

Spicer Positive Railway Generator Drive

(Cover and first two pages missing.)

Smoothness—Smoothness and freedom from vibration are important features of the Spicer Drive. All clutches and propeller shafts are balanced in a rotating test to offset harmful static and dynamic loading beyond the range of operation in the car. Track and truck vibrations are absorbed by rubber mountings, preventing damage to the drive and the transmission of vibration to the car.

Speed—With the high quality of material and workmanship and the careful dynamic balancing of propeller shafts and clutches, Spicer Drives perform very satisfactorily at high speed. Four interchangeable ratios are available to suit different generator requirements. There are no belts or chains that might whip, slip, or be thrown off under high speed operation.

Weight—The weight of all parts has been kept at a minimum consistent with satisfactory performance, long life and safety. There is no additional weight of ice, fuel or fuel containers.

Interchangeability—The various units used to form a complete standard drive have been made interchangeable. This includes all four ratios of gear units, the different size axle mountings to suit the various sizes of axles, and both the safety and automatic clutches. Propeller shafts, torque arms and safety arms are interchangeable except for length.

Capacity—The Spicer Drive has sufficient capacity to satisfactorily handle torque loads up to and

including a 35 K. W. generator and the additional capacity required for the standard electrical safety fuse or control.

Maintenance—Inspection—Testing

—A very minimum amount of maintenance is required. There are only six points to be lubricated, and the same lubricants are used for both summer and winter operation and for all localities. Although periodic inspection is advisable, it need not be frequent. All inspection points are conveniently located and all inspection operations may be quickly done. With the automatic clutch, standby service may be used, or the generator may be run as a motor for testing without disengaging the clutch, as the clutch automatically remains disengaged. When using the safety clutch, the clutch may be easily disengaged by driving in the three release levers with a hammer. It is not necessary to disconnect the propeller shaft nor remove any belts or chains. There are no fuel tanks to be kept filled, no fuel adjustments to be made, nor any close electrical or mechanical adjustments to be maintained. Gears and bearings are permanently adjusted at the factory, and require no further attention. There are no belts or chains to be adjusted or replaced, nor pulleys to keep aligned. There is little, if any, recharging of batteries required.

Serviceable parts, such as oil seals, gaskets, rubber mountings, etc., have been so designed that they may be easily replaced under the car when necessary.

CONSTRUCTION AND OPERATION

The complete Spicer Drive, Fig. 1, 3, consists of three major units, Gear Unit, Propeller Shaft and Clutch, and several minor units such as, axle mounting, torque arm and torque arm mounting. Power is transmitted from the axle through the axle mounting to the gear unit, then through the propeller shaft to the clutch and generator.

Gear Unit—Fig. 2, 4, 5—The gear unit consists of a hypoid gear 53 mounted on a quill 54 which rotates on anti-friction bearings 55. This gear

drives a hypoid pinion 52 which is also mounted on anti-friction bearings 37, 38, and is connected to the propeller shaft. Gears and bearings are running in a constant bath of light oil completely enclosed and sealed by the gear housing 56, fully protected against stones, dirt, snow, ice, water, etc. The lubrication system has been carefully designed and tested to satisfactorily lubricate all the bearings and gears for both directions of operation. The hypoid type of gear is used because it



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

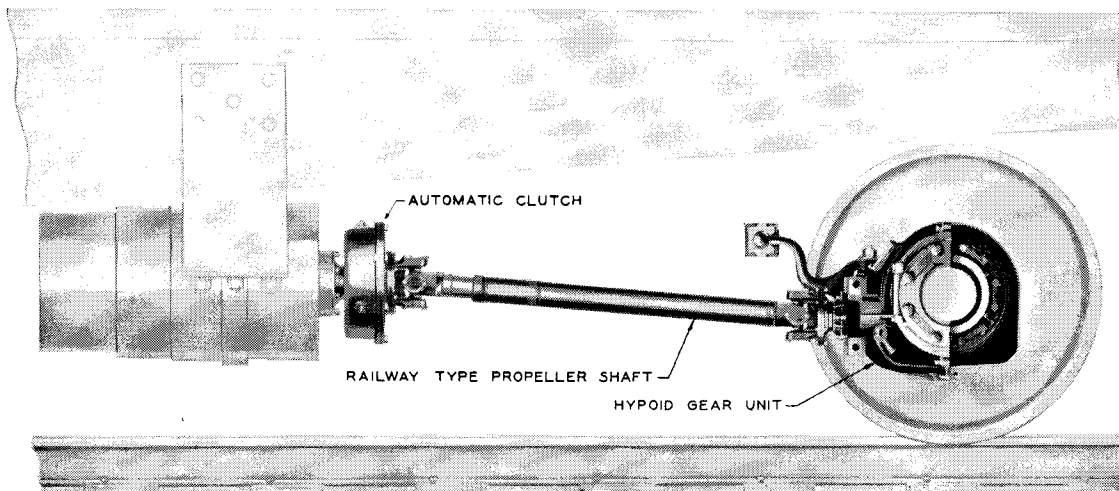


FIG. 1
GENERAL APPLICATION—SPICER DRIVE

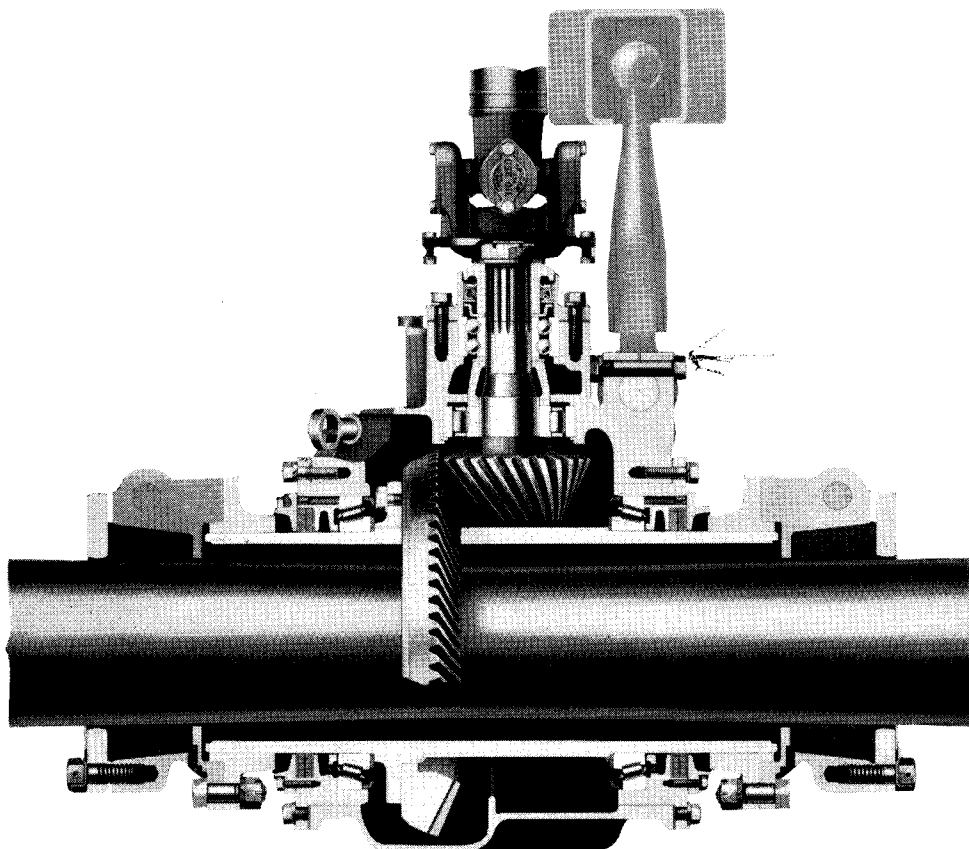


FIG. 2
CROSS SECTION—MODEL 6—GEAR UNIT

has the combined advantages of bevel, spiral bevel and worm gears without the disadvantages, thereby insuring quietness, long life and strength. It also places the pinion below the center line of the axle, permitting the propeller shaft to run below the truck end sill. The gear unit is completely assembled and the gears and bearings care-

fully adjusted before being shipped from the factory. No parts need be disassembled or adjustments disturbed when applying the unit to the axle. The alignment and adjustment of the gears and bearings remain constant as they cannot be affected by any possible misalignment of the axle mounting.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

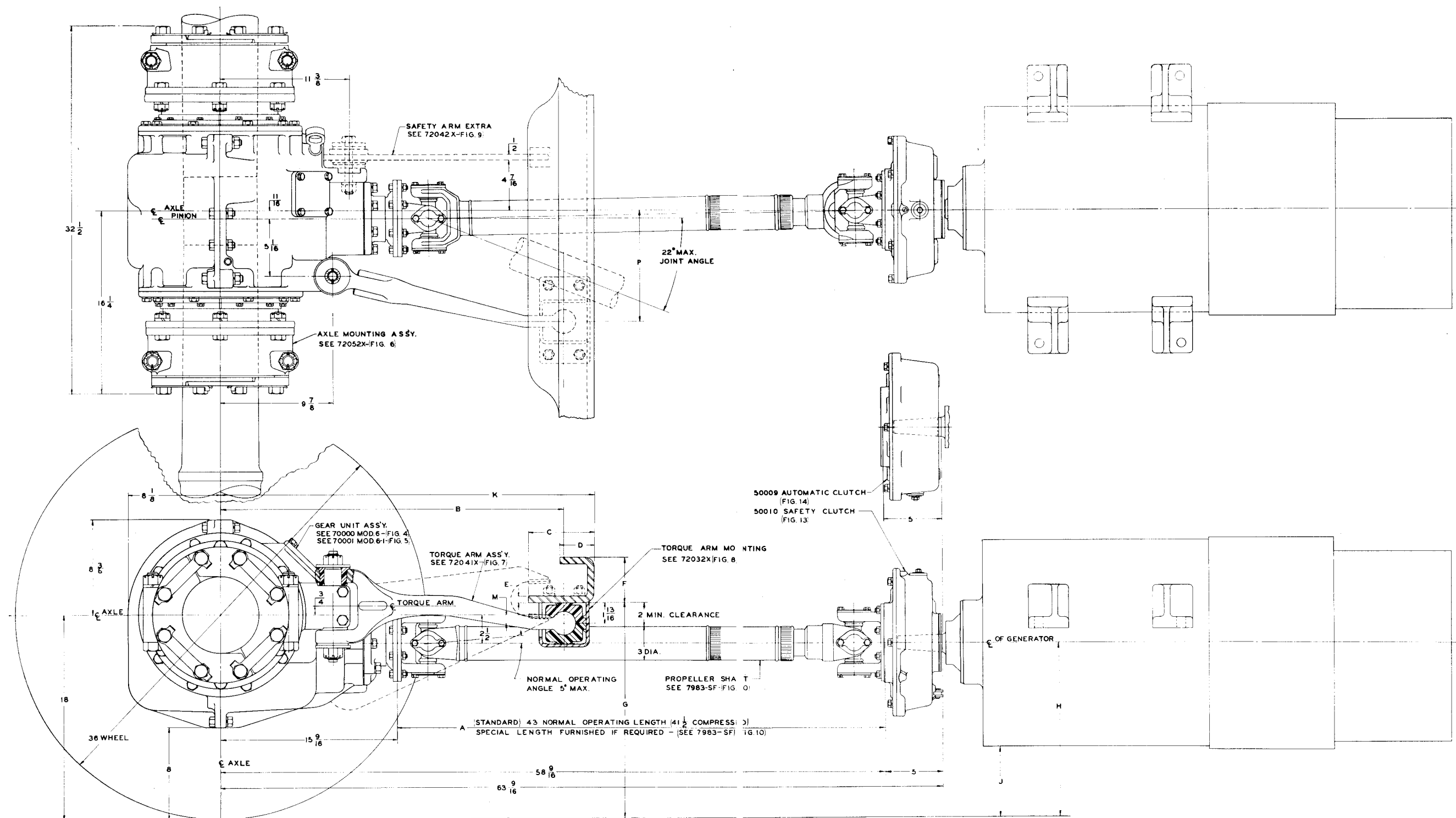


FIG. 3
SKG-44118 TYPICAL INSTALLATION COMPLETE SPICER DRIVE—MODEL 6 AND 6-1

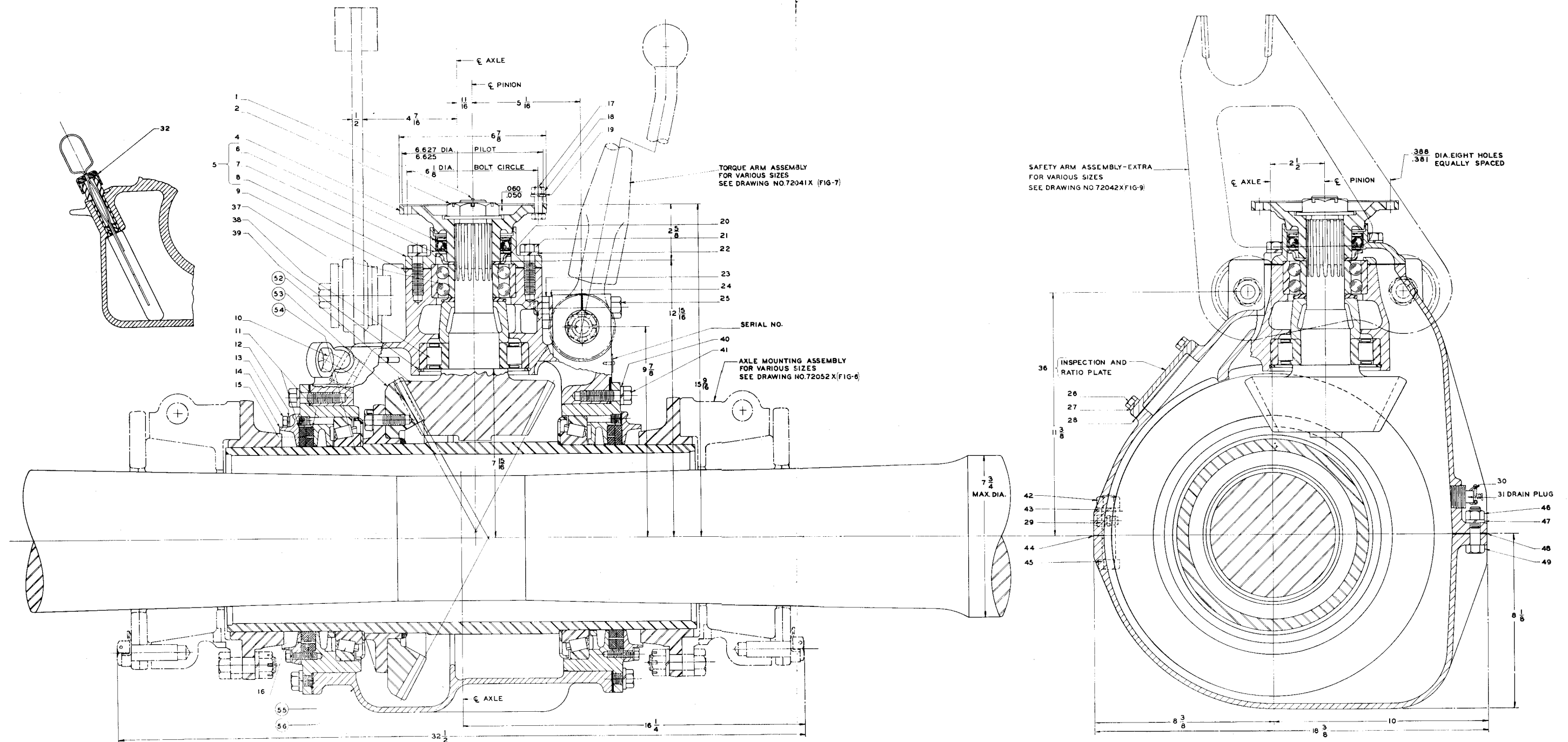


FIG. 4
70000 GEAR UNIT—MODEL 6
(Does not include Torque Arm, Torque Arm Mounting, Safety Arm or Axle Mounting)

70000-1	Gear Unit Assembly	Ratio 2.54
70000-2	Gear Unit Assembly	Ratio 3.09
70000-3	Gear Unit Assembly	Ratio 3.44
70000-4	Gear Unit Assembly	Ratio 3.76 (Special)

REPAIR PARTS

Item No.	Name	Part No.	No. Req'd Complete Drive	Item No.	Name	Part No.	No. Req'd Complete Drive
1	Lock Wire	S-1630	1	13	Screw	8-D	20
2	Nut	S-1613	1	14	Felt Retainer (Half)	75103	4
4	Universal Joint Flange	S-1-1001	1	15	Felt Staple (Inner)	75093	2
5 (6,7,8)	Pinion Bearing Cap Assembly	72006-X	1	16	Felt Staple (Outer)	75094	2
6	Oil Seal	75040	1	17	Bolt	S-617	8
7	Gasket	75129	1	18	Nut	294-J	8
8	Pinion Bearing Cap	75050	1	19	Lock Washer	6-75-29	8
9	Gasket	75041	1	20	Oil Slinger	75095	1
10	Filler Plug	S-963	1	21	Screw	392-D	6
11	Felt	75105	4	22	Lock Washer	S-898	6
12	Lock Washer	S-75-19	20	23	Nut	S-26	2
				24	Lock Washer	S-881	2
				25	Bolt	S-616	2

