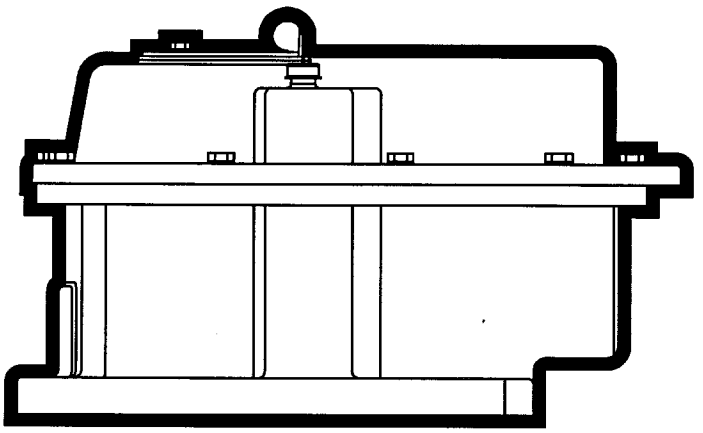
Chemineer

Manual 421.01

GT Gear Drive Maintenance Manual Case Sizes 3,4 Triple Reduction



Equipment Reference:

For service and information contact:

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MAINTENANCE

GEAR DRIVE

Triple Reduction

This manual contains instructions for GT gear drive disassembly and assembly. Refer to the agitator manual for all other information relative to the agitator.

Other than periodic lubrication as defined in the *Lubrication* section of the Agitator Manual, no routine operational gear drive maintenance is required.

To assure the longest life from your gear drive, annual inspections which can correspond with plant shutdowns should be planned. Bolting and the condition of all seals should be checked . Worn parts should be replaced and any areas of general concern should be brought to the attention of your local Chemineer office.

GEAR DRIVE
Triple Reduction

Disassembly

Gear Drive *(Figure 17, page 24)*

1. Remove motor adapter **[131]** and motor. Remove the gear drive flexible coupling half **[110]** and key. Drain oil from gear drive. Refer to Agitator I.O.& M. Manual, *Installation*.

2. Remove V-ring **[212]** and input cap **[211]**.

3. Remove snap ring **[210]**.

4. Remove the input shaft **[202]** assembly.

5. Remove bearing caps and shim sets **[223, 224]** and **[309, 310]**.

6. Remove cover plate **[254]**, output shaft washer, and shim set **[228, 229]**.

7. Remove bolts **[250]** holding the gear drive lid **[247]** to the gear drive housing **[248]**.

GEAR DRIVE
Triple Reduction

Disassembly (Cont'd)

Gear Drive *(Figure 17, page 24)*

8. Tighten set screws **[268]** to break the seal between the gear drive lid **[247]** and housing **[248]**. *(See Figure 1)*. Remove the set screws and install four jacking set screws (supplied by others).

   Case Size 1 & 2 M10 x 1.5 x 50 mm (2") lg.
   Case Size 3 & 4 M12 x 1.75 x 60 mm (2 1/2") lg.

   Tighten jacking set screws to remove the gear drive lid **[247]** assembly.

9. Remove lip seal **[235]**, bearing **[233]** cup and bearing **[205]** race from the gear drive lid. *See Figure 11A, page 14*. Remove bearing **[217,302]** cups from the gear drive lid. *See Figure 16, page 21*.

10. Remove snap ring **[236]** from the output shaft **[244]**

11. Move the gear drive housing assembly to a press, and press the output shaft **[244]** assembly through the gear flange **[237]** and out of the gear drive housing.

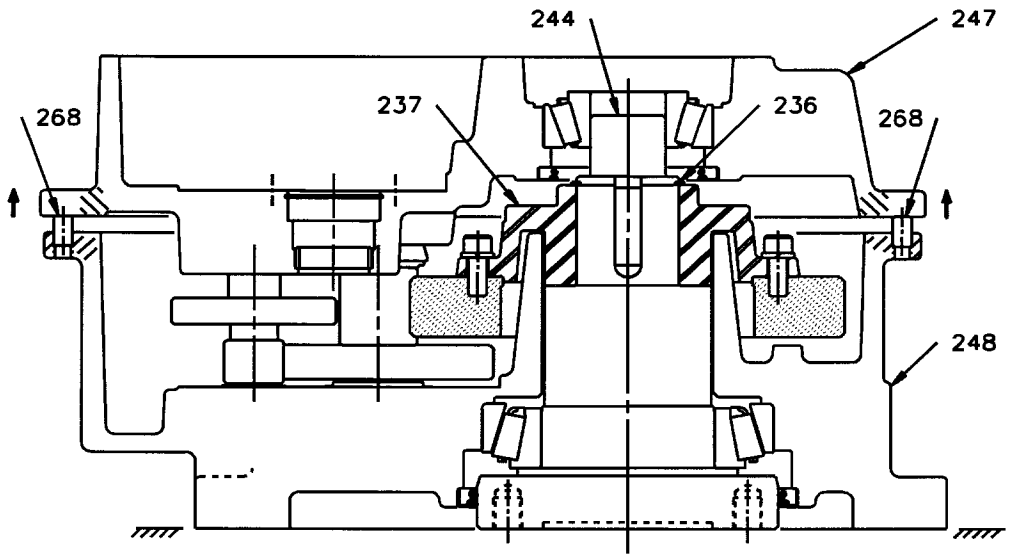

Figure 1: Removal of Gear Drive Lid [247]

GEAR DRIVE
Triple Reduction

Disassembly (Cont'd)

Gear Drive *(Figure 17, page 24)*

12. Remove gear **[239]** from gear flange **[237]**.

13. Remove intermediate pinion shaft **[303]** assembly from the gear drive housing.

14. Remove the pinion shaft **[218]** assembly from the gear drive housing.

15. Remove lip seal **[249]** and bearing **[221, 245, 306]** cups from gear drive housing. Bearing cups mounted with an interference fit can be difficult to remove with a commercial bearing puller. Removal can be made easier by welding a 3mm (1/8") bead completely around the cup in the center of the roller race. Upon cooling, the cup will shrink allowing removal. Be sure to protect adjacent surfaces from weld spatter.

