portion for receiving the spider hub 42 and has a plurality of radially extending brackets 45 which are disposed between the arms 43 of the spider hub 42. As shown, the gear rim center 44 is divided transversely of the axle 13 into two sections, thereby permitting it to be assembled on the axle.

The gear rim center 44 is rotatably mounted on bearings 46 disposed in bearing housings 47 which, in turn, are removably secured in the gear case 19. Thus, the gear case 19 encloses the entire driving mechanism, thereby affording a means of properly lubricating the mechanism and excluding dirt therefrom.

As described in my aforesaid copending application, torque is resiliently transmitted between the gear rim center 44 and the spider hub 42 by means of helical springs which are disposed in cups 48 mounted in the brackets 45 to engage the arms 43 of the spider 42. A gear rim 49 is removably secured to the gear rim center 44 and is provided with teeth for meshing with the teeth on the pinion 38.

From the foregoing description, it is apparent that I have provided a flexible drive for transmitting the power of a turbine to the axle of a locomotive which drive may be disposed in the space available between the side frames of the locomotive and which may be entirely enclosed by a gear case suitably mounted in the locomotive frame. Provision is made for driving the locomotive in either a forward or a reverse direction and for disconnecting the reverse turbine from the drive shaft when the locomotive is operating in a forward direction. The desired reduction in speed between the speed of the turbine shafts and that of the locomotive wheels is obtained by reduction gears which are suitably mounted in the gear case.

Since numerous changes may be made in the above described construction and different embodiments of the invention may be made without departing from the spirit and scope thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim as my invention:

1. In a locomotive drive, the combination with a pair of side frame members disposed in spaced relation and an axle for supporting said frame members, of a forward drive turbine mounted on one frame member, a reverse drive turbine mounted on the other frame member, a shaft directly connected to the forward drive turbine, means for releasably connecting the reverse drive turbine to said shaft, a drive pinion secured to the shaft, a low speed gear surrounding said axle, reduction gears intermeshing with said pinion and said low speed gear, a gear case enclosing said pinion and said gears, said gear case having a trunnion on each side to provide two points of support for one end of the gear case, said shaft extending through said trunnions, and a single point of support for the other end of the gear case, said single point of support being disposed substantially midway between said side frame members.

2. In a locomotive drive, the combination with a pair of side frame members disposed in spaced relation and an axle for supporting said frame members, of a forward drive turbine mounted on one frame member, a reverse drive turbine mounted on the other frame member, a shaft directly connected to the forward drive turbine, means for releasably connecting the reverse drive turbine to said shaft, a drive pinion secured to the shaft, a low speed gear surrounding said axle, reduction gears intermeshing with said pinion and said low speed gear, a gear case enclosing said pinion and said gears, said gear case having a trunnion on each side for supporting one end of the gear case, means on said side frame members for supporting said trunnions, said shaft extending through said trunnions, and means disposed substantially midway between the side frame members for supporting the other end of the gear case from said frame members, thereby providing a three-point support for said gear case.

3. In a locomotive drive, the combination with a pair of side frame members disposed in spaced relation and an axle for supporting said frame members, of a forward drive turbine mounted on one frame member, a reverse drive turbine mounted on the other frame member, a shaft directly connected to the forward drive turbine, means for releasably connecting the reverse drive turbine to said shaft, a drive pinion secured to the shaft, a low speed gear surrounding said axle, reduction gears intermeshing with said pinion and said low speed gear, a gear case enclosing said pinion and said gears, said gear case having a trunnion on each side for supporting one end of the gear case, means on said side frame members for supporting said trunnions, said shaft extending through said trunnions, and means disposed substantially midway between the side frame members for supporting the other end of the gear case from said frame members, thereby providing a three-point support for said gear case, said reduction gears and said low speed gear being supported by said gear case.

4. In a locomotive drive, the combination with a pair of side frame members disposed in spaced relation and an axle for supporting said frame members, of a forward drive turbine mounted on one frame member, a reverse drive turbine mounted on the other frame member, a shaft directly connected to the forward drive turbine, means for releasably connecting the reverse drive

turbine to said shaft, a drive pinion secured to the shaft, a low speed gear, surrounding said axle, reduction gears intermeshing with said pinion and said low speed gear, a gear case enclosing said pinion and said gears, said gear case having a trunnion on each side for supporting one end of the gear case, means secured to the side frame members for supporting the trunnions, said shaft extending through said trunnions, and means disposed substantially midway between the side frame members for resiliently supporting the other end of the gear case from said frame members, thereby providing a three-point support for the gear case.

5. In a locomotive drive, the combination with a pair of side frame members disposed in spaced relation and an axle for supporting said frame members, of a forward drive turbine mounted on one frame member, a reverse drive turbine mounted on the other frame member, a shaft directly connected to the forward drive turbine, means for releasably connecting the reverse drive turbine to said shaft, a drive pinion secured to the shaft, a low speed gear surrounding said axle, reduction gears intermeshing with said pinion and said low speed gear, a gear case enclosing said pinion and said gears, said gear case having a trunnion on each side for supporting one end of the gear case, brackets secured to the side frame members for supporting the trunnions, said shaft extending through said trunnions, and means disposed substantially midway between the side frame members for resiliently supporting the other end of the gear case from said frame members, thereby providing a three-point support for the gear case, said reduction gears and said low speed gear being rotatably mounted in said gear case.

6. In a locomotive drive, the combination with a pair of side frame members disposed in spaced relation and an axle for supporting said frame members, of a forward drive turbine mounted on one frame member, a reverse drive turbine mounted on the other frame member, a shaft directly connected to the forward drive turbine, means for releasably connecting the reverse drive turbine to said shaft, a pair of drive pinions secured to the shaft in spaced relation, an intermediate shaft, a pair of intermediate gears disposed on the intermediate shaft in spaced relation and meshing with said pinions, a low speed pinion disposed on the intermediate shaft between the intermediate gears, a low speed gear surrounding said axle and meshing with the low speed pinion, and a gear case enclosing said pinions and said gears, said gear case having trunnions thereon for supporting one end of the gear case, said turbine shaft extending through said trunnions.

7. In a locomotive drive, the combination with a pair of side frame members disposed in spaced relation and an axle for supporting said frame members, of a forward drive turbine mounted on one frame member, a reverse drive turbine mounted on the other frame member, a shaft directly connected to the forward drive turbine, means for releasably connecting the reverse drive turbine to said shaft, a pair of drive pinions secured to the shaft in spaced relation, an intermediate shaft, a pair of intermediate gears disposed on the intermediate shaft in spaced relation and meshing with said pinions, a low speed pinion disposed on the intermediate shaft between the intermediate gears, a low speed gear surrounding said axle and meshing with the low speed pinion, a gear case enclosing said pinions and said gears, said gear case having trunnions thereon for supporting one end of the gear case, said turbine shaft extending through said trunnions, and means for resiliently supporting the other end of the gear case substantially mid-way between said frame members.

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