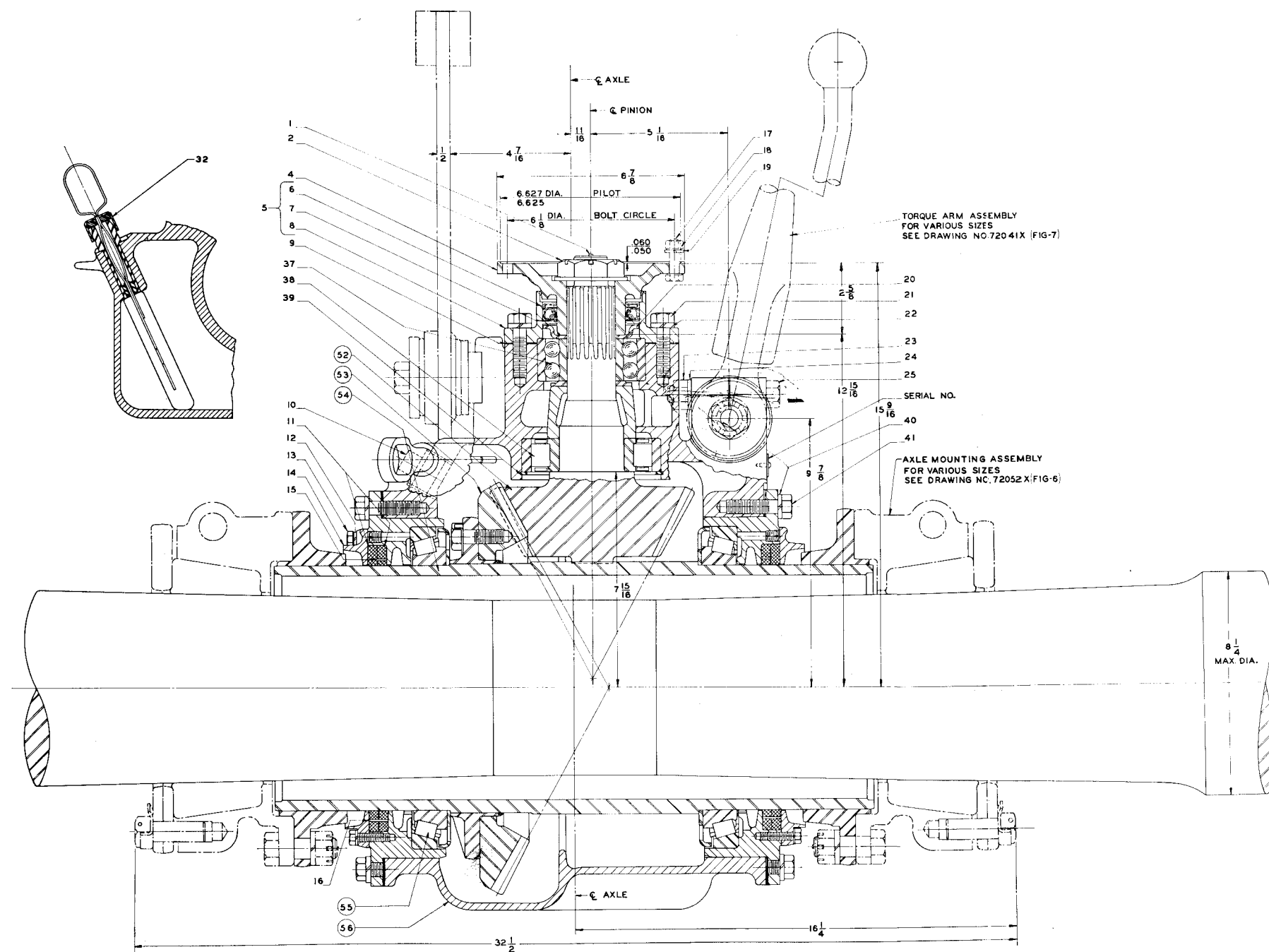
REPAIR PARTS

Item No.	Name	Part No.	No. Req'd Complete Drive	Item No.	Name	Part No.	No. Req'd Complete Drive
26	Screw	104-D	4	37	Outer Pinion Bearing	550074-1	1
27	Lock Washer	6-75-29	4	38	Inner Pinion Bearing	550102	1
28	Gasket	75091	1	39	Snap Ring	75037	1
29	Vent Plug	18750	1	40	Lock Washer	S-898	20
30	Lock Wire	S-960	1	41	Screw	392-D	20
31	Drain Plug	S-959	1	42	Nut	S-26	4
32	Oil Level Gauge	72059-X	1	43	Lock Washer	S-881	4
36	Inspection and Ratio Plate:			44	Gasket—Top	75031	1
	Ratio 2.54 (71-28)	75113-1	1	45	Bolt	S-612	4
	Ratio 3.09 (71-23)	75113-2	1	46	Nut	8-74-11	5
	Ratio 3.44 (79-23)	75113-3	1	47	Lock Washer	S-898	5
	Ratio 3.76 (79-21)	75113-4	1	48	Gasket—Bottom	75032	1
				49	Bolt	S-1504	5
					Special Gear Lubricant (2 Gallon Can)	75115-1	1
					Special Gear Lubricant (110 Lb. Drum)	75115-2	as required

NOTE: Order all material by part number, name and quantity of each part required.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE



SAFETY ARM ASSEMBLY—EXTRA
FOR VARIOUS SIZES
SEE DRAWING NO. 72042XFIG-9

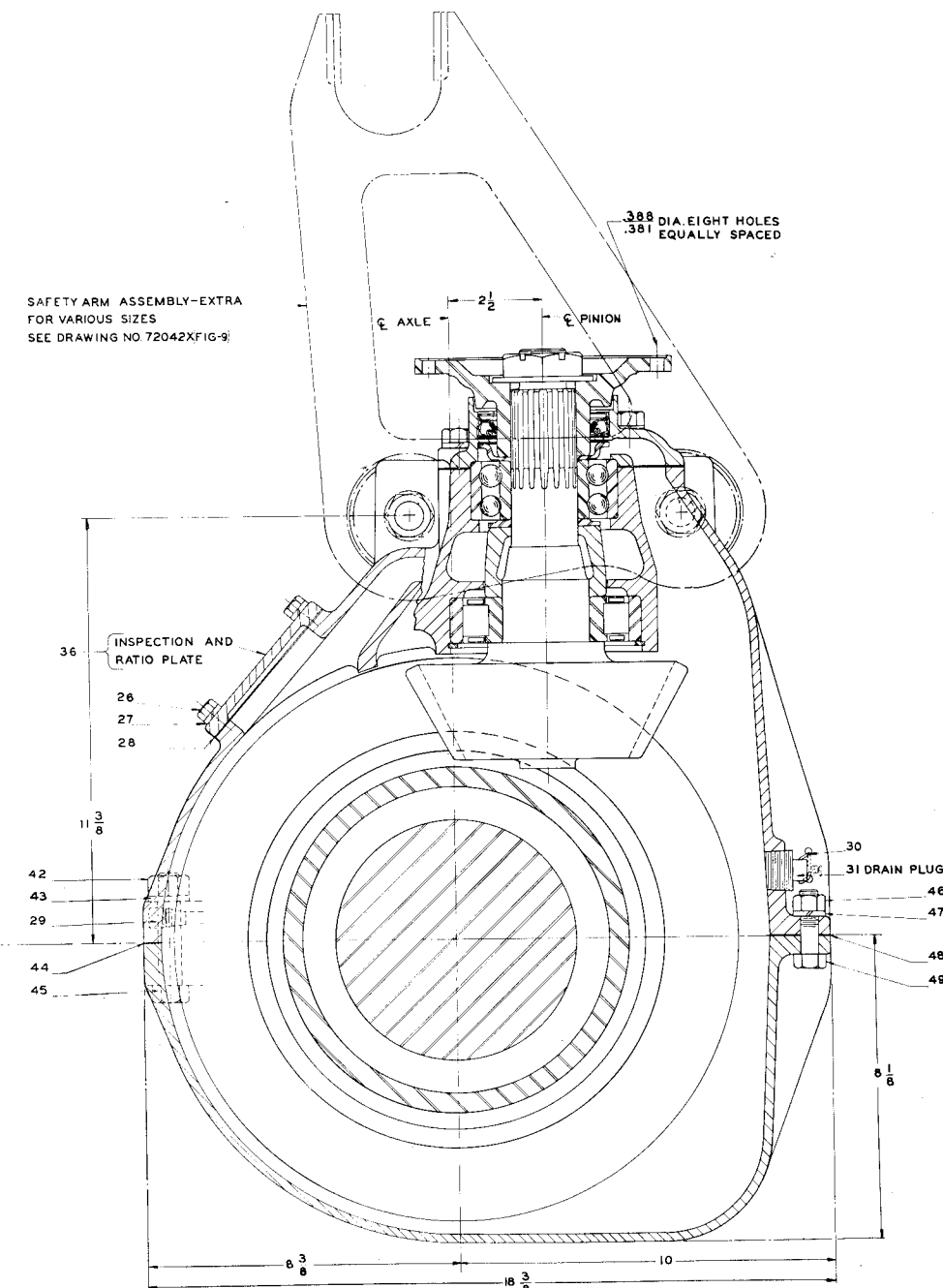


FIG. 5
70001 GEAR UNIT—MODEL 6-1
(Does not include Torque Arm, Torque Arm Mounting, Safety Arm or Axle Mounting)

70001-1	Gear Unit Assembly	Ratio 2.54
70001-2	Gear Unit Assembly	Ratio 3.09
70001-3	Gear Unit Assembly	Ratio 3.44
70001-4	Gear Unit Assembly	Ratio 3.76 (Special)

REPAIR PARTS

Item No.	Name	Part No.	No. Req'd Complete Drive	Item No.	Name	Part No.	No. Req'd Complete Drive
1	Lock Wire	S-1630	1	13	Screw	75061	4
2	Nut	S-1613	1	14	Felt Retainer (Half)	75093	2
4	Universal Joint Flange	5-1-1001	1	15	Felt Staple (Inner)	75094	2
5 (6,7,8)	Pinion Bearing Cap Assembly	72006-X	1	16	Felt Staple (Outer)	S-617	8
6	Oil Seal	75040	1	17	Bolt	294-J	8
7	Gasket	75129	1	18	Nut	6-75-29	8
8	Pinion Bearing Cap	75050	1	19	Lock Washer	75095	1
9	Gasket	75041	1	20	Oil Slinger	392-D	6
10	Filler Plug	S-963	1	21	Screw	S-898	6
11	Felt	75060	4	22	Lock Washer	S-26	2
12	Lock Washer	5-75-19	20	23	Nut	S-881	2
				24	Lock Washer	S-616	2
				25	Bolt		2

REPAIR PARTS

Item No.	Name	Part No.	No. Req'd Complete Drive	Item No.	Name	Part No.	No. Req'd Complete Drive
26	Screw	104-D	4	37	Outer Pinion Bearing	550074-1	1
27	Lock Washer	6-75-29	4	38	Inner Pinion Bearing	550102	1
28	Gasket	75091	1	39	Snap Ring	75037	1
29	Vent Plug	18750	1	40	Lock Washer	S-898	20
30	Lock Wire	S-960	1	41	Screw	392-D	20
31	Drain Plug	S-959	1	42	Nut	S-26	4
32	Oil Level Gauge	72059-X	1	43	Lock Washer	S-881	4
36	Inspection and Ratio Plate:			44	Gasket—Top	75031	1
	Ratio 2.54 (71-28)	75113-1	1	45	Bolt	S-612	4
	Ratio 3.09 (71-23)	75113-2	1	46	Nut	8-74-11	5
	Ratio 3.44 (79-23)	75113-3	1	47	Lock Washer	S-898	5
	Ratio 3.76 (79-21)	75113-4	1	48	Gasket—Bottom	75032	1
	Special Gear Lubricant (2 Gallon Can)	75115-1	1	49	Bolt	S-1504	5
	Special Gear Lubricant (110 Lb. Drum)	75115-2	as required				

NOTE: Order all material by part number, name and quantity of each part required.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

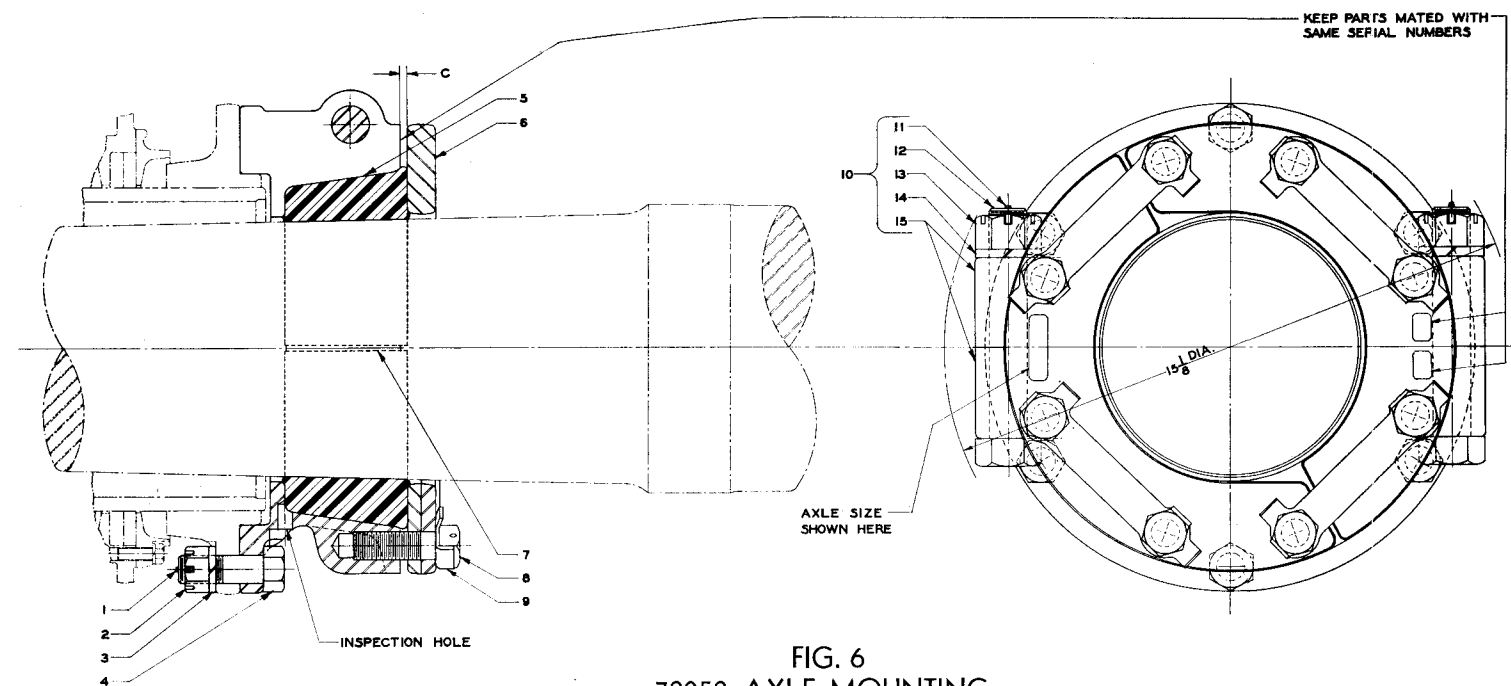


FIG. 6
72052 AXLE MOUNTING

Axle Mounting—Fig. 6—The gear unit is attached to the axle by rubber mountings 5 on each end of the quill. These are tapered and split to provide a convenient means of assembling, disassembling and alignment. This rubber not only acts as a mounting but also transmits the torque from the axle to the gear unit. It absorbs shocks and vibrations, due to both torque and weight loads, and acts as an insulator for noise. No metal comes in contact with the axle.

Standard size of Axle (Center) Axle Mounting Assembly No.			5 x 9 72052-1X	5½ x 10 72052-2X	6 x 11 72052-3X	7¾ Straight A.S.F. 46432 72052-4X	6 x 11 Special Pullman CE-D-2110 72052-5X	6½ Straight 72052-6X	6 x 11 Special C.M.St.P. & P. C-6826 & C-4975 72052-7X	6 x 11 Special C.B. & Q. 25001 & G.N. 20899 Budd D99-51169 72052-8X	5½ x 10 Special Central of Brazil Budd D99-51207 72052-9X	6½ x 12 72052-10X	5½ x 10 Special Budd D99-51890 72052-11X	7⅝ Straight S.F.R. 20-D-1656 72052-12X	5½ x 10 Special C.B. & Q. 25111 G.N. 20981 72052-14X
Item No.	Name	Part No. See Table	No. Required Complete Drive												
1	Axle Mounting Assembly	8-72-79	2	2	2	2	2	2	2	2	2	2	2	2	2
2	Cotter Pin	S-886	12	12	12	12	12	12	12	12	12	12	12	12	12
	Nut	S-2	—	—	—	—	—	—	—	—	—	12	—	—	—
3	Lock Washer	S-714	12	12	12	12	12	12	12	12	12	12	12	12	12
4	Bolt	S-885	12	12	12	12	12	12	12	12	12	12	—	12	12
		S-1620	—	—	—	—	—	—	—	—	—	12	—	—	—
		S-1627	—	—	—	—	—	—	—	—	—	—	12	—	—
5	Rubber (Half)	(5 x 9) 75196-1	4	—	—	—	—	—	—	—	—	—	—	—	—
		(5½ x 10) 75196-2	—	4	—	—	—	—	—	—	—	—	—	—	—
		(6 x 11) 75196-3	—	—	4	—	—	—	—	—	—	—	4	—	—
		(6½ x 12) 75196-4	—	—	—	—	—	—	—	—	—	4	—	—	—
		(7¾ Straight) 75090-1	—	—	—	4	—	—	—	—	—	—	—	—	—
		(6 x 11 Special) 75090-2	—	—	—	—	4	—	—	—	—	—	—	—	4
		(6½ Straight) 75090-3	—	—	—	—	—	4	—	—	—	—	—	—	—
		(6 x 11 Special) 75090-4	—	—	—	—	—	—	4	—	—	—	—	—	—
		(6 x 11 Special) 75090-5	—	—	—	—	—	—	—	4	—	—	—	—	—
		(5½ x 10 Special) 75090-6	—	—	—	—	—	—	—	—	4	—	—	—	—
		(7⅝ Straight) 75090-7	—	—	—	—	—	—	—	—	—	—	—	4	—
6	Compression Ring (Half)	(5 x 9) 75197-1	4	—	—	—	—	—	—	—	—	—	—	—	—
		(5½ x 10) 75197-2	—	4	—	—	—	4	—	—	4	—	—	—	—
		(6 x 11) 75197-3	—	—	4	—	4	—	4	4	—	—	—	—	—
		(7¾ Straight) 75197-4	—	—	—	4	—	—	—	—	—	—	—	—	—
		(6½ x 12) 75197-5	—	—	—	—	—	—	—	—	—	4	—	4	—
		(5½ x 10 Special) 75339	—	—	—	—	—	—	—	—	—	—	—	—	4
7	Shim	(5 x 9) 75016	4	—	—	—	—	—	—	—	—	—	—	—	—
		(5½ x 10) 75017	—	4	—	—	—	—	—	—	4	—	—	—	4
		(6 x 11) 75018	—	—	4	4	4	4	4	4	—	—	—	4	—
		(6½ x 12) 75263	—	—	—	—	—	—	—	—	—	4	—	—	—
8	Screw	S-878	16	16	16	16	16	16	16	16	16	16	—	16	16
		S-1627	—	—	—	—	—	—	—	—	—	—	—	—	—
9	Lock Strap	75199	8	8	8	8	8	8	8	8	8	8	16	8	8
10	(11, 12, 13, 14, 15) Clamp Assembly	(5 x 9) 72053-1X	2	—	—	—	—	—	—	—	—	—	—	—	—
		(5½ x 10) 72053-2X	—	2	—	—	—	—	—	—	2	—	—	—	—
		(6 x 11) 72053-3X	—	—	2	—	2	—	2	2	—	—	2	—	—
		(7¾ Straight) 72053-4X	—	—	—	2	—	—	—	—	—	—	—	—	—
		(6½ Straight) 72053-5X	—	—	—	—	—	2	—	—	—	—	—	—	—
		(6½ x 12) 72053-6X	—	—	—	—	—	—	—	—	—	2	—	—	—
		(7⅝ Straight) 72053-7X	—	—	—	—	—	—	—	—	—	—	—	2	—
		(5½ x 10 Special) 72053-8X	—	—	—	—	—	—	—	—	—	—	—	—	2
11	Cotter Pin	S-388	4	4	4	4	4	4	4	4	4	4	4	4	4
12	Bolt	S-877	4	4	4	4	4	4	4	4	4	4	4	4	4
13	Nut	S-1105	4	4	4	4	4	4	4	4	4	4	4	4	4
14	Lock Washer	S-933	4	4	4	4	4	4	4	4	4	4	4	4	4

NOTE: Order all material by part numbers, name and quantity of each part required.