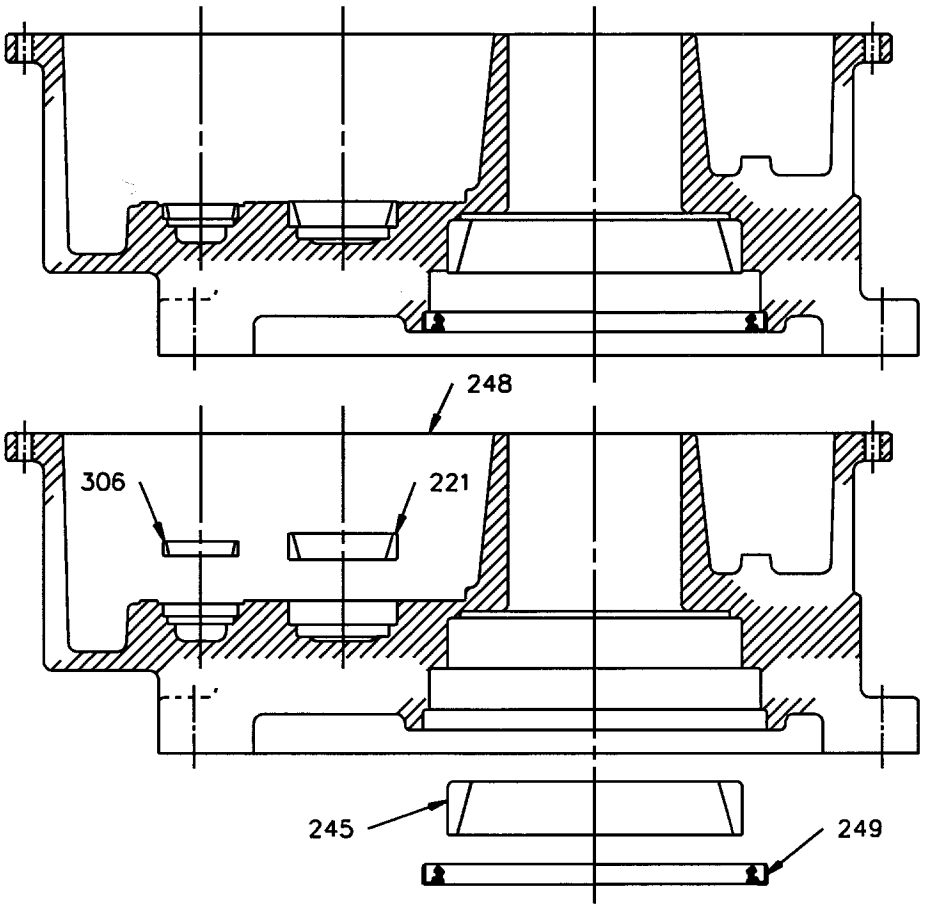

Figure 2: Gear Drive Housing [248]

GEAR DRIVE
Triple Reduction

Disassembly (Cont'd)

Input Shaft Assembly

1. Remove snap ring **[204]**.
2. Press input shaft **[202]** out of bearing **[203]**.
3. Remove spacer **[208]**.
4. Press bearing **[205]** off input shaft.

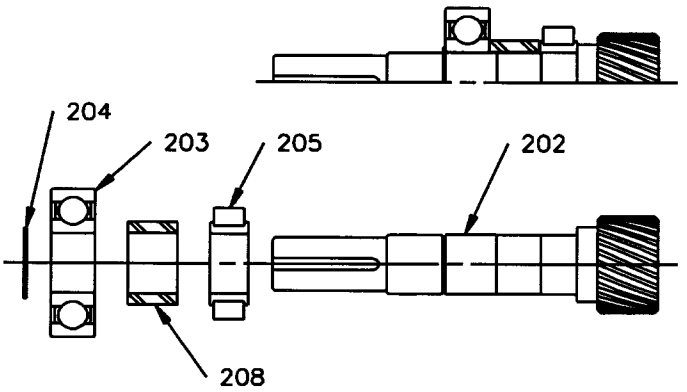

Figure 3: Input Shaft Assembly [201]

GEAR DRIVE
Triple Reduction

Disassembly (Cont'd)

Pinion Shaft Assembly

1. Press gear [219] and bearing **[221]** cone off pinion shaft [218].

2. Cut the roller cage off of bearing **[217]** cone. Apply bearing puller to remove the cone race.

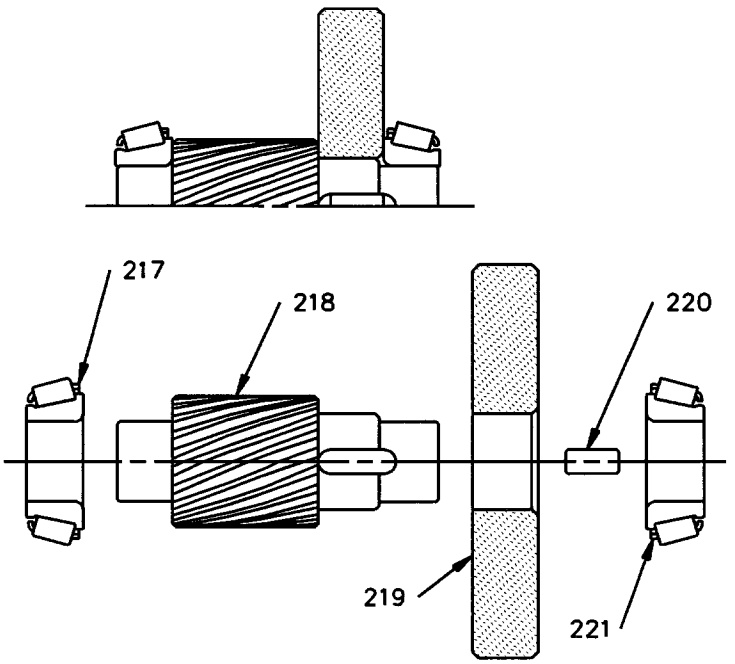

Figure 4: Pinion Shaft Assembly [216]

GEAR DRIVE
Triple Reduction

Disassembly (Cont'd)

Intermediate Pinion Shaft Assembly

1. Press gear **[304]**, bearing **[302]** cone and spacer **[307]** off pinion shaft **[303]**.

2. Cut the roller cage off of bearing **[306]** cone. Apply bearing puller to remove the cone race.

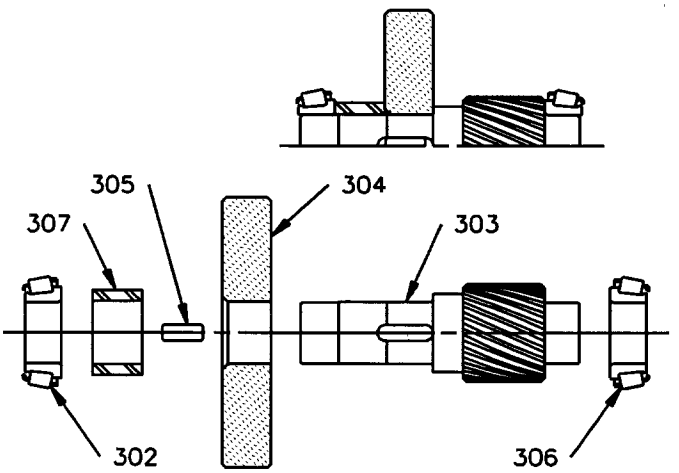

Figure 5: Intermediate Pinion Shaft Assembly [301]