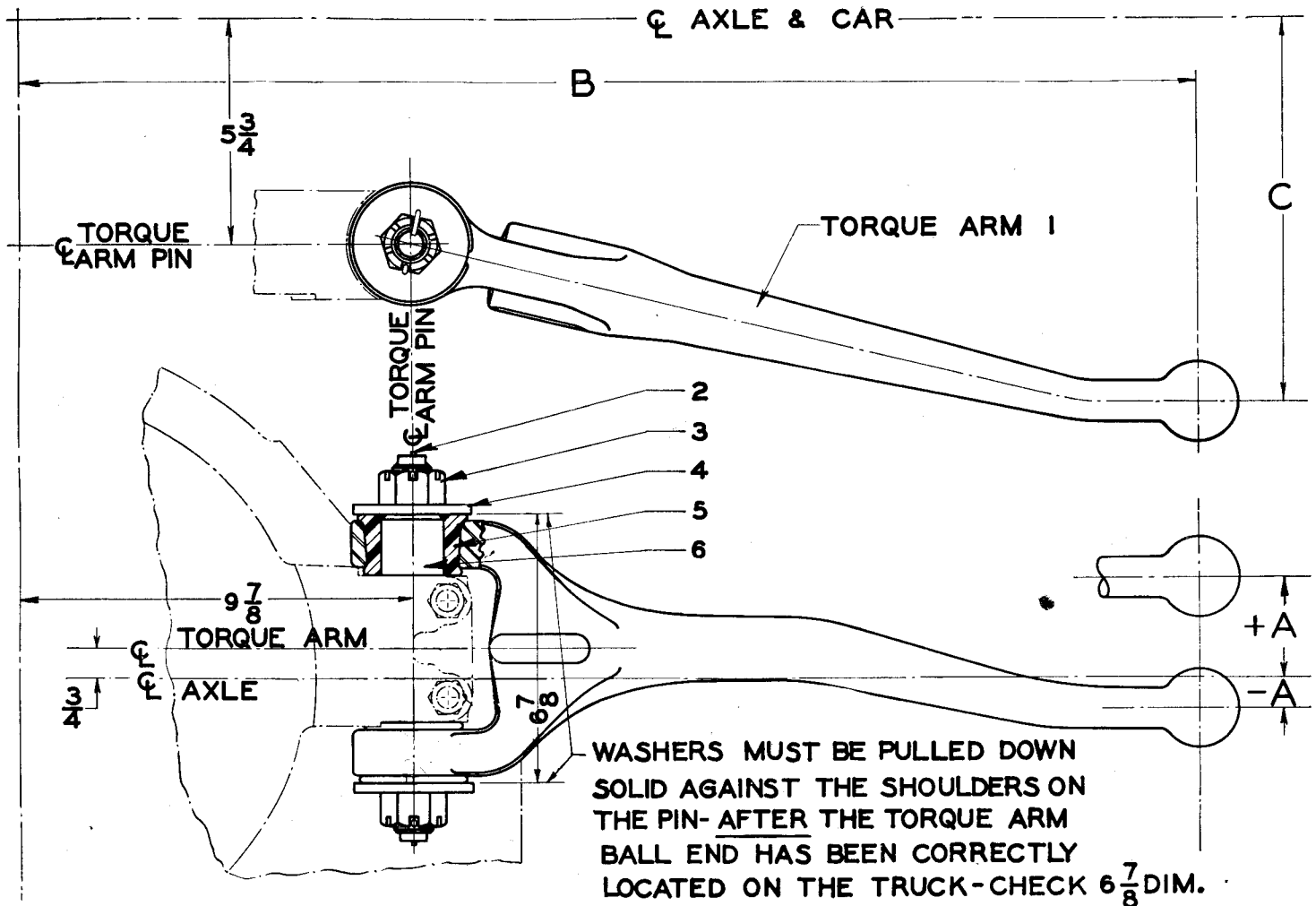


FIG. 7
72041 TORQUE ARM

Assembly No. Complete	Torque Arm	A	B	C	Assembly No. Complete	Torque Arm	A	B	C
72041-1X	75147	$-25/32$	$29 3/4$	$9 3/4$	72041-8X	75163	$+47/16$	$30 3/16$	$5 3/4$
72041-2X	75151	$+3/4$	$21 1/4$	$7 1/8$	72041-9X	75165	$+6 1/32$	$26 7/8$	$5 3/4$
72041-3X	75153	$+5/8$	$22 3/4$	$7 1/8$	72041-12X	75171	0	$29 1/2$	$10 3/4$
72041-4X	75155	$+29/16$	$25 1/2$	8	72041-13X	75002	+5	$25 1/4$	$5 3/4$
72041-5X	75157	$+3 3/8$	$24 1/4$	$5 3/4$	72041-14X	75043	$+3/16$	$32 1/4$	11
72041-6X	75159	$+7 11/16$	$23 3/16$	$5 3/4$	72041-15X	75068	$-3/16$	25	$8 3/4$
72041-7X	75161	$+6 1/8$	$22 11/16$	$5 3/4$	72041-16X	75088	$+4 13/16$	$20 1/2$	$5 3/4$

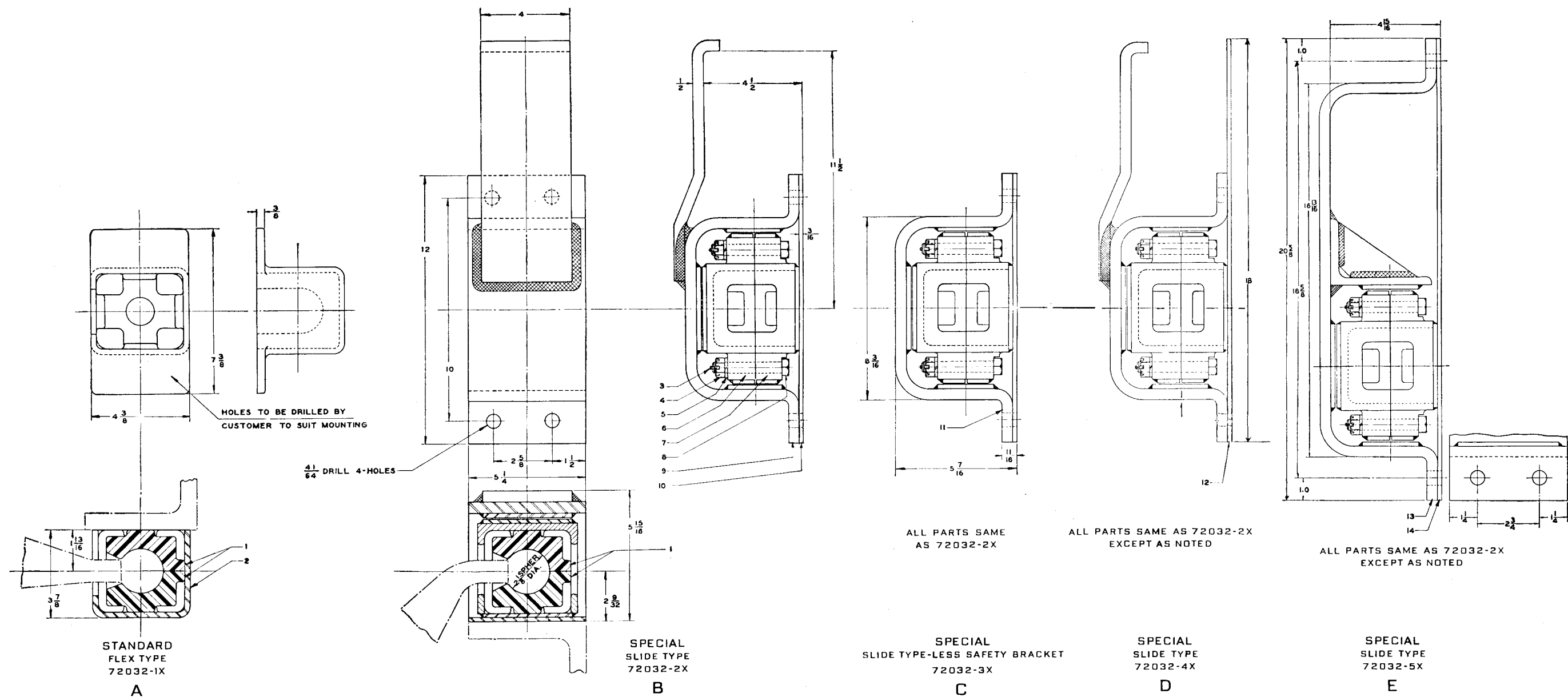
REPAIR PARTS

Item No.	Name	Part No.	No. Required Complete Drive
1	Torque Arm	See Table	1
2	Cotter Pin	8-72-19	2
3	Nut	S-1105	2
4	Washer	S-774	2
5	Rubber Bushing	75149	2
6	Torque Arm Pin	75150	1

NOTE: Order all material by part number, name and quantity of each part required.

Torque Arm—Fig. 6—The torque reaction of the gears is taken by the torque arm, one end being fastened to the gear housing and the other to the truck end sill. It is attached to the gear

housing by two rubber bushings 5, which absorb shocks, vibrations and all movement by the flexing of the rubber. This prevents failures and eliminates the necessity for lubrication.



Torque Arm Mounting—Fig. 8—The torque arm mounting attaches the torque arm to the end sill of the truck. The ball end of the torque arm is surrounded by two rubber blocks 1, which are enclosed by the housing 2. In the standard flex type of mounting Fig. 8A all movement, shock and

vibration are absorbed by the rubber. No lubrication is required and the rubber may easily be replaced. Special slide type of mountings Fig. 8B-C-D-E can also be furnished when additional movement is required. This extra movement is taken by sliding action on manganese steel plates.

FIG. 8
72032 TORQUE ARM MOUNTING
REPAIR PARTS

Torque Arm Mounting Assembly No.			Fig. 8A 72032-1X Standard	Fig. 8B 72032-2X Special	Fig. 8C 72032-3X Special	Fig. 8D 72032-4X Special	Fig. 8E 72032-5X Special
Item No.	Name	Part No.	No. Required Complete Drive				
1	Rubber Mounting	75133	2	2	2	2	2
2	Housing	75134	1	—	—	—	—
3	Cotter Pin	11-G	—	4	4	4	4
4	Nut	S-1107	—	4	4	4	4
5	Lock Washer	83-W	—	4	4	4	4
6	Housing—Upper	72037-X	—	1	1	1	1
7	Housing—Lower	72038-X	—	1	1	1	1
8	Bolt	S-639	—	4	4	4	4
9	Bracket	72039-X	—	1	—	1	—
10	Base Plate	75136	—	1	1	—	—
11	Bracket	72040-X	—	—	1	—	—
12	Base Plate	75146	—	—	—	1	—
13	Bracket	72000-X	—	—	—	—	1
14	Base Plate	75007	—	—	—	—	1

NOTE: Order all material by part number, name and quantity of each part required.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

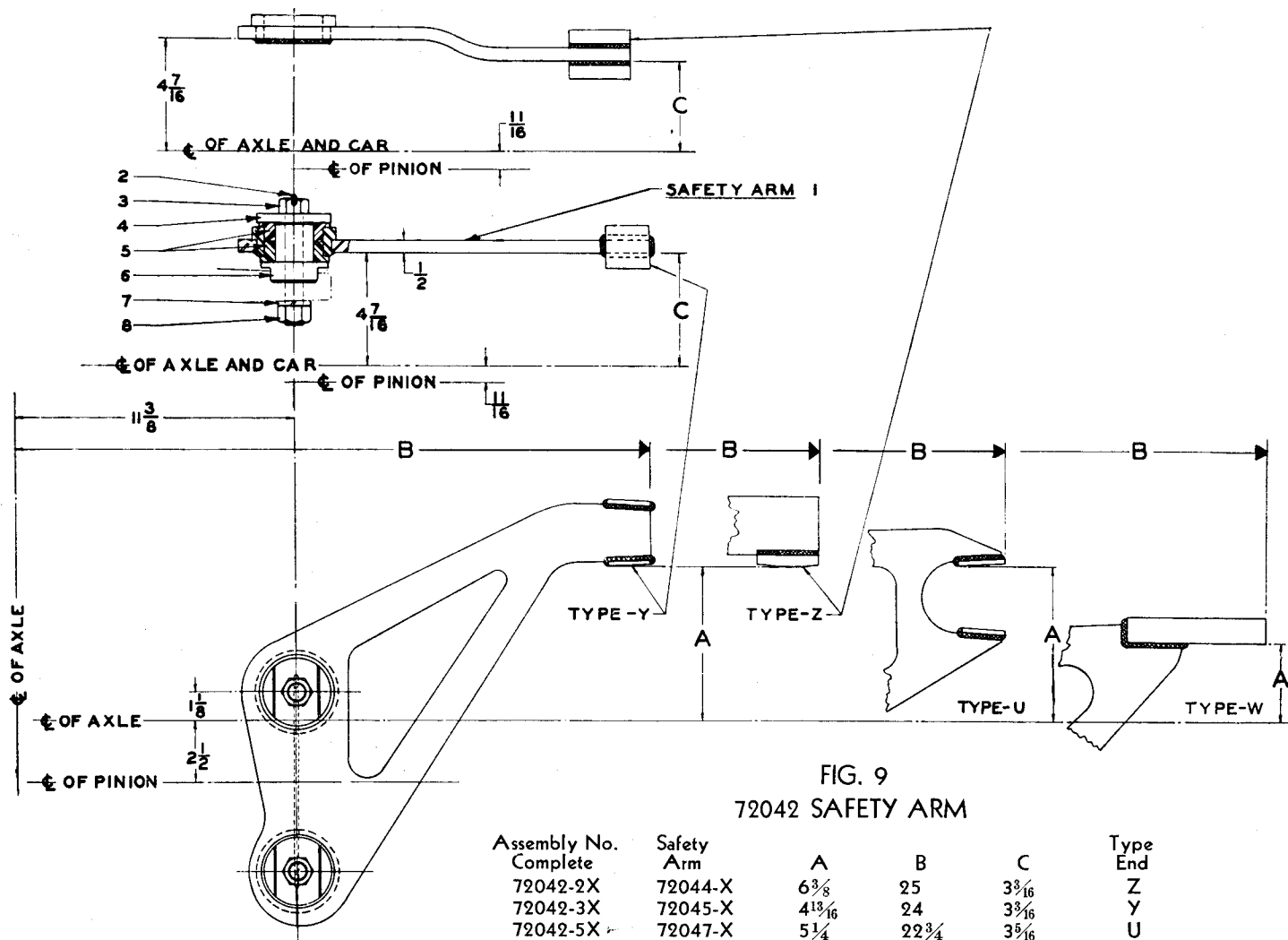


FIG. 9
72042 SAFETY ARM

Assembly No. Complete	Safety Arm	A	B	C	Type End
72042-2X	72044-X	6 ³ / ₈	25	3 ³ / ₁₆	Z
72042-3X	72045-X	4 ¹³ / ₁₆	24	3 ³ / ₁₆	Y
72042-5X	72047-X	5 ¹ / ₄	22 ³ / ₄	3 ⁵ / ₁₆	U
72042-6X	72048-X	3 ⁷ / ₁₆	28 ³ / ₄	4 ⁷ / ₁₆	U
72042-7X	72049-X	2 ¹¹ / ₁₆	28 ¹⁵ / ₁₆	4 ⁷ / ₁₆	U
72042-8X	72050-X	2 ¹³ / ₁₆	24 ¹ / ₈	2 ¹⁵ / ₁₆	U
72042-10X	72001-X	3 ⁷ / ₈	26 ¹ / ₂	3 ³ / ₁₆	Z
72042-11X	72025-X	3 ¹ / ₈	25 ¹ / ₄	4 ⁷ / ₁₆	W
72042-12X	72058-X	3 ¹ / ₈	28 ¹ / ₄	4 ⁷ / ₁₆	W

REPAIR PARTS

Item No.	Name	Part No.	No. Required Complete Drive
1	Safety Arm	See Table	1
2	Lock Wire	S-888	1
3	Bolt	S-883	2
4	Washer	S-882	2
5	Rubber Bushing	75173	4
6	Mounting Plug	75174	2
7	Lock Washer	S-714	2
8	Nut	S-2	2

NOTE: Order all material by part number, name and quantity of each part required.

Safety Arm—Fig. 9—The safety arm is furnished only as special equipment when requested. It is used only as an additional safety means to support the reaction of the gear unit in case of a torque arm failure. It is attached to the gear unit with rubber bushings 5, which absorb shocks and

vibrations thereby preventing failure of the arm. The other end is placed over the truck end sill but does not come in contact with the sill except in case of a torque arm failure. Several types of ends and lengths can be furnished to suit the end sill construction and location.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

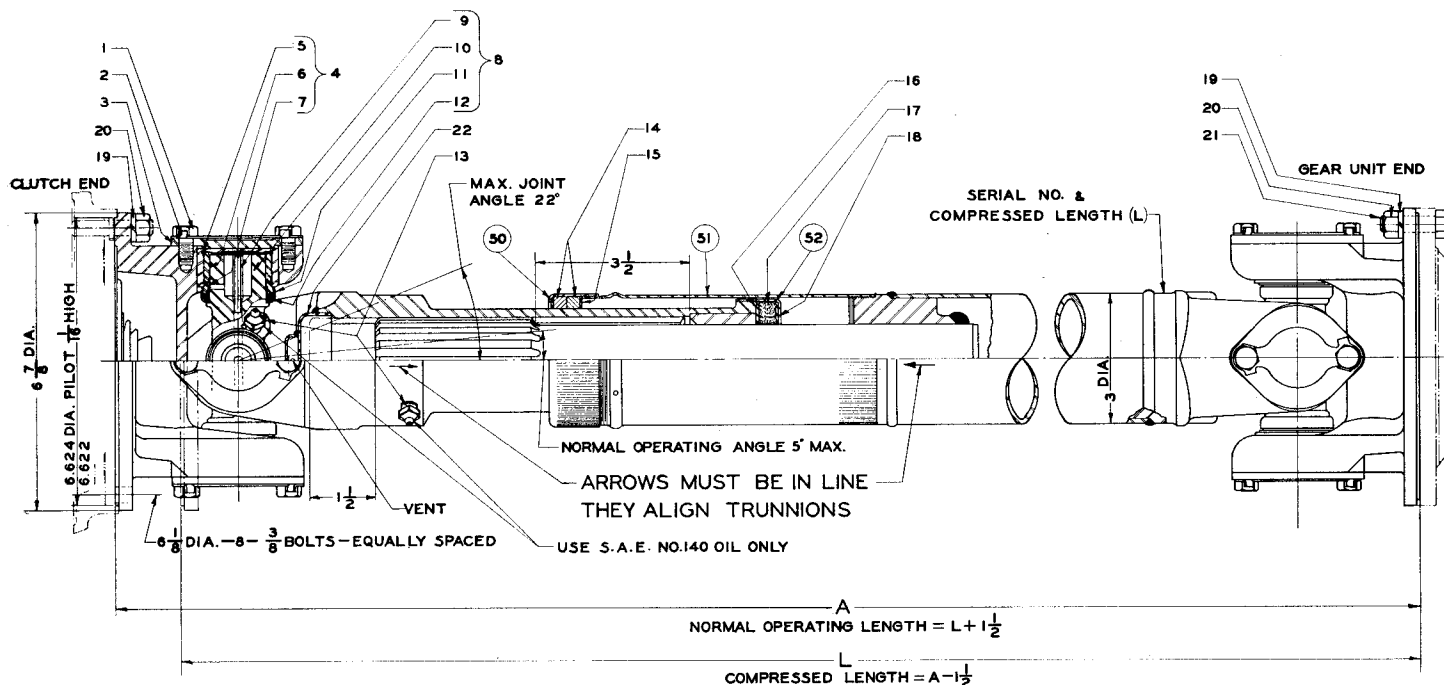


FIG. 10
7983-SF PROPELLER SHAFT (Standard—Tubular Type)

Assembly No. Complete	A	L	Assembly No. Complete	A	L
7983-1-SF	43	41 1/2	7983-18-SF	61 1/4	59 3/4
7983-2-SF	50 1/2	49	7983-20-SF	62 1/4	60 3/4
7983-4-SF	56 1/2	55	7983-21-SF	55	53 1/2
7983-8-SF	46 5/8	45 1/8	7983-22-SF	62 7/8	61 3/8
7983-9-SF	68 1/2	67	7983-23-SF	44 1/4	42 3/4
7983-10-SF	47 15/16	46 7/16	7983-24-SF	54	52 1/2
7983-13-SF	39	37 1/2	7983-25-SF	60 1/2	59
7983-14-SF	41 1/2	40	7983-26-SF	49 7/8	48 3/8
7983-15-SF	47	45 1/2	7983-27-SF	59 5/8	58 1/8
7983-16-SF	45	43 1/2	7983-28-SF	42 1/4	40 3/4

REPAIR PARTS

Item No.	Name	Part No.	No. Req'd Complete Drive	Item No.	Name	Part No.	No. Req'd Complete Drive
*1	Screw	5-73-109	16	17	Cork Washer	6-16-73	1
*2	Lock Strap	98-741	8	18	Steel Washer	6-15-53	1
*3	Bearing Cap	5-70-49	8	19	Lock Washer	6-75-29	16
*4 (5,6,7)	Bearing Assembly	5-6-108X	8	20	Nut	294-J	16
*8 (9,10,11,12)	Journal Assembly	5-5-168X	2	21	Bolt	S-617	8
11	Bearing Seal Retainer	5-76-17	8	22	Cup Assembly	5-68-18X	1
12	Bearing Seal Cork	5-86-79	8		Tack Weld After Assembling		
13	Alemite Fitting	99-29	3	50	Dust Cap	4-14-49	1
14	Felt Washer	4-16-103	2	51	Dust Shield Tube	98-991	1
15	Steel Washer	4-15-93	2	52	Dust Cap	6-14-29	1
16	Steel Washer	6-15-13	1	*	Journal & Bearing Kit Containing Parts Marked with *	5-69X	2

NOTE: Order all material by part number, name and quantity of each part required.

Propeller Shaft—Fig. 10, 11, 12—The standard propeller shaft is the tubular type as shown in Fig. 10. A special feature of the shaft is the double sealing arrangement 14, 17, to retain the lubricant and to prevent the entrance of dirt, dust, water, etc., which would result in rapid wear of the splines. The universal joints are equipped with plain bushings especially designed to reduce

wear and assure long life in railway service. A special propeller shaft of the solid type Fig. 11, can be furnished when necessary to obtain more clearance. Another special propeller shaft is shown in Fig. 12, which is used in connection with the Pullman Dynamotor. All propeller shafts are dynamically balanced above car speed, before being shipped from the factory.

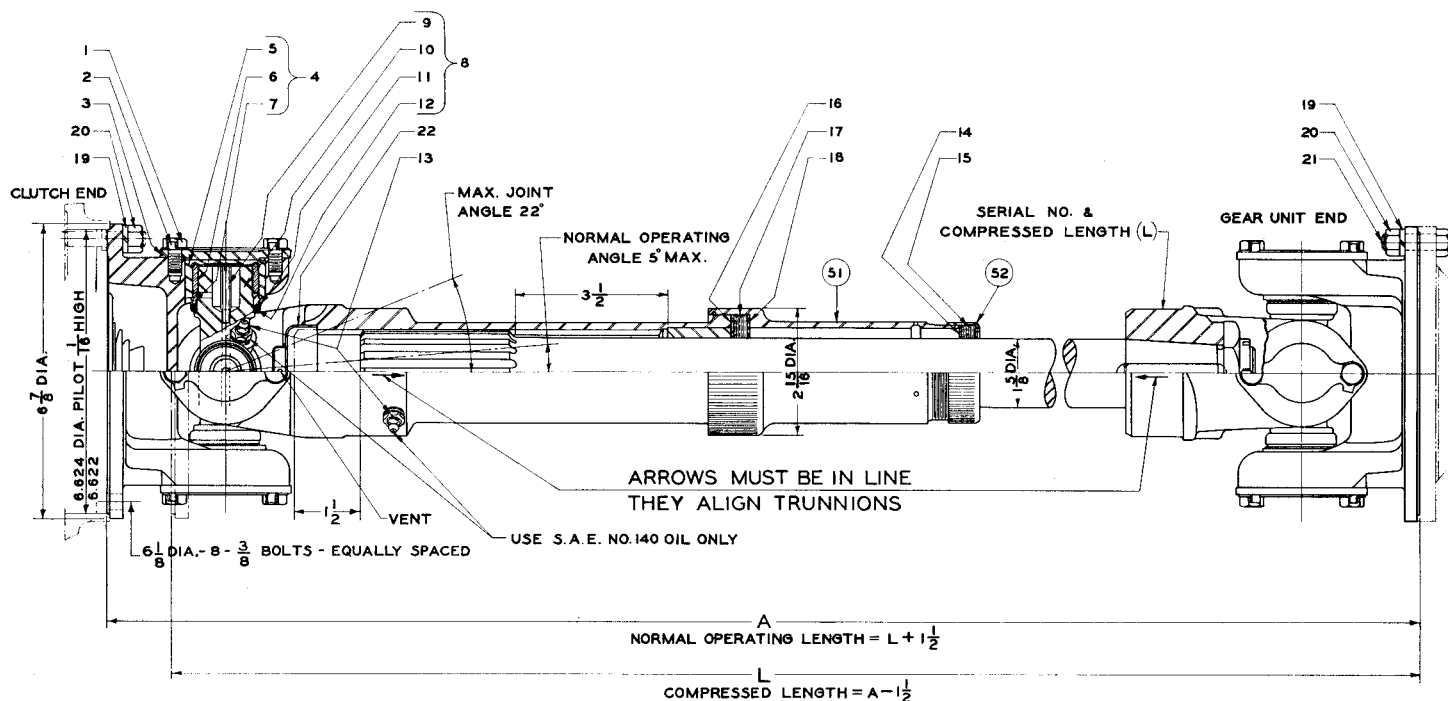


FIG. 11
8024-SF PROPELLER SHAFT (Special—Solid Type)

Assembly No. Complete	A	L
8024-1-SF	43	41 1/2

REPAIR PARTS

Item No.	Name	Part No.	No. Req'd Complete Drive	Item No.	Name	Part No.	No. Req'd Complete Drive
*1	Screw	5-73-109	16	16	Steel Washer	6-15-13	1
*2	Lock Strap	98-741	8	17	Cork Washer	6-16-73	1
*3	Bearing Cap	5-70-49	8	18	Steel Washer	6-15-53	1
*4 (5,6,7)	Bearing Assembly	5-6-108X	8	19	Lock Washer	6-75-29	16
*8 (9,10,11,12)	Journal Assembly	5-5-168X	2	20	Nut	294-J	16
11	Bearing Seal Retainer	5-76-17	8	21	Bolt	S-617	8
12	Bearing Seal Cork	5-86-79	8	22	Cup Assembly	5-68-18X	1
13	Alemite Fitting	99-29	3		Tack Weld After Assembling		
14	Steel Washer	5-15-23	2	51	Dust Shield	98-1016	1
15	Felt Washer	5-16-43	1	52	Dust Cap	4-14-19	1
				*	Journal & Bearing Kit	5-69X	2
					Containing Parts Marked with *		

NOTE: Order all material by part number, name and quantity of each part required.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

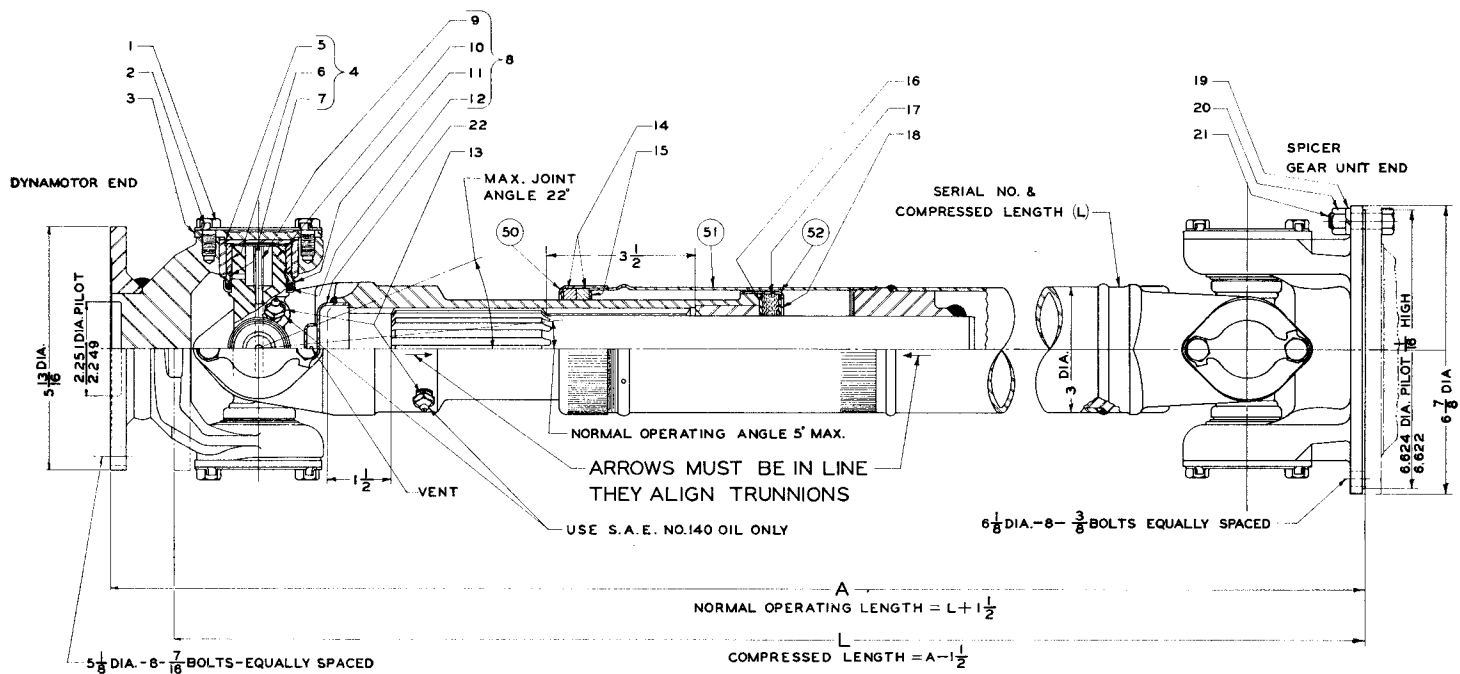


FIG. 12
9439-SF PROPELLER SHAFT (Special—Pullman Dynamotor)

Assembly No. Complete	A	L
9439-1-SF	49 1/2	48
9439-2-SF	68 3/4	67 1/4
9439-3-SF	52 1/2	51
9439-4-SF	74	72 1/2
9439-5-SF	48	46 1/2

REPAIR PARTS

Item No.	Name	Part No.	No. Req'd Complete Drive	Item No.	Part	Part No.	No. Req'd Complete Drive
*1	Screw	5-73-109	16	16	Steel Washer	6-15-13	1
*2	Lock Strap	98-741	8	17	Cork Washer	6-16-73	1
*3	Bearing Cap	5-70-49	8	18	Steel Washer	6-15-53	1
*4 (5,6,7)	Bearing Assembly	5-6-108X	8	19	Lock Washer	6-75-29	8
*8 (9,10,11,12)	Journal Assembly	5-5-168X	2	20	Nut	294-J	8
11	Bearing Seal Retainer	5-76-17	8	21	Bolt	S-617	8
12	Bearing Seal Cork	5-86-79	8	22	Cup Assembly	5-68-18X	1
13	Alemite Fitting	99-29	3		Tack Weld After Assembling		
14	Felt Washer	4-16-103	2	50	Dust Cap	4-14-49	1
15	Steel Washer	4-15-93	2	51	Dust Shield Tube	98-991	1
				52	Dust Cap	6-14-29	1
				*	Journal & Bearing Kit	5-69X	2
					Containing Parts Marked with *		

NOTE: Order all material by part number, name and quantity of each part required.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

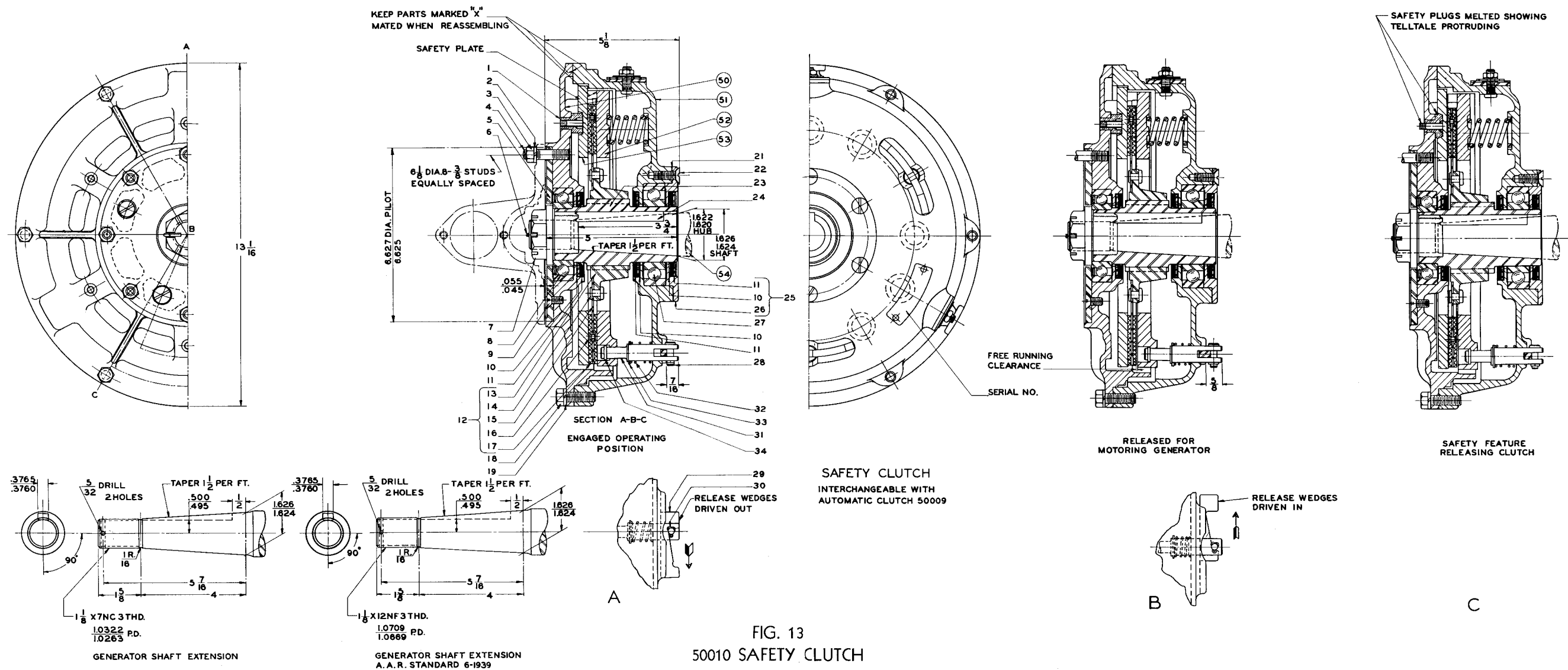


FIG. 13
50010 SAFETY CLUTCH

50010-1 Safety Clutch Assembly (Nut 1 1/8" x 12 Thds.)

50010-2 Safety Clutch Assembly (Nut 1 1/8" x 7 Thds.)

REPAIR PARTS				REPAIR PARTS				REPAIR PARTS				REPAIR PARTS			
Item No.	Name	Part No.	No. Required Complete Drive	Item No.	Name	Part No.	No. Required Complete Drive	Item No.	Name	Part No.	No. Required Complete Drive	Item No.	Name	Part No.	No. Required Complete Drive
1	Safety Plug Assy.	52010X	6	9	Screw	S-971	4	17	Facing	55103-6	2	26	Bearing Retainer	55213	1
2	Lock Washer	6-75-29	8	10	Gasket	55195	3	18	Screw	3-D	6	27	Bearing in Housing	550014	1
3	Nut	294-J	8	11	Oil Seal	55194	3	19	Lock Washer	6-75-29	6	28	Clevis Pin	278-SP	3
4	Stud	S-970	8	12 (13,14,15, 16, 17)	Driven Disc Assy.	52009-X	1	20	Inspection Plug	98-78-5	3	29	Release Wedge	55174	3
5	Bearing Retainer	55196	1	13	Driven Disc Hub	55205	1	21	Gasket	55200	1	30	Cotter Pin	6-G	3
6	Cotter Pin	8-72-19	1	14	Hub Rivet	110-R	16	22	Screw	S-1141	6	31	Clutch Release Rod	55171	3
7	Nut 1 1/8 x 12 Thds.	S-884	1	15	Driven Disc	55123	1	23	Driving Hub	55207	1	32	Spring	55173	3
7	Nut 1 1/8 x 7 Thds.	S-887	1	16	Facing Rivet	224-R	12	24	Key	S-945	1	33	Washer	167-W	3
8	Bearing in Cover	550245	1					25	Bearing Retainer Assy.	55208-X	1	34	"C" Washer	55180	3



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

Clutch—Fig. 13, 14—The safety clutch Fig. 13 is a single plate friction clutch with the capacity controlled by spring pressure. The torque load is transferred from the propeller shaft through the clutch cover 50, housing 51, pressure plate 52, and safety plate 53 to the driven disc 12, then through the hub to the generator shaft 54. The clutch may be released for motoring the generator by driving in the three release wedges 29, Fig. 13B. This raises the pressure plate clear of the friction facings 17, permitting the generator shaft to run free on the bearings 8 and 27.