GEAR DRIVE
Triple Reduction

Disassembly (Cont'd)

Output Shaft

1. Remove bearing **[245]** cone off output shaft **[244]**.

2. To remove bearing **[245]** cone, it will be necessary to cut the roller cage and remove the rollers. Hang the output shaft from the large end so the shaft is free to turn. Apply heat (acetylene torch) while turning the shaft at approximately 30 rpm or greater. When the bearing is hot enough it will start to drop off the end of the shaft. Use a screwdriver or similar tool to push the bearing off the shaft if it hangs up.

CAUTION! *Heat the bearing race only. Use a small flame to avoid damage to the shaft.*

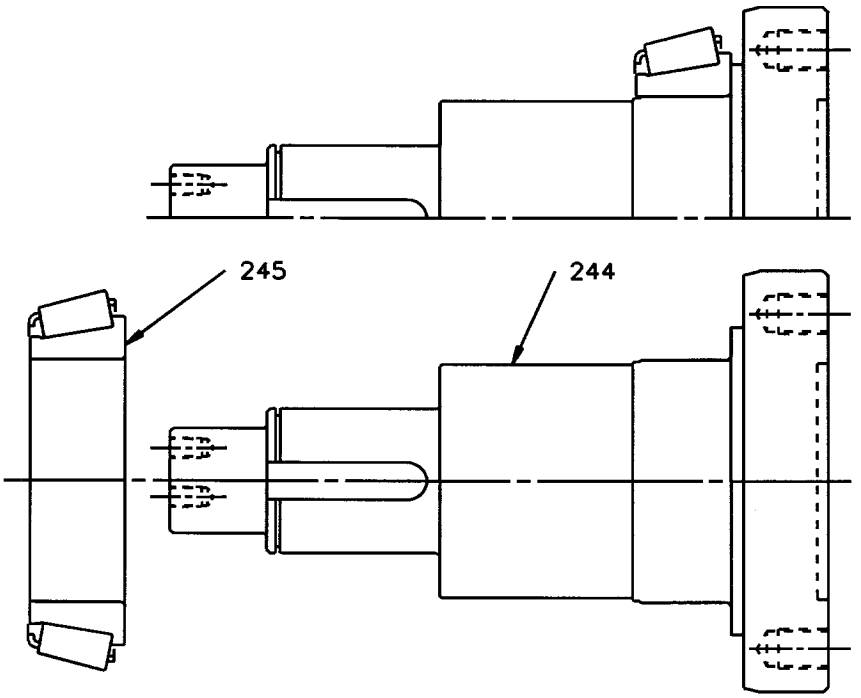

Figure 6: Output Shaft Assembly [243]

The gear drive is now fully disassembled. Clean all parts and inspect for wear. Replace worn parts as required. All bearings, lip seals, and shims should be replaced with new parts. When replacing bearings, always replace both inner and outer races (cup and cone). Gears should be replaced in sets.

GEAR DRIVE
Triple Reduction

Assembly

Inspect all bolts and setscrews for damage after cleaning (threads, shank, and head). If replacement is required, replace with the equivalent type and strength grade.

Inspect and clean all tapped holes. If threads are damaged, chase with an appropriate tap.

NOTE: *The following assembly procedures require the use of a torque wrench. The values listed in Table 1 are proper tightening torques as a function of thread size.*

Bearing **[217, 221, 233, 245, 302 and 306]** cones are mounted with interference fits. Heat the cones and press onto the shaft. Heat bearings in oven or oil bath.

NOTE: *Do not heat parts in excess of 135° C (275°F). Do not apply direct flame. Do not allow parts to touch the bottom or sides of the oven or oil bath.*

Bearing **[221, 233, 245, and 306]** cups are mounted with interference fits. Press bearing cups into their housing cold. *Placing the cups in dry ice will cause them to shrink and ease installation.*

Install lip seals with the seal lip towards the bearing. Coat the seal lip with bearing grease prior to installing the shaft.

TABLE 1: BOLT TIGHTENING TORQUE FOR CARBON STEEL

	Grade 8.8		Grade 10.9	
Bolt Size	Nm	Ft-lb	Nm	Ft-lb
M6 x 1	9.9	7.3	12	8.8
M8 x 1.25	24	18	29	21
M10 x 1.5	48	35	58	43
M12 x 1.75	80	59	101	75

Lubricate all fasteners at assembly with grease, oil or an anti-seize material. Bolt threads and contact surfaces of bolt heads and nuts should be lubricated.
If fasteners cannot be lubricated, multiply table values by 1.33.

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Input Shaft

1. Press bearing **[205]** race onto input shaft **[202]**.

2. Install spacer **[208]**.

3. Press bearing **[203]** onto the input shaft.

4. Install snap ring **[204]**.

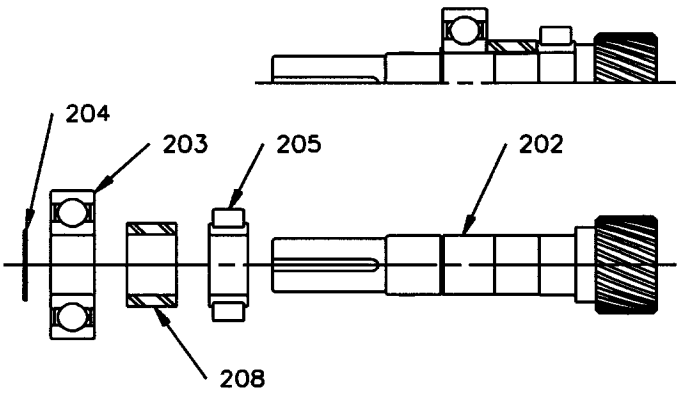

Figure 7: Input Shaft Assembly [201]

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Pinion Shaft

1. Install key **[220]** into pinion shaft **[218]**. Heat gear **[219]** and press onto the pinion shaft.

Note: *Do not heat gear in excess of 135°C (275°F). Do not apply direct flame. Do not allow the gear to touch the bottom or sides of the oven or oil bath.*

2. Heat bearing **[217, 221]** cones and press onto pinion shaft. The gear and bearing cones must be firmly seated against their respective shoulders. Check with a feeler gauge.