The safety feature of the clutch functions as follows: In case of any extreme overload on the generator the clutch starts slipping at the friction surfaces, generating heat in the safety plate. This excessive heat transfers to the safety plugs causing them to melt or collapse. The safety plate moves out of engagement with the friction facings as shown in Fig. 13C and the clutch runs free until repaired. The safety plugs are made of a specially developed material and are provided with a telltale feature.

Collapse of the safety plugs causes the telltale to protrude beyond the shank of the safety plug to an extent readily observed as shown in Fig. 13C. The clutch then runs free on the bearings until new safety plugs are installed. The safety plugs are made of a specially developed material.

The automatic clutch Fig. 14 is similar in design and interchangeable with the safety clutch. The safety feature 14C is the same and functions the same. In addition to this feature, the clutch engages and releases automatically. Engagement starts at approximately 300 RPM and full disengagement is also accomplished near this speed. This eliminates the additional starting load on the locomotive as the generator is not running until this speed is reached. It also permits the

motoring of the generator for testing or the use of motor-generators or standby motors without manually disengaging the clutch. In case of an emergency stop, the clutch automatically releases, preventing the high inertia loads of the generator armature from damaging the drive and also prevents damage to both the generator and drive from shock loads such as caused by coupling cars.

Engagement and disengagement of the clutch is controlled by centrifugal force which functions as follows: When the car is standing still and up to speeds of 300 r.p.m. (8 to 12 M.P.H.) the clutch remains disengaged Fig. 14B as the centrifugal weights 58 are held inoperative in this position by the retracting springs 55. As the speed increases the retracting spring load is overcome and the centrifugal weights tip outward Fig. 14A, the foot of the weight forcing the pressure plate 52 into engagement with the friction facings 17. When engagement is completed all centrifugal weights are held in one radial position by the rim of the reaction plate 57, thereby maintaining the balance of the clutch and limiting the effect of centrifugal force as the maximum capacity of the clutch is controlled by the pressure springs 56 and not by centrifugal force. This makes it possible to limit the capacity, assuring satisfactory operation of the safety feature. When the speed drops below 300 r.p.m. the retracting springs return the weights and pressure plate to the disengaged position Fig. 14B. When motoring the generator the clutch remains disengaged as only the driven disc 12 revolves, the rest of the clutch remaining stationary.

All clutches are checked for engagement and disengagement and carefully balanced both statically and dynamically. All clutches are completely enclosed and sealed. All clutches operate the same for either direction of rotation.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

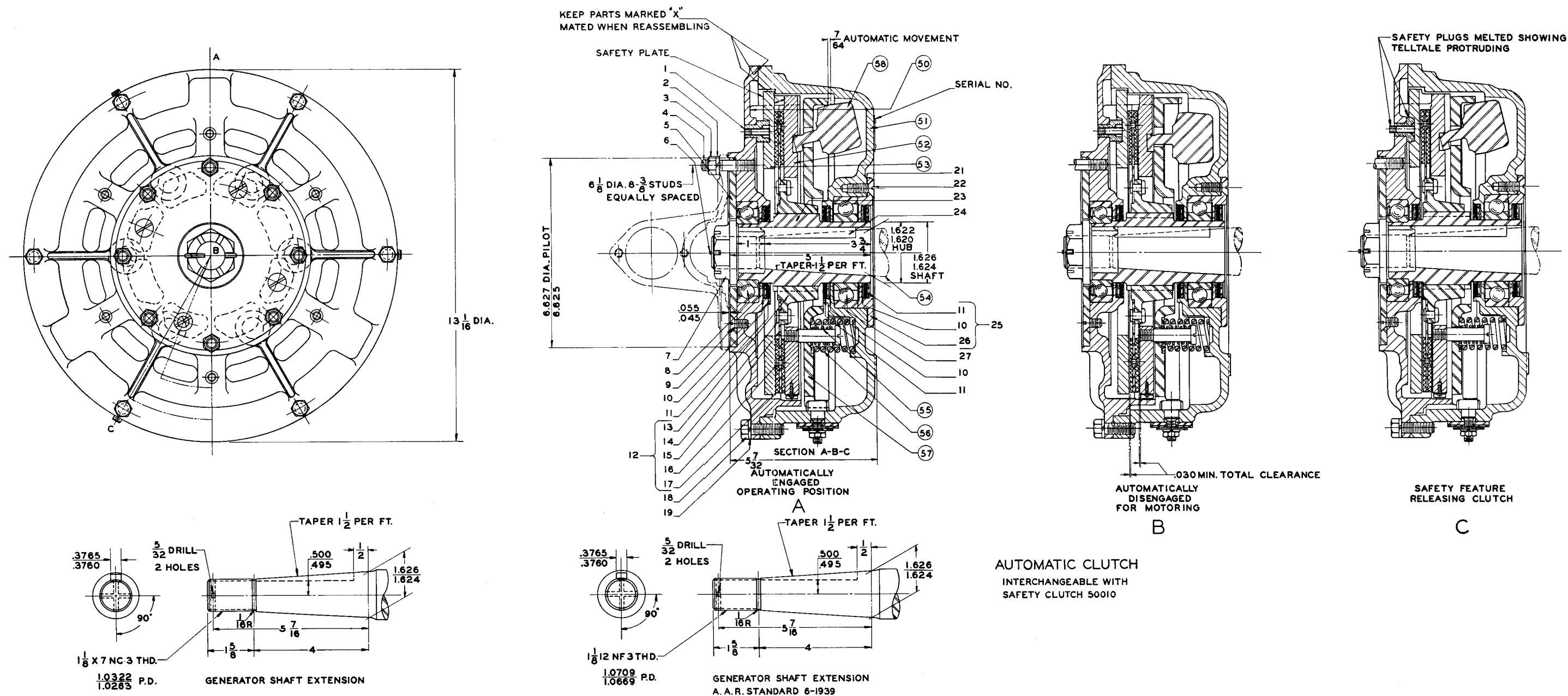


FIG. 14
50009 AUTOMATIC CLUTCH

50009-1 Automatic Clutch Assembly (Nut 1 1/8" x 12 Thds.)

50009-2 Automatic Clutch Assembly (Nut 1 1/8" x 7 Thds.)

REPAIR PARTS			
Item No.	Name	Part No.	No. Required Complete Drive
1	Safety Plug Assy.	52010X	6
2	Lock Washer	6-75-29	8
3	Nut	294-J	8
4	Stud	S-970	8
5	Bearing Retainer	55196	1
6	Cotter Pin	8-72-19	1
7	Nut 1 1/8" x 12 Thds.	S-884	1

REPAIR PARTS			
Item No.	Name	Part No.	No. Required Complete Drive
7	Nut 1 1/8" x 7 Thds.	S-887	1
8	Bearing in Cover	550245	1
9	Screw	S-971	4
10	Gasket	55195	3
11	Oil Seal	55194	3
12 (13, 14, 15, 16, 17)	Driven Disc Assy.	52009-X	1

REPAIR PARTS			
Item No.	Name	Part No.	No. Required Complete Drive
13	Driven Disc Hub	55205	1
14	Hub Rivet	110-R	16
15	Driven Disc	55123	1
16	Facing Rivet	224-R	12
17	Facing	55103-6	2
18	Screw	3-D	6
19	Lock Washer	6-75-29	6

REPAIR PARTS			
Item No.	Name	Part No.	No. Required Complete Drive
20	Inspection Plug	98-78-5	3
21	Gasket	55207	1
22	Screw	S-1141	6
23	Driving Hub	55207	1
24	Key	S-945	1
25	Bearing Retainer Assy.	55208-X	1
26	Bearing Retainer	55213	1
27	Bearing in Housing	550014	1



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

SPECIFICATIONS

Spicer Drives are readily adaptable to both old and new cars with but few, if any, changes necessary in the car, truck or axle construction. The complete drive consists of several units and each unit can be furnished with several variables to suit each application. In some cases special units might be required. We would suggest, however, that each railroad keep all units as nearly alike as possible on all drives used by that particular railroad. This will considerably help maintenance and reduce the number of spare units and repair parts necessary to be carried in store to a minimum.

All the necessary data to properly select the correct units to form a complete drive for any application are contained in the following paragraphs and accompanying drawings. With this information, each unit required can be identified by the corresponding assembly number. If any additional data or more complete drawings are required we shall be glad to send these to you.

Models—Although the general principle of all Spicer Drives is the same, a positive drive through gears and propeller shaft, several different models have been furnished to suit various conditions and to incorporate later developments and improvements. The different models are designated by basic and dash numbers, such as 6 and 6-1. The basic number (6) indicates the general design and the dash numbers are used to show minor differences, such as:

Model 6 To be used with $5\frac{1}{2}$ x 10 or smaller axles. Fig. 4.

Model 6-1 Larger quill and bearings for 6 x 11 and smaller axles. Fig. 5.

Standard and Special Units—In addition to the regular standard drive, many special units have been brought out to meet various conditions.

Although it is advisable to use the standard equipment, if possible, the special equipment can be furnished when required. However, in many cases an additional cost is involved. The adoption of standard units has many advantages including the interchangeability of both units and parts thereby greatly facilitating maintenance, service and repairs. When special units are required by some particular railroad it is an advantage to use those same units for all applications on that railroad whenever possible to do so. A quantity of repair parts for standard units are kept on hand where they are readily available. A table showing the standard and special units is given on page 19.

Installation Drawing—Fig. 3.—An installation drawing similar to that shown by Fig. 3 should be made to determine the required data represented by letters A, B, C, D, E, F, G, H, J, and K. All dimensions are to be determined with the car in the normal loaded straight ahead position. The assembly numbers of the various units required should be given on the drawing along with the size of the axle center, gear ratio and type of clutch. A print of this drawing should be sent to the Spicer Manufacturing, Division of Dana Corporation, for final checking and approval by their engineering department.

If it is not possible for the railroad to furnish such a drawing we shall be glad to have our engineering department make one. In order to do this it will be necessary to furnish prints of the following drawings to us:

- Axle
- Truck Frame
- Truck Assembly
- Brake Rigging Assembly on Truck
- Car Underframe Assembly
- Generator Assembly
- Wheel



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

SPECIFICATIONS

Fig. No.	NAME	ASSEMBLY NUMBER	
		STANDARD	SPECIAL
4	Gear Unit—Model 6..... (for 5½ x 10 and smaller axles).....		70000-1 (Ratio 2.54) 70000-2 (Ratio 3.09) 70000-3 (Ratio 3.44) 70000-4 (Ratio 3.76)
5	Gear Unit—Model 6-1..... (for 6 x 11 and smaller axles).....	70001-1 (Ratio 2.54) 70001-2 (Ratio 3.09) 70001-3 (Ratio 3.44)	70001-4 (Ratio 3.76)
6	Axle Mounting.....	72052-1X (5 x 9) 72052-2X (5½ x 10) 72052-3X (6 x 11)	All others special
7	Torque Arm.....	72041-1X 72041-2X	All others special
8	Torque Arm Mounting—Flex Type.....	72032-1X	
8	Torque Arm Mounting—Slide Type.....		72032-2X 72032-3X 72032-4X 72032-5X
9	Safety Arm.....		72042X All special
10	Propeller Shaft—Tubular.....	7983-1-SF	All other lengths special
11	Propeller Shaft—Solid.....		8024-1-SF
12	Propeller Shaft—Pullman Dynamotor.....		9439-1-SF
13	Safety Clutch.....	50010-1 50010-2	
14	Automatic Clutch.....	50009-1 50009-2	



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

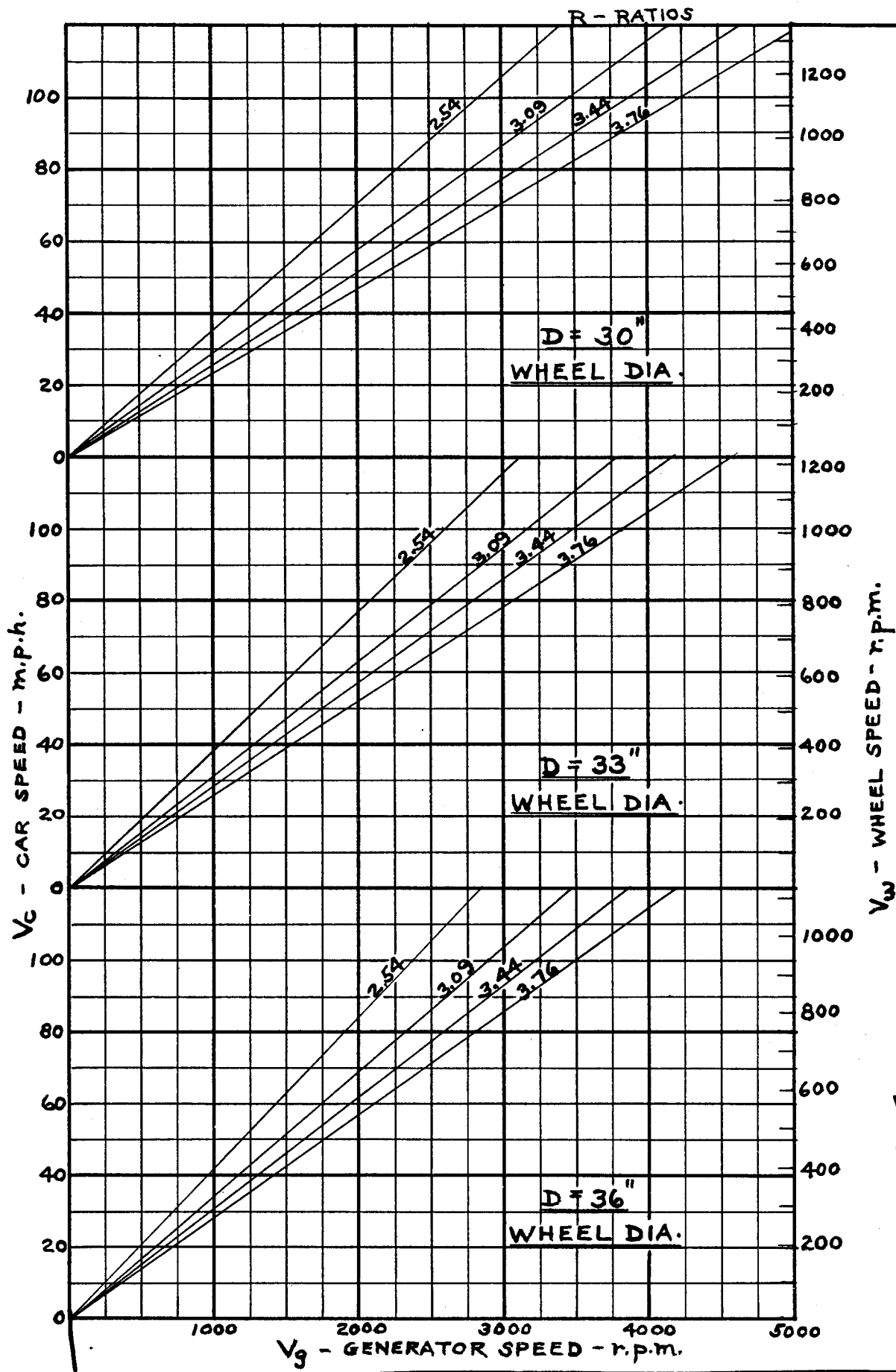


FIG. 15
CHART—CAR—WHEEL—GENERATOR—SPEED

Gear Unit—Fig. 4, 5.—Both the Model 6 and 6-1 gear units are interchangeable except when used in connection with the new A. A. R. 6 x 11 axle. *Caution*—The Model 6 (Fig. 4) cannot be used with this axle as a larger quill and bearings are required. The Model 6-1 (Fig. 5) may be used with the 6 x 11 and all smaller axles (See Axle Chart Fig. 16). Therefore, when any 6 x 11 axles are involved we suggest that the Model 6-1 gear units be specified for all drives in order that gear units may be interchangeable for all sizes of axles being used.

Either model can be furnished with four different ratios 2.54, 3.09, 3.44, and 3.76. To determine the ratio required refer to speed chart, Fig. 15. The gear unit is located at the center of the axle with the pinion in a horizontal position. When doing this note that the center line of the pinion is not on the center of the axle but is located $1\frac{1}{16}$ " toward one side, see Figs. 3, 4, 5.

Axle Mounting—Fig. 6.—Axle mountings are made in three standard sizes: 5 x 9, $5\frac{1}{2}$ x 10 and 6 x 11, as shown in Fig. 6 and will fit both the old and new A. A. R. standard axle centers to the dimensions and tolerances shown on Axle Chart, Fig. 16. The surface of the axle may be either turned, ground or polished finish. Note that the sizes mentioned refer to the center of the axle and have no relation to the wheel bearing size.

Special sizes of axle mountings can also be furnished to fit axles that are not in accordance with A. A. R. standards provided they are finished to specified tolerances, see Fig. 6, 16.

All sizes of axle mountings may be used with both the Model 6 and 6-1 gear unit.

Torque Arm—Fig. 7.—Torque arms are furnished in several different lengths and types of bends to suit the location of the truck end sill. The proper arm may be selected from the table given in Fig. 7. The correct height of the ball end,

dimension M, should be determined when the center line of the pinion on the gear unit is in a horizontal position, see Fig. 3.

Torque Arm Mounting — Fig. 8.—The standard flex type of torque arm mounting, 72032-1, may be attached either above or below the truck end sill. However, it is advisable to locate it as near the center line of the axle as possible which is usually below the sill, as this reduces the horizontal reaction on the rubber due to the vertical movement of the axle. Be sure it is located far enough from the propeller shaft to permit the full angular movement of the shaft, see Fig. 3. Due to the variation in end sills, no bolts are furnished for attaching the mounting, nor is the mounting drilled. This is drilled at the time of installation to suit each individual condition.

The special slide type of torque arm mountings, 72032-2, 72032-3, 72032-4, 72032-5 are designed to take all the horizontal movement by a sliding action and not through the flexing of the rubber. These may be attached either above or below the truck end sill, either location being satisfactory. Note that several of these are equipped with special safety arm brackets to take the reaction at the end of the arm.

Safety Arm—Fig. 9.—Safety arms are furnished only as special equipment when requested. Several types of ends and lengths can be furnished and may be selected from the table shown in Fig. 9. When locating the safety arm note that when the arm is in its normal position the end does not come in contact with the sill or bracket, but is located equal distance between to take the reaction for both directions of rotation. Also, be sure that there is no interference with the maximum angular movement of the propeller shaft.

Propeller Shaft—Fig. 10, 11, 12.—The standard propeller shaft, as shown by Fig. 10 is of tubular construction. Although it is preferable to



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

use the standard length A of 43 inches, special lengths can be furnished when required, as shown on the table in Fig. 10. However, for best operating results this length should not be less than 43 inches nor more than 55 inches. Note that the length A Fig. 3, 10, 11, 12 is the normal operating length of the shaft when the car is in a straight ahead position. The generator should be located so that the dimension A Fig. 3 between the clutch flange and the gear unit flange corresponds to the length A on the propeller shaft. Although the propeller shaft is shown in a horizontal position this may be located at a normal operating angle, not to exceed plus or minus 5° , if required. Be sure that there is no interference with the propeller shaft when operating at the maximum joint angle of 22° Fig. 3 on curves, such as safety straps,

torque arm mounting, truck end sill, etc. The normal vertical clearance between the end sill and the shaft should not be less than 2 inches.

A special propeller shaft of solid construction is shown by Fig. 11. This is used only on special installations where additional clearance is required. It is furnished only in one length of 43 inches. The special propeller shaft shown by Fig. 12 is used only for driving the Pullman Dynamotor.

Clutch—Fig. 13, 14.—Either the Safety Fig. 13 or Automatic Fig. 14 Clutch can be furnished. Both are interchangeable and fit the standard A. A. R. long taper on the generator shaft, and can be furnished with either the $1\frac{1}{8}''$ -7 Thds., or the $1\frac{1}{8}''$ -12 Thds. nut.



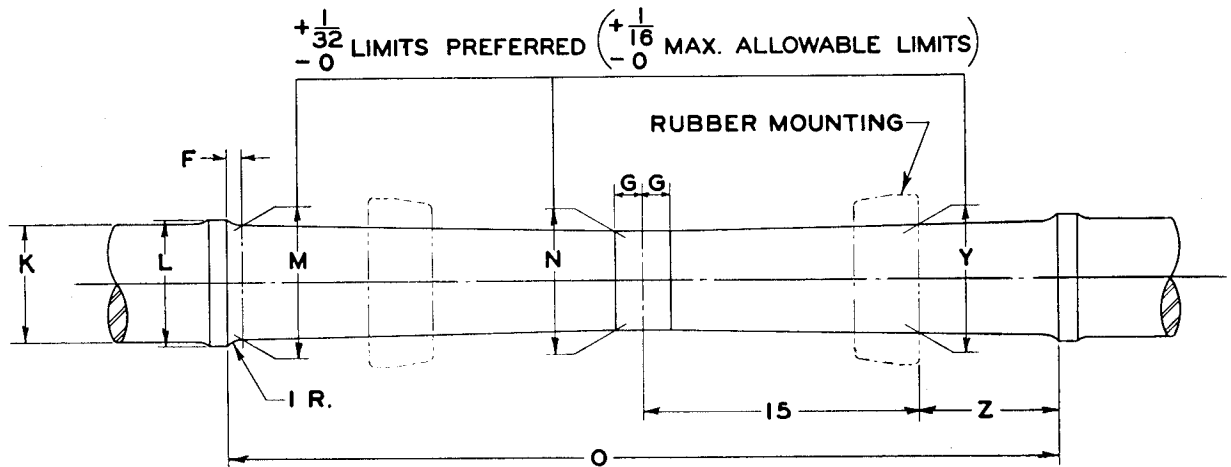
USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

AXLES

THAT MAY BE USED WITH MODEL 6 & 6-1 SPICER DRIVE

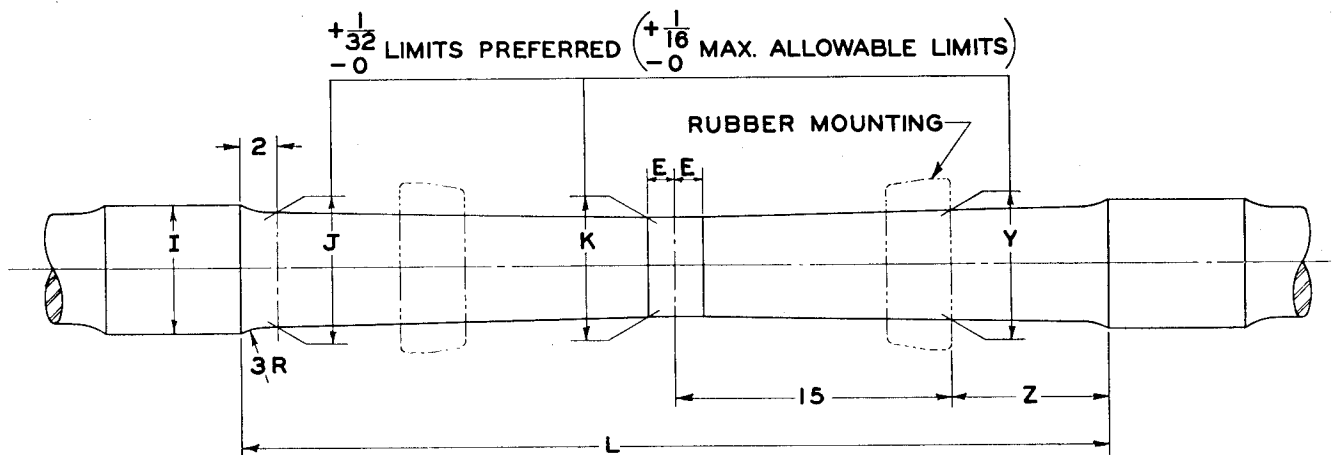
AXLE CENTER MAY BE TURNED, GROUND, OR POLISHED FINISH.

LIMITS MUST BE HELD AS SHOWN.



REFERENCE A.A.R. D-6-AUG.1, 1946

CLASS	NORMAL JOURNAL SIZE	CENTER DIMENSIONS							USE			DIMENSIONS AT	
		F	G	K	L	M	N	O	GEAR UNIT		AXLE MTG. ASSEMBLY	RUBBER MTG.	
									MODEL	ASSEMBLY		Y	Z
C	5 X 9	$\frac{23}{32}$	$1\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{7}{8}$	$6\frac{3}{16}$	$5\frac{3}{8}$	$3'-9\frac{1}{4}"$	6 6-1	70000 70001	72052-1	5.913	$7\frac{5}{8}$
D	$5\frac{1}{2}$ X 10	$\frac{23}{32}$	3	7	$7\frac{3}{8}$	$6\frac{3}{4}$	$5\frac{7}{8}$	$3'-9\frac{1}{4}"$	6 6-1	70000 70001	72052-2	6.430	$7\frac{5}{8}$
E	6 X 11	$\frac{3}{4}$	3	$7\frac{5}{8}$	$7\frac{3}{4}$ MAX.	$7\frac{3}{16}$	$6\frac{7}{16}$	$3'-5\frac{3}{4}"$	6 6-1	70000 70001	72052-3	6.963	$5\frac{7}{8}$
* E	6 X 11	$\frac{3}{4}$	3	$7\frac{5}{8}$	8	$7\frac{3}{16}$	$6\frac{7}{16}$	$3'-5\frac{3}{4}"$	6-1	70001	72052-3	6.963	$5\frac{7}{8}$



REFERENCE A.A.R. D-3-AUG. 1, 1946 & D-4A-AUG. 1, 1946

CLASS	NORMAL JOURNAL SIZE	CENTER DIMENSIONS					USE			DIMENSIONS AT	
		E	I	J	K	L	GEAR UNIT		AXLE MTG. ASSEMBLY	RUBBER MTG.	
							MODEL	ASSEMBLY		Y	Z
C	5 X 9	$1\frac{1}{2}$	7	$6\frac{3}{16}$	$5\frac{3}{8}$	$3'-11\frac{1}{4}"$	6 6-1	70000 70001	72052-1	5.920	$8\frac{5}{8}$
D	$5\frac{1}{2}$ X 10	3	$7\frac{9}{16}$	$6\frac{3}{4}$	$5\frac{7}{8}$	$3'-11\frac{1}{4}"$	6 6-1	70000 70001	72052-2	6.439	$8\frac{5}{8}$
* E	6 X 11	3	$8\frac{1}{4}$ MAX.	$7\frac{5}{16}$	$6\frac{7}{16}$	$3'-11\frac{1}{4}"$	6-1	70001	72052-3	7.001	$8\frac{5}{8}$

* THESE AXLES CAN BE USED ONLY WITH MODEL 6-1 GEAR UNIT
NOTE - ANY AXLE SHOWN CAN BE USED WITH THE MODEL 6-1 GEAR UNIT

FIG. 16 — CH-400 R. R. AXLE CHART

WEIGHTS

The actual and shipping weights of the various units are given below. The total weight of a complete drive may be obtained by adding the weights

of the various units required. Weights will vary plus or minus 2½ per cent due to variations in castings, forgings, ratios, etc.

		Weight—Lbs.	
		Actual	Shipping
70000	Gear Unit Assembly Model 6	465	585
70001	Gear Unit Assembly Model 6-1	465	585
72052-X	Axle Mounting Assembly (per drive)	150	172
72041-X	Torque Arm Assembly	22	35
72032-1X	Torque Arm Mounting Assem. (Flex Type)	8	13
72032-2X	Torque Arm Mounting Assem. (Slide Type)	43	55
72042-X	Safety Arm Assembly	12	25
7983-1SF	Propeller Shaft Assembly (Tubular)	60	78
8024-1SF	Propeller Shaft Assembly (Solid)	65	83
9439-1SF	Propeller Shaft Assembly (Pullman)	61	79
50010	Safety Clutch	63	77
50009	Automatic Clutch	86	100

SERVICE ENGINEERS

Spicer service engineers are available to assist in supervising the application of Spicer Drives, give whatever instructions are necessary and approve the installation.

All Spicer Drives are sold with the distinct understanding that a Spicer service engineer shall be present at the installation of the first drives to be applied by a new customer. Thereafter, a service engineer will respond to reasonable requests of the railroad company for assistance in connection with inspection, tests and maintenance of Spicer Drives provided the railroad company will furnish free transportation to the service engineer in so far as they may lawfully do so. Spicer agrees that such free transportation shall not be used in any way which shall constitute a violation of any Federal or State law or any transportation agreement. Requests for service engineers should be made as far in advance as possible in order to avoid any delay. We do not furnish regular outside inspection service.

WARRANTY

We agree to replace without charge F. O. B. our factory, or at our option to allow credit for any units of our manufacture which prove to be defective in material or workmanship within a period of 90 days from the date the material is placed in service. No claims for defective material shall be allowed until we have had a reasonable opportunity to examine the material. No credit will be allowed for material that has not been properly protected during storage periods.

PATENTS

Spicer Drives have been continually improved since their introduction. The basic design and improvements of the drive and the various units are covered by patents with other still pending, which enables us to offer the many exclusive features found only in Spicer equipment.

ORDERING

Orders and inquiries should be sent to Spicer



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

Manufacturing, Division of Dana Corporation,
Toledo 1, Ohio.

New Units—When ordering completely assembled new units give quantity, assembly number, name and specification of each unit.

Repair Parts—When ordering repair parts give quantity, part number and name of each part. Due to the cost of handling and packing orders should represent a minimum value of \$1.50.

Factory Repaired Units—Orders to cover the repairs of units returned to the factory should refer to the serial number and the name of the unit being returned. Such orders should be in our plant by the time the unit arrives to avoid any delay in putting the repairs through.

If any unit returned is so badly damaged that repairs would cost more than 80 per cent of the price of a new unit the customer will be so advised and recommended that this unit be scrapped and a new one ordered to replace it. No unit will be scrapped without authority from the customer. There is no refund for any material scrapped as the cost of disassembling and inspection is much greater than the scrap value of the parts.

Tools—Orders for maintenance tools should be sent directly to the source of that particular tool as noted in the section on tools, page 36.

Quotations will be gladly submitted upon request. All orders are handled only on the basis of F. O. B. our factory, Toledo, Ohio.

SERVICE

Although Spicer Drives require only a minimum amount of attention it is important that all items of service including installation, maintenance and repairs be correctly and promptly made if satisfactory performance and long life is to be

assured. These instructions, based on many years of experience and practice, have been carefully prepared as a guide to show what should be done and when and how it should be done to obtain the maximum reliable service from each Drive at the minimum cost.

INSTALLATION FIG. 3

● All major units of the Spicer Drive have been designed so that they may be completely assembled and all bearing and gear adjustments made, checked and running tests conducted before leaving the factory. No parts, that might affect the adjustment or performance of any unit, need be disassembled or readjusted when installing under a car. When applying the drive to the car follow the data given on the installation drawing for that particular application, similar to Fig. 3.

Installing the Gear Unit—Fig. 4, 5, 17.—Press one wheel on the axle. Insert the axle through the quill and press the other wheel on.

The Axle Mountings Fig. 6 are shipped separate from the gear unit. These are loosely assembled with the rubbers and compression rings in place and the two halves bolted together. The size of the corresponding axle center is stamped on the mounting, such as 5 x 9, 5½ x 10 or 6 x 11. The halves are mated and the same mating number stamped on each half. These should be kept mated at all times. The rubber halves have also been selected, mated and marked. Only halves marked with the same number should be used together. Miscellaneous loose parts, such as nuts, screws, cotters, washers, leather shims, etc., are shipped in a bag attached.

Disassemble the mounting parts Fig. 6. Fasten



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

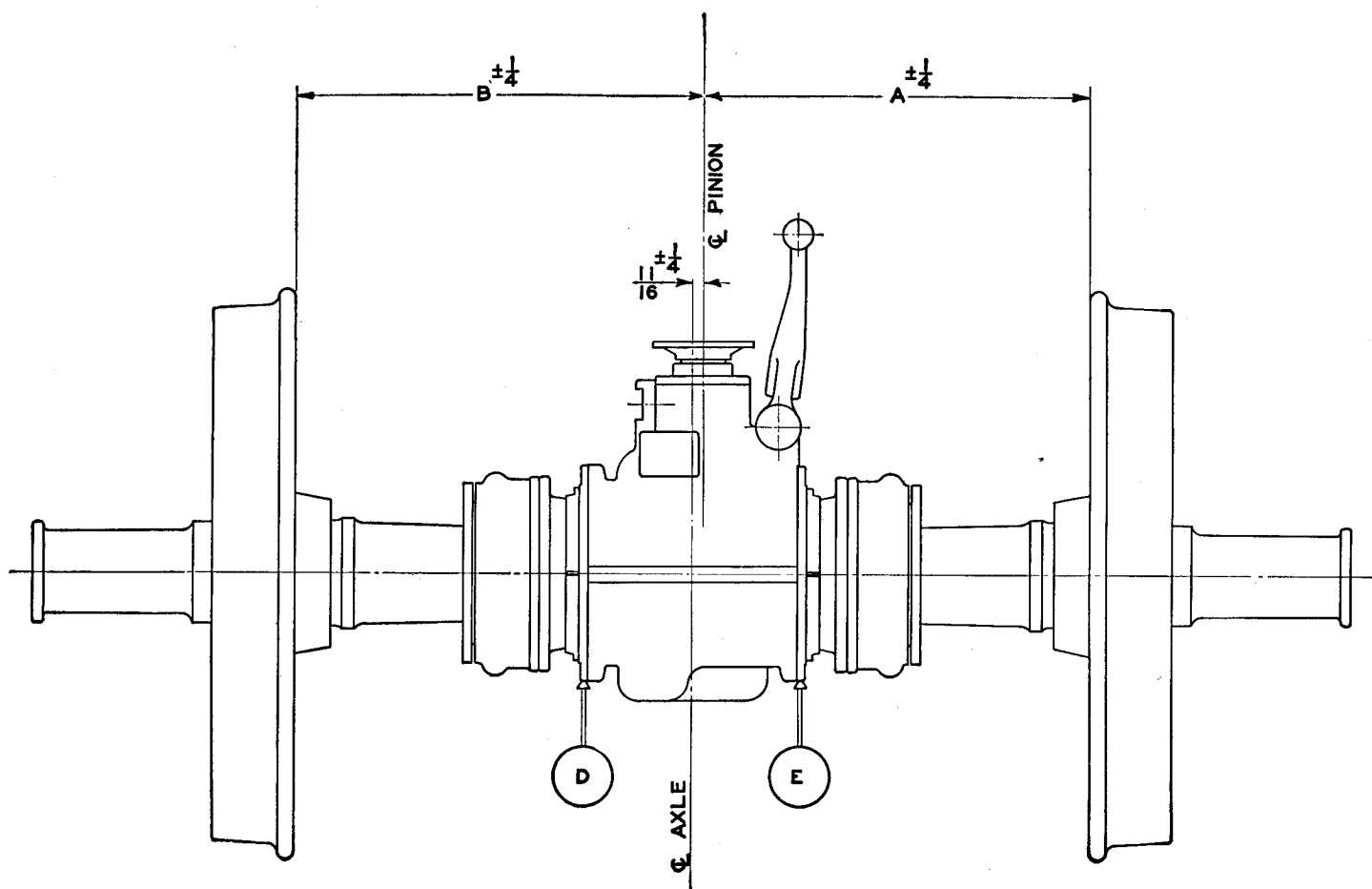


FIG. 17
LOCATION OF THE GEAR UNIT ON THE AXLE

the two halves of the clamp 15 to the quill flange loosely with bolts 4. Insert the clamp bolts 12 and pull tight. Then tighten the quill flange nuts 2. Before proceeding further assemble the other clamp to the opposite end of the quill in the same manner.

Insert the rubbers 5 in the clamps 15 at both ends. Center the gear unit on the axle in relation to the wheels Fig. 17. To do this note that the center of the pinion is located $1\frac{1}{16}$ inch off the center line of the axle. Therefore, in order to have the gear unit in the correct location on the axle, the distance "A" must be $1\frac{3}{8}$ inches shorter than the distance "B." This may vary plus (+) or minus

(—) $\frac{1}{4}$ inch provided both rubber mountings pull up satisfactorily. If the unit is too far off center the rubber mountings will not pull up evenly as one set will be high on the taper of the axle and the other low on the taper. Block the gear unit against both wheels so that it cannot be shifted off center when applying the remaining parts.

Force the rubbers into the clamps, keeping both halves of the rubber the same distance from the clamp. If there is any space at the ends of the rubbers between the two halves, this space should be filled with leather shims 7. Apply the compression rings 6 and the compression screws 8 and lock



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

straps 9, pulling the compression screws up evenly on each end. It is important that both sets be pulled up gradually at the same time. Do not tighten one end ahead of the other. This may best be controlled by using a torque wrench Fig. 33. Tighten each screw one half turn at a time, until an average of 60 ft. lbs. per screw is reached. At this point a check should be made to see if the small end of the rubber has bottomed, by using a thin narrow shim through the inspection hole Fig. 6. If the rubber does not bottom either the axle is oversize or the rubber is too thick and a correction should be made either by changing the axle or selecting a thinner set of rubbers. The rubbers are numbered according to thickness variations, the lowest numbers indicating the thinnest rubber. Do not use grease, oil, rubber cement or other lubricant on the rubber or axle. If the axle is to be painted the paint should be approved by our Engineering Department.

If these instructions are carefully followed the concentricity of the mounting will usually come within .020 total indicator reading (.010 off center), which has proven satisfactory for all general types of service. However, it is desirable to check the concentricity at this point and hold it at least within above limits.

To do this, mount the axle on centers or on the wheel bearings. Hold the gear unit stationary and place indicators against the quill bearing retainer at D and E Fig. 17. Rotate the axle, checking the total runout on the indicators. If the concentricity is not within the required limits, this may be controlled when tightening the screws, by pulling up more on some than others. Continue to tighten the compression screws until a wrench torque of 90 to 120 ft. lbs. has been reached.