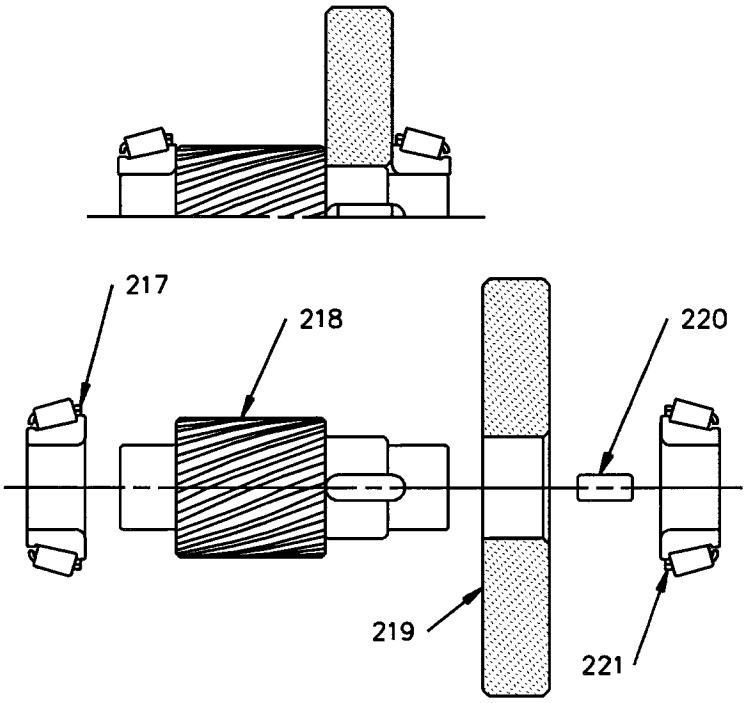

Figure 8: Pinion Shaft Assembly [216]

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Intermediate Pinion Shaft

1. Install key **[305]** into pinion shaft **[303]**. Heat gear **[304]** and press onto the pinion shaft.

Note: *Do not heat gear in excess of 135°C (275°F). Do not apply direct flame. Do not allow the gear to touch the bottom or sides of the oven or oil bath.*

2. Install spacer **[307]**.

3. Heat bearing **[302, 306]** cones and press onto pinion shaft. The gear and bearing cones must be firmly seated against their respective shoulders. Check with a feeler gauge.

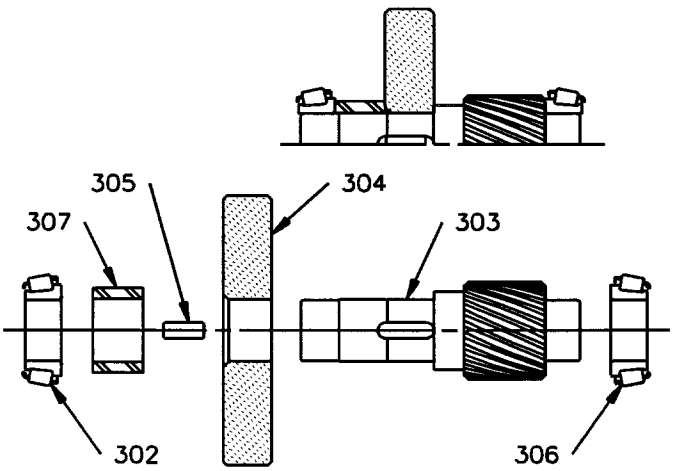

Figure 9: Intermediate Pinion Shaft Assembly [301]

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Output Shaft Assembly

1. Heat bearing **[245]** cone and press onto the output shaft **[244]**. The bearing cone must be firmly seated against the shaft shoulder. Check with a feeler gauge.

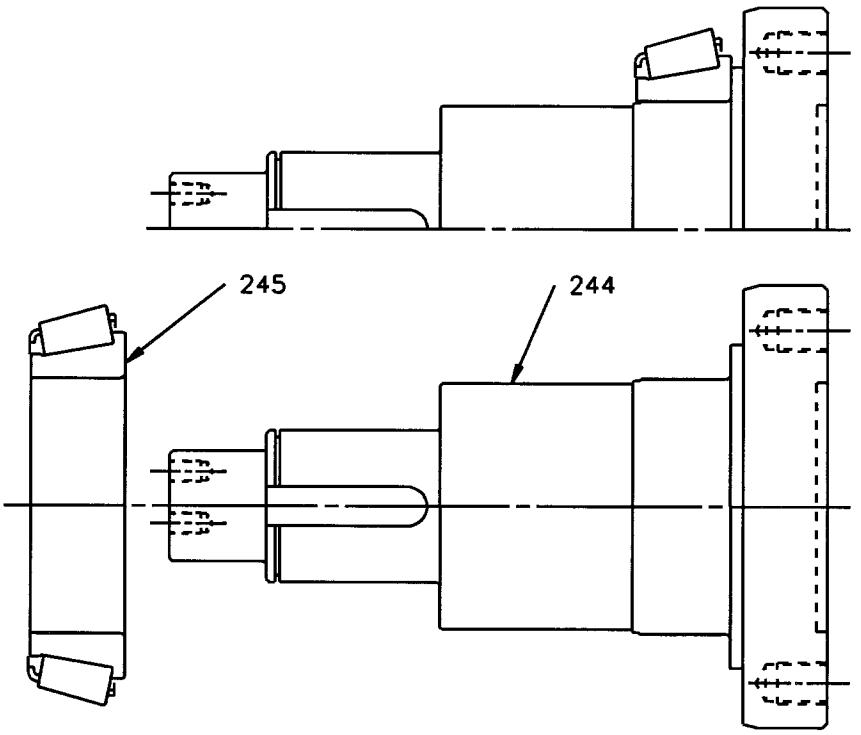

Figure 10: Output Shaft Assembly [243]

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Gear Drive Lid

1. Install lip seal **[235]** in the gear drive lid **[247]**.

2. Press bearing **[233]** cup into the gear drive lid. The bearing cup must be firmly seated against the lid shoulder. Check with a feeler gauge.