If no torque wrench is available the torque load on the screws may be controlled by using a 12 or 14 inch wrench. This would correspond to the required torque of 90 to 120 ft. lbs., which is the

amount an average man can pull with this size wrench.

The clearance "C" Fig. 6 between the compression ring and the clamp should never be less than $\frac{1}{64}$ inch at any point. See that all screws, nuts, etc., are properly locked.

The axle may now be applied to the truck in the conventional manner.

Installing the Torque Arm—Fig. 7, 8. The torque arms are shipped loosely assembled to the gear unit. These should be left loose until the ball end has been correctly located on the truck end sill so as not to damage the rubber bushings.

With the Flex Type of Torque Arm Mounting Fig. 8-A the full load of the car should be on the truck before the mounting is secured to the end sill.

Remove one half of the rubber mounting 1 and put the ball end of the torque arm in position. Then replace the half rubber removed and locate the mounting on the end sill at the correct distance P Fig. 3 from the center of the car. Now drill the flange of mounting housing 2 and the end sill together and securely fasten with bolts. The bolts should be pulled down tight until the housing is flush with the sill to obtain the correct amount of pressure on the rubber.

Now tighten the nuts 3 at the gear unit end of the torque arm Fig. 7. These should be pulled down securely against the shoulders and the distance between the two washers 4 should measure $6\frac{7}{8}$ inches.

If rubber mountings are left loose rapid wear will occur.

With the Slide Type of Torque Arm Mounting Fig. 8 B, C, D, E, the mounting may be located and attached to end sill before the car load is put on the truck as the housing is permitted to slide

DELAWARE
and
HUDSON

USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

in the bracket. Otherwise follow the same instructions as given for the Flex Type.

Installing the Safety Arm—Fig. 9. When Safety Arms are furnished these are completely assembled to the gear unit and no further adjustment or mounting is necessary. The end of the safety arm is not attached to the end sill but should have at least $\frac{1}{4}$ inch clearance.

Installing the Clutch—Figs. 13, 14. When applying the clutch be sure the taper on the armature shaft, the hub bore and keyway are clean. Tap the key in place and slide the clutch into position, forcing home on the taper. Check to be sure that the key does not bottom in the keyway of the hub.

Screw the nut 7 on and pull up tight. The shaft may be prevented from turning when applying the Safety Clutch by using the special holding wrench Fig. 35. However, this wrench cannot be used with the Automatic Clutch as this clutch remains disengaged. When applying the Automatic Clutch force the clutch onto the taper by using the special pusher and holding tool Fig. 37. This pusher may also be used for the Safety Clutch in place of the holding wrench. After the clutch is securely forced on the taper, remove the pusher and apply nut 7 pulling up tight and locking in place with cotter pin 6.

Whenever any clutch is to be removed be sure to use the clutch puller Fig. 34. Otherwise the clutch or generator is likely to be damaged.

Installing the Propeller Shaft—Fig. 10, 11, 12. If the generator has been correctly located on the car body the distance "A" Fig. 3 from the clutch flange to the gear unit flange should correspond with the normal operating length "A" of the Propeller Shaft Fig. 10, 11, 12. This should be held within limits of plus (+) or minus (—) $\frac{1}{4}$

inch. If there is any question regarding the normal operating length of the propeller shaft, this may be checked by compressing the shaft solid and measuring the length over the flanges. This compressed length "L" plus (+) $1\frac{1}{2}$ inches is equal to the normal operating length "A."

Place the propeller shaft in position and fasten securely with bolts 21, nuts 20 and lock washers 19.

CAUTION

Before operating the drive be sure the correct lubricant has been added to the gear unit, the universal joints and the propeller shaft spline in accordance with instructions on

PAGE 30

Motoring the Generator. When using the Automatic Clutch the generator may be run as a motor without having to disconnect the clutch as the Automatic Clutch remains disengaged when operated from the generator end.

When using the Safety Clutch be sure the clutch is manually disengaged before motoring the generator, otherwise the safety feature is likely to function, making it necessary to replace the safety plugs. To disengage the 50010 Safety Clutch Fig. 13 drive in all three release wedges 29. After motoring the generator be sure that all release wedges have been driven back out so that the clutch will be fully engaged.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

MAINTENANCE

All units of the Spicer Drive have been designed to reduce wear and maintenance to a minimum. This has been made possible by using a small number of moving parts, carburized alloy steel gears and anti-friction bearings. The gears and bearings are running in a constant bath of light oil completely sealed and protected from dirt, water, snow and ice. However, there are minor items such as lubrication, oil seals, gaskets, rubber mountings, bolts, nuts and washers, that must be maintained in good condition if the major parts are to be protected and the full life of the Drive is to be realized.

The best type of maintenance is preventive maintenance. "An ounce of prevention is worth a pound of cure." Arranging a definite program of inspection and replacing the small parts necessary will prevent excessive wear or possible failure of major parts and assure satisfactory performance and long life of the Drive. Inspection should be made regularly but need not be frequent. Inspection points are few and are conveniently located. Minor repairs necessary may be quickly done either under the car, or in the shop.

The general maintenance schedule outlined below was developed to show WHAT should be done and WHEN it should be done to obtain the maximum reliable service from each Drive at the minimum cost. Although this schedule is based on mileage intervals, it may be arranged on a daily, weekly, monthly or trip basis, provided these correspond to the mileage given.

CAUTION: Propeller Shaft must be disconnected when dropping wheels or jacking up car.

GENERAL MAINTENANCE SCHEDULE

*Inspection Period
each*

Maintenance Service

10,000-15,000 Miles—Lubricate propeller shaft spline and universal joints.

Check oil level in the gear unit and add oil if level is below the "LOW" mark on the gauge.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

50,000-75,000 Miles—Drain all lubricant from the gear unit and refill to the correct level with new oil.
(or at each wheel turning)

100,000-150,000 Miles—Drain all lubricant from the gear unit, flush with light flushing oil and re-fill with new oil. Check oil leakage at pinion oil seal and replace seal, if required.

Repack clutch bearings with grease.

Remove and clean air vent or replace with new vent. Check wrench torque on axle mounting rubber compression screws and readjust if necessary. Replace any broken screws, nuts and washers with new.

General Inspection—After the drives have been in use for some time it is advisable to make a general inspection to locate any parts that may have become worn, loose or broken, such as rubber mountings, bolts, nuts, washers, oil seals, gaskets, bearings, etc. It is not possible to advise any definite period when this should be done as it has been found that when the drive has been correctly installed and maintained in accordance with instructions, they will operate satisfactorily without additional attention over very long periods. If parts are loose or worn they should be re-adjusted or replaced with new. In cases of excessive bearing wear the complete unit should be removed and returned for major repairs. (See Factory Repairs, Page 35.)

LUBRICATION

Correct lubrication is undoubtedly the most important item of maintenance in connection with Spicer Drives. If improper lubricants are used, or if the correct oil level or regular periods of inspection and relubrication are not maintained, premature failure of the drive will result. There are only six lubrication points on the complete drive and all are conveniently located for easy inspection and lubrication. The following instructions should be rigidly followed to assure satisfactory performance of the drives:

Gear Unit Lubrication—The hypoid gears used with Spicer Drives require a special E. P. (extreme pressure) type of lubricant. This is absolutely necessary as ordinary lubricants are not satisfactory for hypoid gears. A two gallon can of this lubricant is shipped with each new drive and is satisfactory for both summer and winter use. Additional lubricant may be obtained by separate order at any time or from any of the approved sources given in the table below. No new or repaired drives are shipped from the factory filled with lubricant. Therefore, BE SURE that the lubricant is added before the drive

is put in operation. To do this remove the filler plug, item 10, Fig. 4 and pour in the lubricant until it shows "FULL" on the level gauge, item 32. This will require seven quarts of lubricant. Do not attempt to overfill as this will result in leakage at the oil seals. If the lubricant is put in before the drive is installed under the car it is necessary to measure an even seven quarts or support the gear unit in a horizontal position to obtain the correct oil level.

The gears and all the bearings are lubricated by the splash or bath method of lubrication and therefore it is very important that the correct oil level be maintained at all times. Regular inspection of the oil level should be made each 10,000 - 15,000 miles. To do this, pull or pry out the stick type gauge, item 32, wipe off, put back in place, forcing down all the way. Remove again, checking the oil level on the gauge. If the oil level has dropped near or below the "LOW" mark additional oil should be added to bring the level up to the "FULL" mark. Do not run the drive with the level below the "LOW" mark. When replacing gauge be sure it is forced down all the way.

APPROVED SOURCES FOR HYPOID GEAR LUBRICANT

COMPANY	ADDRESS	TRADE NAME
C. F. Battenfeld Oil Co.....	Detroit, Mich.....	Battenfeld Hypoid Axle Lubricant SAE 90 & SAE 140
Black Bear Co.....	Long Island City, N. Y.....	S.C.L. All Purpose Lubricant
Calumet Refining Co.....	Chicago, Ill.....	Calumet No. 33 All Purpose Gear Lubricant
Cities Service Oil Co.....	New York, N. Y.....	Cisco Gear Oil
Elco Lubricant Corp.....	Cleveland, O.....	Elco Gear Safety "28"
Franklin Oil & Gas Co.....	Bedford, O.....	Franklin Universal Gear Lubricant
Gulf Oil Co.....	Pittsburgh, Pa.....	Gulf Hypoid Gear Lubricant All Purpose Type
Imperial Oil, Ltd.....	Toronto, Canada.....	Marvelube T-T Gear Oil
W. Floyd Jackson Co.....	Wilmington, Del.....	Elco Gear Safety "28"
Kendall Refining Co.....	Bradford, Pa.....	Kendall Hypoid Gear Lube SAE 90 & SAE 140
Orel H. Meyer Co.....	Fort Wayne, Ind.....	Elco Gear Safety "28"
Northwestern Oil Co.....	Superior, Wis.....	Elco Gear Safety "28"
The Pennzoil Co.....	Oil City Pa. and Los Angeles, Calif.....	Pennzoil Gear Lubricant Nos. SCL 612 & 614
Phelps-Roberts Corp.....	Washington, D. C.....	Elco Gear Safety "28"
Riley Bros., Inc.....	Burlington, Iowa.....	Riley Bros. 4-101 Gear Lube
E. P. Rotzell Co.....	Philadelphia, Pa.....	Elco Gear Safety "28"



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

COMPANY	ADDRESS	TRADE NAME
Shell Oil Co. of Canada, Ltd.	Toronto, Ontario, Canada	Shell Special Gear Lubricant Universal Type
L. Sonneborn Sons, Inc.	New York, N. Y.	Amalie Special Hypoid Gear Lubricant
Sta-Vis Oil Co.	St. Paul, Minn.	Sta-Vis D Gear Lubricant
Stevens Grease & Oil Co.	Cleveland, O.	Stevens 666 All Purpose Gear Lubricant
Sunland Refining Corp.	Fresno, Calif.	Frictioneze All Purpose Gear Lubricant
United Oil Co.	Baltimore, Md.	Duralene Hypoid Lubricant
Texas Co.	New York, N. Y.	Texaco HD-90

Extreme care should be taken to prevent dirt entering the open filler plug hole, and the gauge, filler plug and filler hose or can nozzle should be kept clean. If successive inspections indicate that a rapid loss of oil is occurring, an examination of the oil seals should be made and the seals replaced with new, if necessary.

At each 50,000-75,000 miles or for convenience at each wheel turning period when the axle has been removed from the car, the gear unit should be drained of all old oil and completely refilled with new. This not only removes the worn out lubricant but also any contamination, such as water, dirt, chips, etc. Do not be alarmed if the old oil drained out appears to be "muddy" or gray as this is caused by the extreme pressure additive used in the oil.

At each 100,000-150,000 miles the old oil should be completely drained and the unit flushed out with a light flushing oil before refilling with new. It is a good plan to rotate the gears and bearings at moderate speed to thoroughly flush them. It is therefore suggested that this flushing be performed when the axle is in the lathe for turning the wheels. It is advisable to first flush with kerosene or benzol and then with the flushing oil. In no case should kerosene or benzol be used without following with the flushing oil. This flushing oil should be of the straight petroleum type. No caustic or alkaline cleaning solutions should ever be used. Old oil from the gear unit cannot satisfactorily be reclaimed—USE NEW OIL ONLY.

Propeller Shaft Lubrication—Use only a good grade of straight mineral oil corresponding to SAE 140 specification and made by a reputable oil company. DO NOT USE GREASE as this will

clog the small oil passages, resulting in improper lubrication and possible failure.

All new and repaired shafts are shipped from the factory with only a protective coating of oil. Therefore, these **MUST BE** lubricated before the drive is put in operation. This should be done after the shaft is installed under the car at its proper operating length.

There are only three points to be lubricated, Fig. 10, 11, 12, one at the slip spline and one at each of the universal joints. Use the high pressure type of grease gun, Fig. 31, and be sure the connection is securely attached to the fitting. When lubricating the universal joints, pressure should be continued until the oil comes through the pressure relief valve at the center of the journal, and when lubricating the spline, continue until the oil comes through the vent at the end of the shaft.

All three points should be re-lubricated every 10,000-15,000 miles. This has a double purpose of adding fresh lubricant and forcing out the old oil and any dirt that may have collected.

If at any time the propeller shaft is compressed to measure the length, the spline should be re-lubricated after it is again installed under the car, as compressing the shaft forces the lubricant out of the vent.

Clutch Lubrication—The clutch bearings have been packed with the proper lubricant before leaving the factory. This is sufficient lubricant for the first 100,000-150,000 miles. Thereafter these bearings should be re-lubricated each 100,000-150,000 miles. To do this, first remove the clutch from the generator (Fig. 13, 14) with



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

the puller Fig. 34. Next remove retainer plates 5 and 25. Pack the bearings $\frac{1}{3}$ full with approved lubricant. Do not put in any more than this

amount, otherwise the bearings will run hot and the excess lubricant will get on the facings resulting in the failure of the clutch.

APPROVED SOURCES FOR CLUTCH BEARING LUBRICANT

COMPANY	ADDRESS	TRADE NAME
Fiske Brothers.....	Toledo, Ohio.....	630-A
Standard Oil of N. J.....	New York, N. Y.....	Andok "C"
Penola, Inc.....	Detroit, Mich.....	Andok "C"

Oil Leaks—No serious or chronic oil leaks have ever occurred in any of the hundreds of Spicer Drives that have been in operation over a period of years. If leakage does occur it is due to some definite reason and the cause should be located and corrected. There is usually a slight seepage of oil indicated by a wetting of the surface around the sealed points. This is only a natural condition and should not be misinterpreted as serious. Leakage that requires attention is indicated by an excessive amount of oil on the surface or thrown on to the car body or truck, or by a rapid consumption of the oil in the unit, requiring frequent refilling.

The usual causes of leakage at either the quill or pinion are the overfilling of the gear box with lubricant, or the vent plug may be dirty, which permits pressure to build up inside the housing. Very often changing to a different lubricant will cause leakage as some lubricants are much more adhesive than others. If leakage continues after checking and correcting these conditions, new oil seals should be installed. (See Repairs.)

Rubber Mountings—Rubber cannot be compressed but under pressure slowly flows or creeps, gradually reducing the pressure until it is lost entirely and the rubber becomes loose. All the rubber mountings used on Spicer Drives (the axle, torque arm and safety arm mountings) have been designed to closely confine the rubber, thereby reducing the creep and loss of pressure to a minimum. However, over long periods of operation some creep and loss of pressure does occur, there-

fore, the bolts or screws controlling the pressure on the rubber should occasionally be tightened. A convenient time to do this is when the axle is off the car for re-turning the wheels.

If no additional pressure on the rubber is possible (restricted by metal to metal contact) the rubber should be replaced with new. All mountings must have sufficient pressure between the rubber and the metal so that all movements and deflections are taken internally within the rubber and not by slipping between the metal and the rubber. Rubber also expands and contracts, due to temperature changes, much more rapidly than metal. Therefore, unless sufficient pressure is maintained, looseness is more likely to result during cold weather than warm. **ANY LOOSENESS WILL CAUSE VERY RAPID WEAR OF THE RUBBER AND PREMATURE FAILURE OF THE COMPRESSION SCREWS.**

Bolts—Nuts—Lockwashers—Bolts and nuts are securely locked either by cotter pins, lock washers or special locking means. However, the excessive vibration under the car may have a tendency to loosen these and therefore they should be tightened at each wheel turning.

Clutches—Fig. 13, 14—If the clutch fails to operate, it is likely that it has been overloaded and the safety plugs have released the clutch. To check this remove inspection plug 20 and note the clearance of the safety plate. If this has increased to $\frac{1}{16}$ " or more it would indicate that safety plugs have melted and should be replaced (See Repairs



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

page 35). Before reinstalling the clutch try to determine the cause of the overload on the generator and correct this, otherwise the safety feature will function again and release the clutch.

REPAIRS

To be of greatest service to the railroads a method of handling repairs has been adopted which has proven very satisfactory over the many years that the Spicer Drive has been in use. Repairs has been divided into two classes, railway repairs and factory repairs. Railway repairs are those that can readily be made under the car or in the railroad shops and involves such items as replacing oil seals, rubber mountings, etc. Factory repairs are major repairs that cannot be conveniently made in the railroad shops, but should be returned to the factory. These involve the complete rebuilding of the major units requiring close adjustment of gears and bearings and any repairs affecting the balance of clutches and propeller shafts. This arrangement of handling repairs has shown the following advantages and the reduction of maintenance for the railroads.

1. Assures continued long life and excellent performance of the drive.
2. Eliminates the necessity of a large investment for assembling and testing equipment by the railroads. The hypoid gears and bearings cannot be satisfactorily adjusted for long life and quietness without the use of extensive fixtures, gauges and testing equipment costing several thousand dollars, nor can the clutches and propeller shafts be properly balanced without the use of expensive dynamic balancing equipment.
3. It makes it unnecessary for the railroads to carry a large inventory of repair parts.
4. Repairs can be made promptly at the factory where the necessary parts, assembling and test-

ing equipment and experienced mechanics are available.

5. Latest improvements both in design and materials can usually be incorporated when the repairs are being made.
6. For convenience of maintenance, during the development and improvement of the Spicer Drive all completely assembled units have been kept interchangeable. However, it has not been possible to keep all the internal parts within these units interchangeable, which would make it difficult for the railroads to make this type of repairs.
7. With the long life of the drive, factory repairs are normally only required after long periods of operation.

RAILWAY REPAIRS

Repairs that can conveniently be made under the car or in the railroad shops are described in the following paragraphs. Repairs requiring parts not listed under Repair Parts, should be returned to the factory for repairs.

Caution: Before making any repairs, remove all dirt, grease, etc., from the unit.

GEAR UNIT REPAIRS FIG. 5

Pinion Oil Seal—Item 6—To replace the pinion oil seal, first remove cotter pin 1 nut 2 and washer 3. Next remove the flange 4 by using the flange puller Fig. 32. Never attempt to drive the flange on or off as this is likely to damage the gears or bearings. The oil seal 6 may now be pried out of the bearing cap. Put a new gasket 7 back of the seal and press in the new seal. Be sure that there is a press fit between the seal and the cap and that the sealing edge is facing inward toward the bearing. If the flange is badly worn this also should be replaced. Reassemble the parts, pushing the flange on with the flange pusher. Be sure

**NICKEL PLATE
ROAD**

USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

that the pinion nut 2 is pulled down tight (350 to 400 lbs. ft.) and securely locked.