3. Coat bearing **[205]** lid bore with loctite #290. Press bearing **[205]** outer race into the gear drive lid.

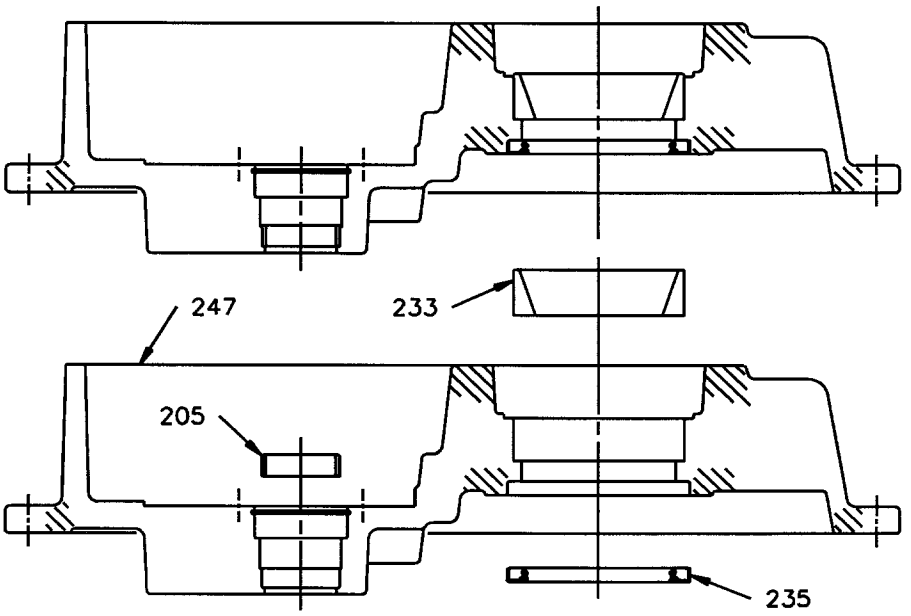

Figure 11A: Gear Drive Lid [247]

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Gear Drive Housing

1. Coat bearing **[306, 221]** housing bores with loctite #290. Press bearing **[306]** and bearing **[221]** cup into the gear drive housing **[248]**.

2. Press bearing **[245]** cup into gear drive housing. The cup must be firmly seated against the housing shoulder. Check with a feeler gauge.

3. Install lip seal **[249]** in the gear drive housing.

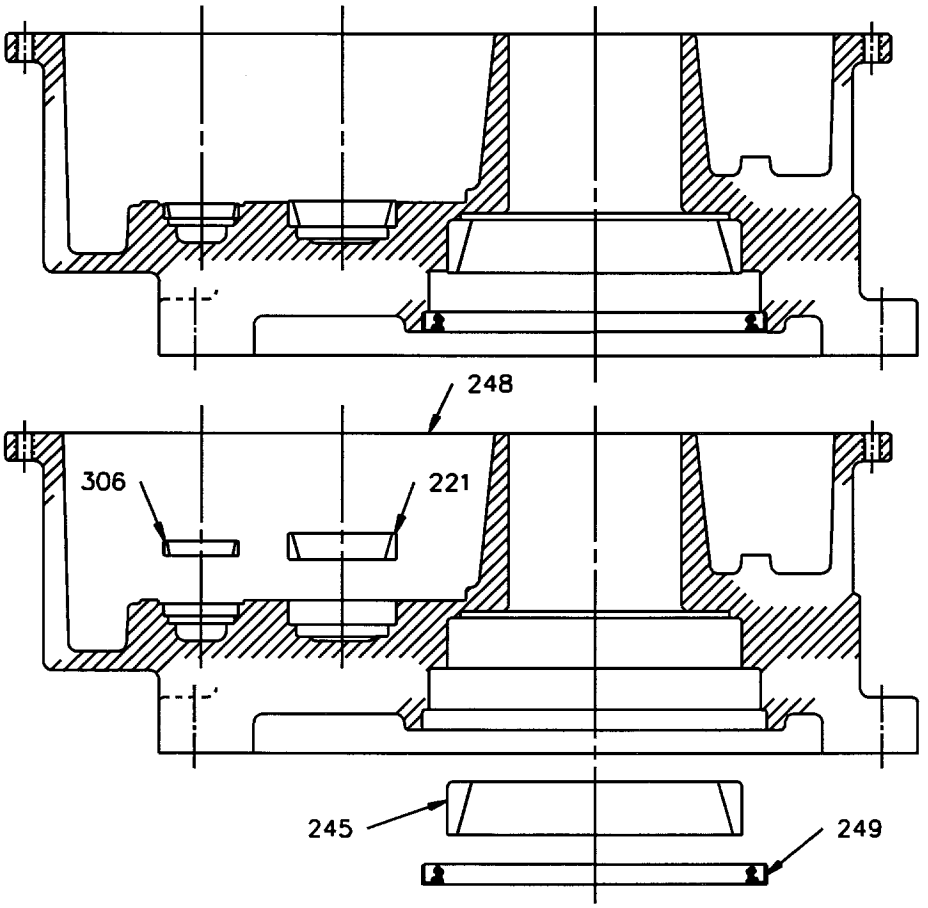

Figure 12: Gear Drive Housing [248]

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Gear Drive *(Figure 13, page 17)*

1. Cut a 200mm (8") diameter x 10mm (½") thick disc of plywood.

2. Set output shaft assembly **[243]** onto the plywood disc, large end down.

3. Raise the gear drive housing **[248]** and center the output shaft bore over the output shaft assembly. Carefully lower the gear drive housing until bearing **[245]** is seated.

4. Shim under gear drive housing to center the output shaft in the housing bore.

5. Install intermediate pinion shaft **[301]** assembly and pinion shaft assembly **[216].** Place gear **[239]** over the housing drywell, rest the gear on the pinion shaft assembly gear.

Note: *Pinion shaft assemblies must be installed before gear is placed into gear drive housing.*

6. Place key **[238]** into the output shaft keyway.

7. Heat gear flange **[237]** to 200°C (400°F) and press onto the output shaft.

8. Allow the gear flange to cool. Assemble snap ring **[236]** to the output shaft.

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Gear Drive

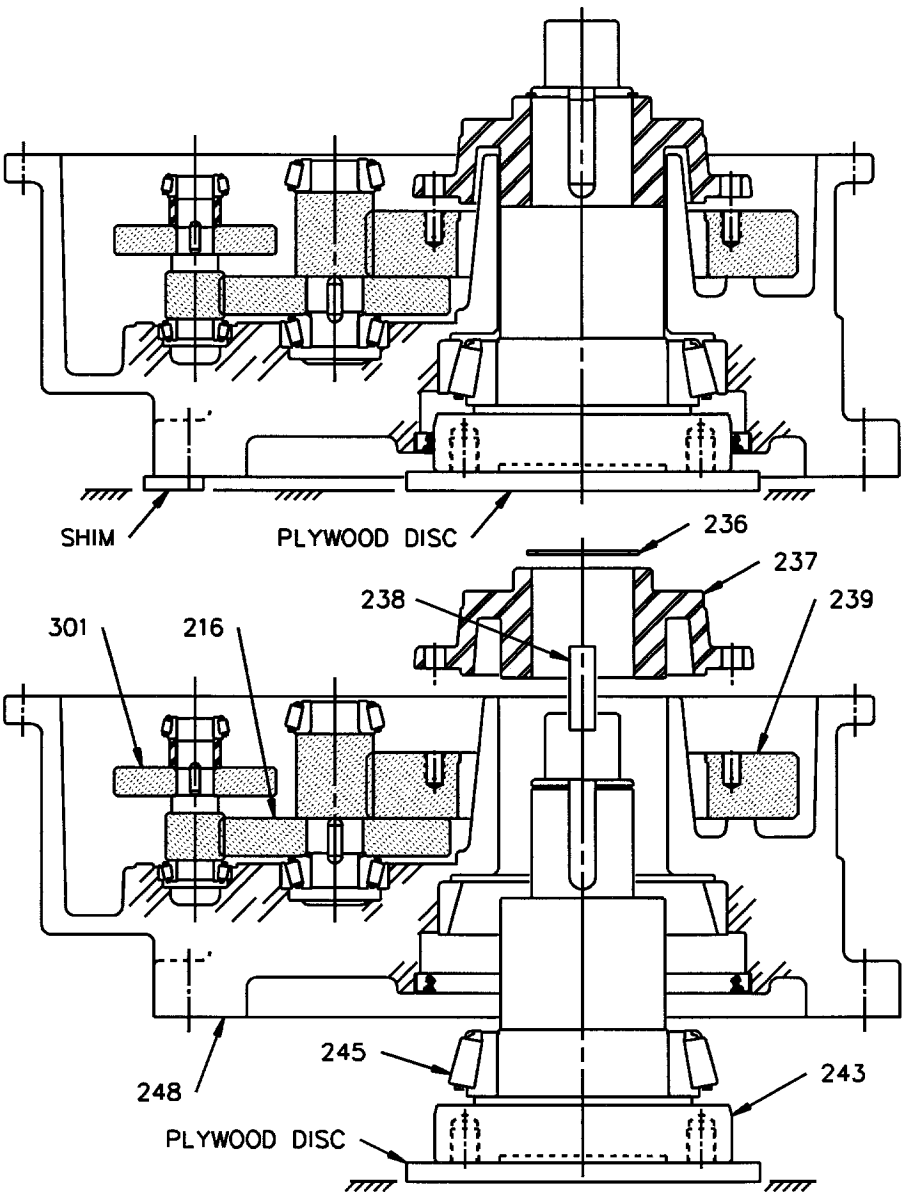

Figure 13: Gear Drive Assembly

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Gear Drive

9. Lift the gear **[239]** to engage tenon. Install bolts and lockwashers **[240, 241]**. Torque bolts to the value shown in *Table 1, page 9.*

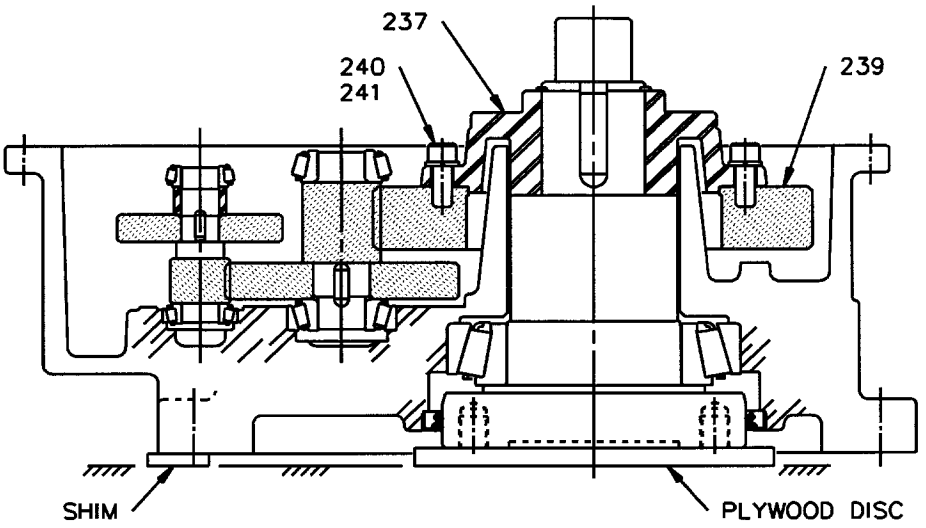

Figure 14: Gear Drive Assembly

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Gear Drive (Figure 15, page 20)

10. Apply RTV sealant, Three Bond #1215AA or equal, to the gear drive housing **[248]** flange.

11. Assemble gear drive lid **[247]** to the gear drive housing **[248]**.

12. Install dowel pins **[252]** flush with the top of the gear drive lid flange. Install bolts and lockwashers **[250, 251]**. Torque bolts to the value shown in *Table 1, page 9.*

13. Heat bearing **[233]** cone and press onto the output shaft **[244]**. Ensure that the bearing cone is firmly seated in its cup. Allow bearing to cool.

14. Remove the plywood disc from under the output shaft.

15. Place a nylon strap under the output shaft washer **[228]** and secure with two bolts **[230]**. Place a dial indicator stem on the face of bearing **[233]** cone and lift the shaft to measure the bearing end play. Record this measurement "A".

16. Remove the nylon strap, measure the distance with a depth micrometer from the bearing cone face to the end of the output shaft. *See insert, Figure 15.* Record this measurement "B".

17. Calculate the required shim set **[229]** thickness.

    Required shim set thickness = B - A -.051mm (.002").

18. Count out the required number of new shims.

    Red = .051mm (.002") thick
    Blue = .127mm (.005) thick

19. The final end play setting should be .0mm (.000") end play to .075mm (.003") preload.

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Gear Drive

20. Install shim set **[229]**. Install output shaft washer **[228]** with bolts and lockwashers **[230, 231]**. Torque bolts to the value shown in *Table 1, page 9*.

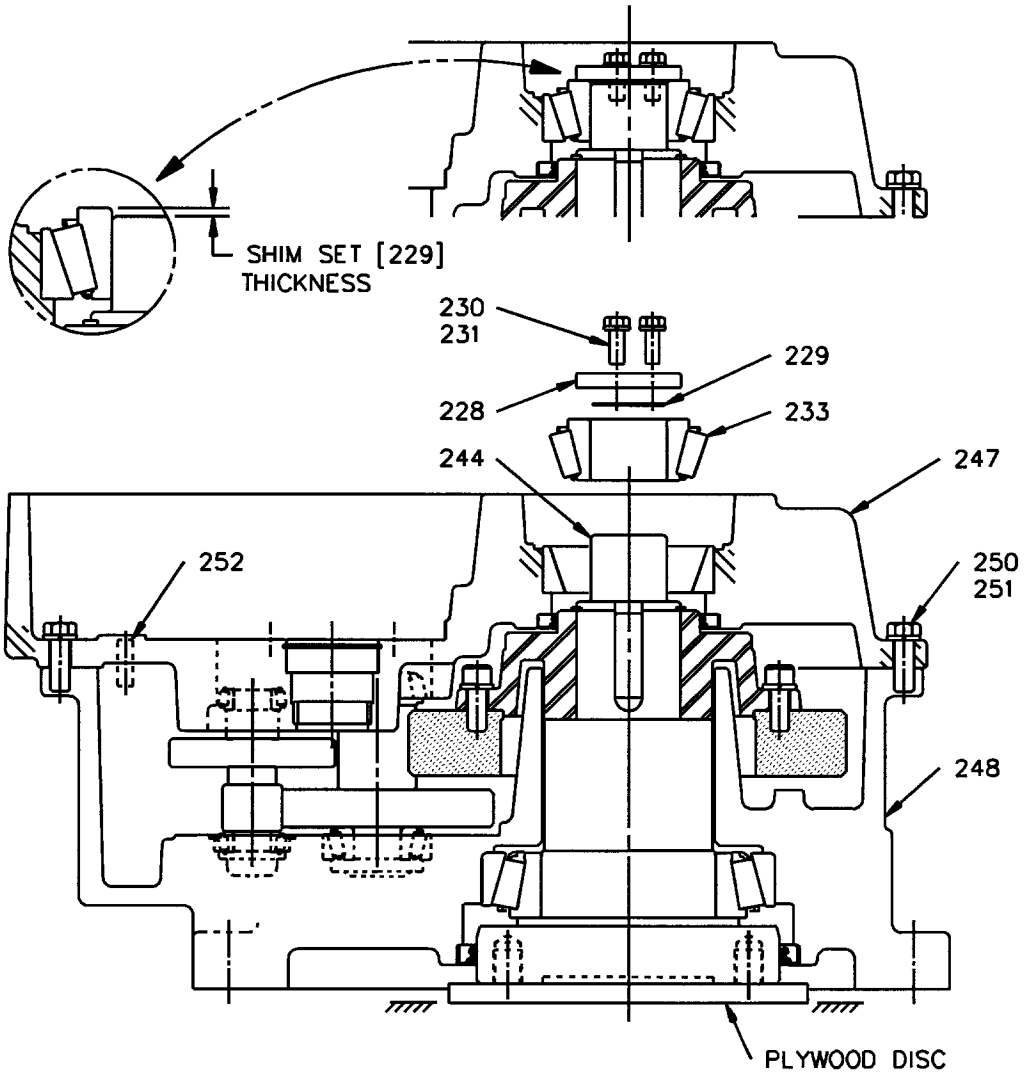

Figure 15: Gear Drive Assembly

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Gear Drive

21. Install bearing **[217]** cup. Install bearing cap **[223]** without bolts .

22. Install bearing **[302]** cup. Install bearing cap **[309]** without bolts.

23. Apply hand pressure to the bearing caps to avoid movement and measure the gap between the bearing cap and the gear drive lid **[247]**. Count out new shims equal to the measured gap plus .051mm (.002") to provide a bearing setting of .0 mm (.000") to .051mm (.002") end play.

Red = .051mm (.002") thick
Blue = .127mm (.005") thick

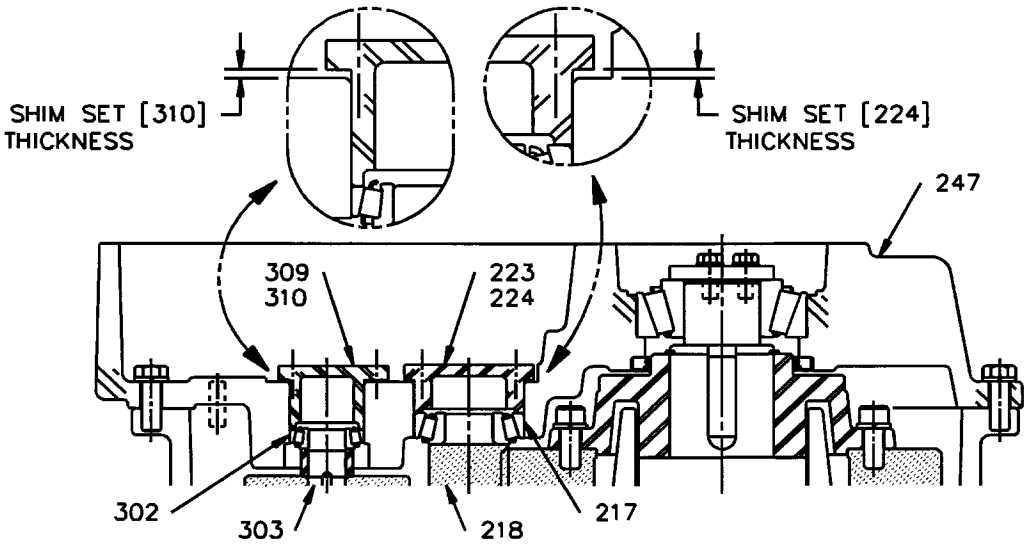

Figure 16: Gear Drive Assembly

GEAR DRIVE
Triple Reduction

Assembly (Cont'd)

Gear Drive

24. Install shim set **[224]**. Install bolts and lockwashers **[225, 226]**. Torque bolts to the value shown in *Table 1, page 9.*

25. Install shim set **[310]**. Install bolts and lockwashers **[311, 312]**. Torque bolts to value shown in *Table 1, page 9.*

26. Apply RTV sealant, Three Bond #1215AA or equal, to cover plate **[254]**. Assemble to the gear drive lid with bolts and lockwashers **[255, 256]**. Torque bolts to the value shown in *Table 1.*

27. Install input shaft **[202]** assembly. Carefully lower into the housing. Turn the shaft as the assembly is lowered to allow the pinion to mesh with its gear.

28. Install snap ring **[210]**.

29. Apply RTV sealant, Three Bond #1215AA or equal, to input cap **[211]**. Assemble to the gear drive lid with bolts and lockwashers **[213, 214]**. Torque bolts to the value shown in *Table 1.*

30. Install V-ring **[212]** with sealing lip against the input cap. Rotate the input shaft by hand until the output shaft makes at least one revolution. Check for any binding.

31. Add grease to bearings **[233, 245]** and fill the gear drive housing with oil. *See Agitator I.O.&M. Manual, Lubrication.*

32. Install gear drive flexible coupling half **[110]**. *See Agitator I.O.&M. Manual, Installation.*

33. Install motor adapter **[131]** and motor **[100]**. *See Agitator I.O.&M. Manual. Installation.*

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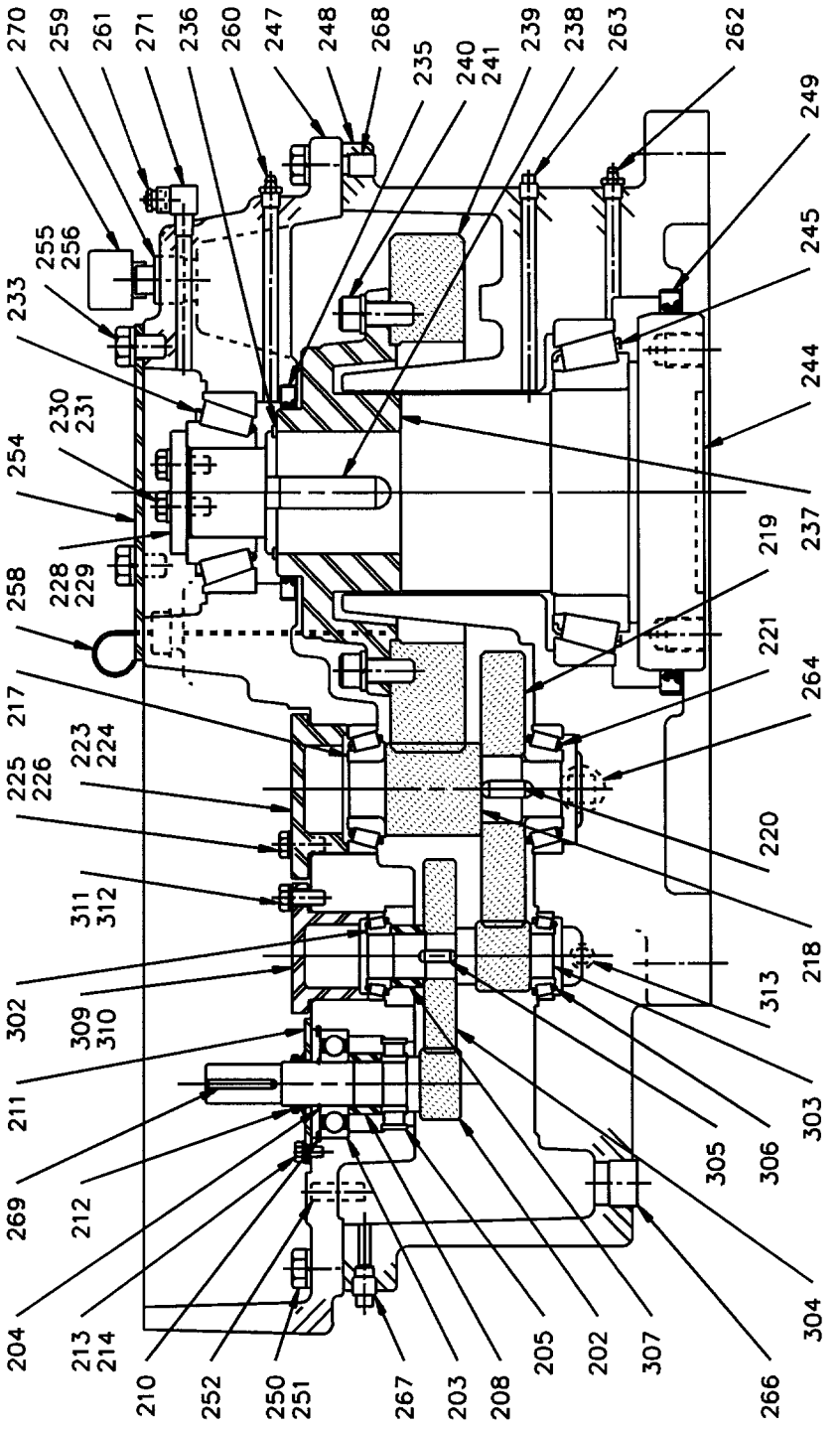

Figure 17A: GT Gear Drive: Sizes 3,4 Triple Reduction

GEAR DRIVE ITEM LIST

Triple Reduction Sizes 3,4

Item #	Description	Qty.
200	**gear drive assembly**	**1**
201	**input shaft assembly**	**1**
202	input shaft	1
203-002	bearing (sealed)	1
204	snap ring	1
205-002	bearing	1
208	spacer	1
210	snap ring	1
211	input cap	1
212	V-ring	1
213	bolt	4
214	lockwasher	4
216	**pinion shaft assembly**	**1**
217	bearing	1
218	pinion shaft	1
219	gear	1
220	key	1
221	bearing	1
223	bearing cap	1
224	shim set	1
225	bolt	4
226	lockwasher	4
228	output shaft washer	1
229	shim set	1
230	bolt	3
231	lockwasher	3
233	bearing	1
235	lip seal	1
236	snap ring	1
237	gear flange	1
238	key	1
239	gear	1
240	bolt	8
241	lockwasher	8
243	**output shaft assembly**	**1**
244	output shaft	1
245	bearing	1
247-002	gear drive lid triple reduction	1
248-002	gear drive housing triple reduction	1
249	lip seal	1
250	bolt	11
251	lockwasher	11
252	dowel pin	2
254	cover plate	1
255	bolt	3
256	lockwasher	3
258	dipstick	1
259	oil fill plug, NPT	1
260	grease fitting	1
261	relief fitting	1
262	grease fitting	1
263	pipe plug, NPT	1
264	magnetic drain plug, NPT	1
266	pipe plug, NPT	1
267	pipe plug, NPT	1
268	set screw	4
269	input shaft key	1
270	breather	1
271	elbow fitting	1
301	**intermediate pinion shaft assembly**	**1**
302	bearing	1
303	intermediate pinon shaft	1
304	gear	1
305	key	1
306	bearing	1
307	bearing spacer	1
309	bearing cap	1
310	shim set	1
311	bolt	4
312	lockwasher	4
313	pipe plug, NPT	1

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