Quill Oil Seal—Item 11—To replace the quill oil seal, first remove screws 13. Now remove the retainer 14 which is in two halves. This exposes the felt seal 11 which can easily be removed. Note that the felt is in two pieces, each piece completely around the quill with the ends fastened together by staples. When replacing the felt, first soak the felt in light oil and drain off the surplus. Wrap the inner felt completely around the quill, forcing in position, and trim to the length required. Fasten the ends together with the short staple 15, keeping the ends near the top side of the gear unit. Now force in the second felt, staggering the ends from that of the first, and fasten together with the long staple 16. Reassemble the retainer and screws.

Pinion Bearings—Items 37, 38—It is not necessary to remove the unit from the axle when removing or replacing the pinion bearings. Remove cotter pin 1, then loosen but do not remove pinion nut 2. Now loosen all quill bearing retainer screws 41 and remove only those on the pinion half of the housing. Next remove the bolts 45, 49 at the split of the housing. The pinion half of the housing may now be removed to the bench. Remove the pinion nut 2 and pull off flange 4 with puller Fig. 32. The pinion may now be driven out by using a rawhide or copper hammer, being careful not to damage the threaded end. Remove the loose parts, spacer and adjusting shim and press off the inner bearing 38. Next, remove the snap ring 39 and pull the outer race with special puller Fig. 38. Remove bearing cap screws 21 and cap 5. Check oil seal 6 and gaskets 7, 9 and if worn replace with new. The outer bearing 37 may now be inspected and if worn replace with new.

To rebuild the unit press the inner bearing 38 on the pinion. Press the outer race in the housing by using special pusher Fig. 38. Be sure outer

race is down against shoulder and put in snap ring 39. Place the loose parts, spacer and adjusting shim, over the pinion in the same relation in which they were removed. (The same spacer and adjusting shim should be used. If new parts are required, they should be the same overall length of those removed.) Now set the pinion on a block of wood and lift the housing over the pinion and drop in place. Press the outer bearing 37 in place then the slinger 20, gasket 9 and bearing cap 5. Press on flange 4 with special pusher Fig. 32 and replace washer 3, nut 2 and cotter. Reassemble the two halves of the housing together.

AXLE MOUNTING REPAIRS FIG. 6

Rubber Mounting—Item 5—When the clearance "C" between the ring and the clamp has been reduced below $\frac{1}{64}$ inch the rubber should be removed and replaced with new. To do this, first block up the gear unit to support the weight. Next disassemble the mounting by removing screws 8, lock strap 9, compression ring 6, clamp bolts 12 and flange bolts 4. The mounting will now come apart and the old rubber can be removed. Keep all parts mated and be sure both halves of the new rubbers are marked with the same mating number. Reassemble the same as described for new installations on pages 25, 26 and 27.

TORQUE ARM REPAIRS FIG. 7

Rubber Bushing—Item 5—To remove old bushings first remove cotter pin 2 nut 3 and washer 4. The rubber bushings 5 may now be lifted out and new bushings inserted. Pull bushings down into position with washers 4 and nuts 3. Do not tighten the nuts until the ball end of the torque arm is located in the final operating position. Then tighten until the distance between washers 4 is $6\frac{7}{8}$ ".



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

PROPELLER SHAFT REPAIRS FIG. 10, 11, 12

Propeller shafts operate at high speed and therefore balance is very important. For any repairs that might affect balance the shaft should be sent to the factory.

Before removing any parts from a propeller shaft be sure that they are marked so that they may be replaced in the *EXACT* relationship that existed before removal; otherwise, an out-of-balance condition is likely to occur.

Bearings and Journals—Items 4,-8.—When bearings appear to be worn it is advisable to replace both the bearings 4 and journal 8 to obtain the best results.

A kit which includes all items that should be replaced can be obtained. See Pages 12, 13 and 14.

To remove, bend down the locking lugs on strap 2 and remove screws 1 and bearing cap 3. The bearing 4 can now be removed by tapping lightly on the outside of the flange. The journal 8 can be removed by sliding to one side and tipping to clear the yoke. When assembling the new parts, dip the bearings in light oil before assembly. Be sure all screws are tightened and locked.

Oil and Dust Seals—Items 14, 15, 16, 17, 18—Parts for the oil and dust seals are split to provide an easy means of assembling around the shaft. To remove, pry loose locks and unscrew dust shield 51 and dust cap 52 then remove oil seals 14, 17. If the steel washers 15, 16, 18 are not damaged they need not be removed. Insert new felt and cork washer and screws on dust shield and dust cap locking in place. Both the felt and cork washer should be soaked in light oil before assembling. Be sure to lubricate the universal joints and spline in accordance with instructions on Page 31 before putting the shaft back in operation.

CLUTCH REPAIRS FIG. 13, 14

Clutches also operate at high speed and therefore balance is very important. For any repairs that might affect the balance the clutch should be sent to the factory.

Before removing any parts from a clutch be sure that they are marked and replaced in the exact relationship that existed before removal or the clutch will be out-of-balance.

Safety Plug—Item 1. Remove cap screws and pry off cover 50. Now the safety plates 53 may be lifted out exposing the fused safety plugs 1. Drive out old plugs and clean cover of any excess melted material. Drive in a new set of plugs with the special punch Fig. 36. Do not drive, tap, or press on the face of the plug as this will damage the special soft material. Reassemble keeping marked parts matched.

FACTORY REPAIRS

Units that should be returned to the factory for repairs include—

1. Gear units in which the gears, bearings or quills are worn or damaged. The maximum allowable end play (wear) of the bearings should not exceed .040 for quill bearings and .015 for pinion bearings.
2. Gear units that require a change in ratio of the gears.
3. Clutches and propeller shafts requiring repairs that will affect balance.
4. Maximum allowable wear on the universal joint bearings should not exceed a total backlash of .070 on a 10 inch radius. Maximum allowable wear on the propeller shaft slip spline should not exceed a total backlash of $\frac{1}{4}$ inch on a 10 inch radius.
5. As a general rule, any unit should be returned to the factory for repairs if the parts required are not shown in the list of Repair Parts.

All units returned for repairs are completely disassembled and all parts inspected and replaced with new where required, then reassembled and tested the same as new units. If any unit returned is so badly damaged that repairs would cost more than 80 per cent of the price of a new unit the customer will be so advised and recommended that this unit be scrapped and new one ordered to



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

replace it. No unit will be scrapped without authority from the customer. There is no refund for any material scrapped as the cost of disassembling and inspection is much greater than the scrap value of the parts.

SERIAL NUMBERS

Each major unit, gear unit, propeller shaft and clutch, is given an individual serial number, located as shown on Fig. 4, 5, 10, 11, 12, 13, 14. A complete record is kept of each and the full history of each unit is available at all times.

Units returned to the factory for repairs are given a new serial number and a cross reference made to the old so that a complete record of the repairs will also be available. A record of the new serial number is sent to the railroad when the repaired unit is returned.

TOOLS

For convenience in maintenance and repair work on Spicer Drives, several tools have been selected and some special tools provided that are particularly adaptable for this work. These are described in the following paragraphs and may be obtained from the sources given:

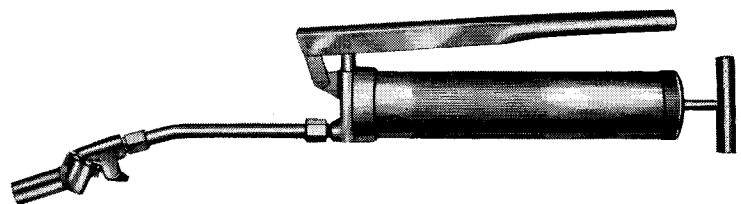


FIG. 31
OIL PRESSURE GUN (Propeller Shaft)



FIG. 30
OIL FILLER PUMP AND HOSE (Gear Unit)

Rio-Grande

USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

FIG. 30. OIL FILLER PUMP and HOSE is used to fill the gear unit with lubricant and may be obtained from any Alemite dealer under the Alemite part numbers as follows:

6536 Volume Oil Pump (less hose)

6623G 5½ Ft. Hose and Nozzle

The lubricant capacity is 35 pounds and is easily filled as the entire cover swings to one side. A patented pressure release automatically relieves pressure in the hose, eliminating all dripping.

FIG. 31. OIL PRESSURE GUN is used to lubricate the universal joints and spline on the propeller shaft. It may be obtained from any Alemite

dealer under Alemite part numbers as follows:

6577E Gun

G-51340 Check Valve

6509B Universal Adapter

49136 Pipe

This is a high pressure gun and has a capacity of 17 ounces. To fill gun, raise lever handle, pull back "T" handle and twist to lock in place. Then unscrew body at the head and fill body with the lubricant. Screw head back on and push in "T" handle. To use the gun, press the universal adapter (this can be adjusted to suit) over the fitting and apply pressure with the lever handle.

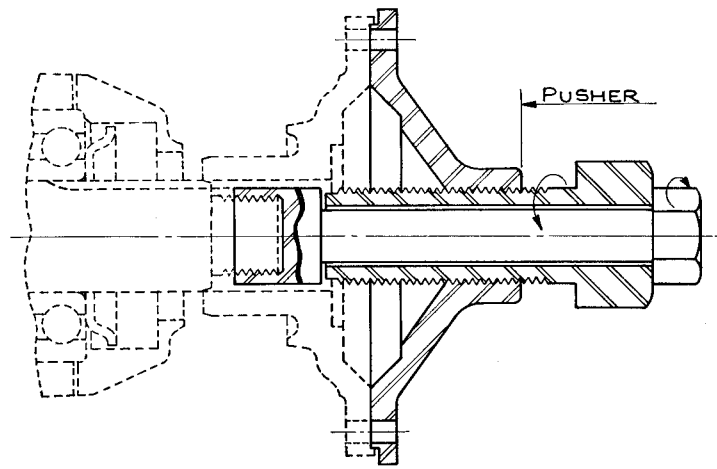
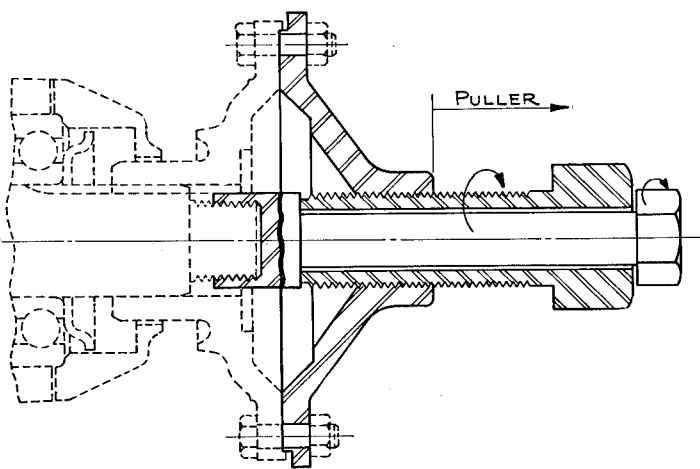


FIG. 32

72054X COMPANION FLANGE PULLER AND PUSHER

FIG. 32. 72054X COMPANION FLANGE PULLER and PUSHER is used to remove and replace the companion flange on the gear unit (Item 4, Fig. 4, 5). It is a special tool and may be purchased from Spicer Manufacturing and should always be used to remove or replace the companion flange. Never attempt to drive the flange on or off as this is likely to damage the gears or bearings. To use as a puller, first remove the pinion cotter, nut and washer (Items 1, 2, 3, Fig.

4, 5) then screw the inner nut of the puller on to the threaded end of the pinion as far as it will go. Turn the puller flange until it mates with the holes in the companion flange and fasten the two together with bolts (Fig. 32). Now turn the large screw clockwise. When replacing the flange, first align the splines with those on the pinion then turn the large screw counter-clockwise forcing the flange on to the pinion. Apply washer and nut, pull down tight and lock with cotter.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

FIG. 33. TORQUE WRENCH AND SOCKET is used to control the torque on the axle mounting rubber compression screws (Item 8, Fig. 6). This may be obtained from the Snap-On Tool Corporation, Kenosha, Wisconsin under their part numbers as follows:

TQ-150 Torqometer 150 ft. lbs. capacity

SW-360 $\frac{1}{2}$ Socket (1 $\frac{1}{8}$ " across flats)

SW-1500 Set of Sockets

Use as an ordinary wrench reading the torque directly in ft. lbs. on the dial.

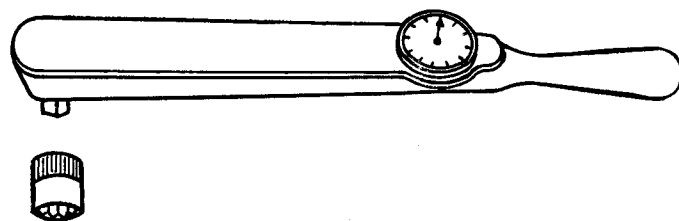


FIG. 33
TORQUE WRENCH AND SOCKET

FIG. 34. 55223X CLUTCH PULLER is used to remove the clutch from the generator shaft. This is a special tool and may be purchased from Spicer Manufacturing. It can be used for any type or model of Spicer automatic or safety clutches. It should be used whenever a clutch has to be removed, as driving the clutch off is likely to damage both the clutch and generator. To use the puller first remove the clutch cotter and nut (Items 6, 7, Figs. 13, 14). Back off the puller screw and screw the puller into the internal thread of the clutch hub as far as it will go. Now turn the screw clockwise and continue until the clutch is free.

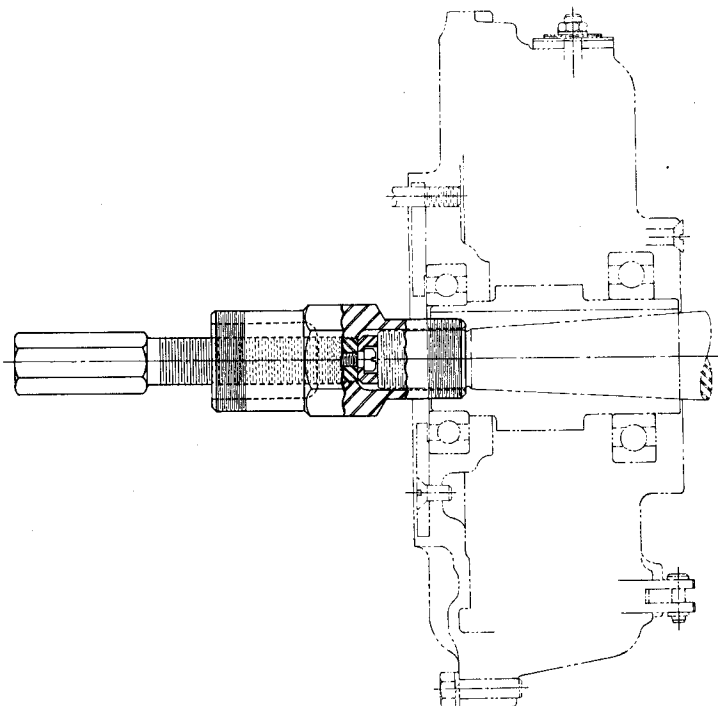


FIG. 34
55223X CLUTCH PULLER



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

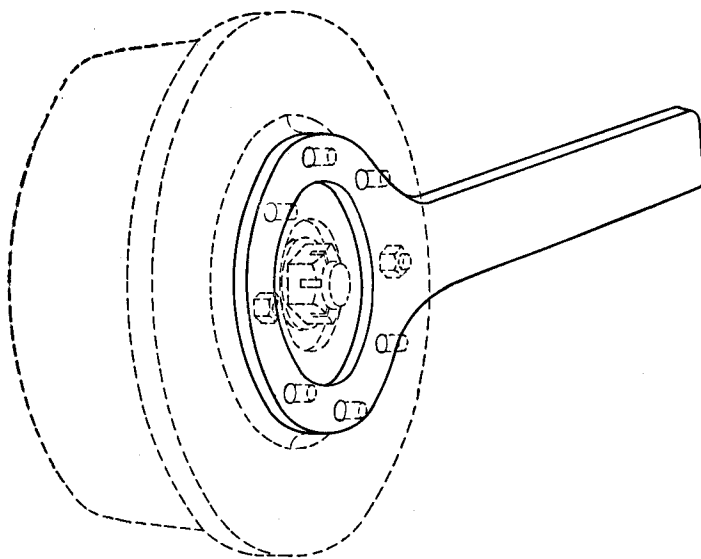


FIG. 35
55186 SAFETY CLUTCH HOLDING WRENCH

FIG. 35. 55186 SAFETY CLUTCH HOLDING WRENCH is used to prevent the safety clutch and armature from turning when the armature nut is applied or removed. This is a special tool and may be obtained from Spicer Manufacturing. It can be used for any model of Spicer safety clutches but cannot be used for the automatic clutch, as this clutch is disengaged when not in operation. To use the wrench, place over the flange studs and hold in place with two or three nuts to prevent damaging the studs.

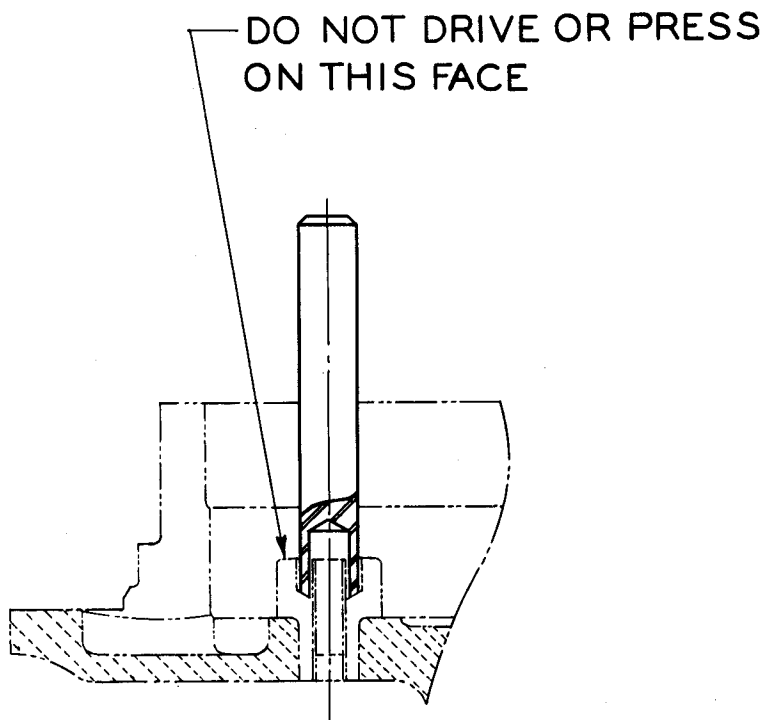


FIG. 36
55241 CLUTCH SAFETY PLUG DRIVE PUNCH

FIG. 36. 55241 CLUTCH SAFETY PLUG DRIVE PUNCH is used to drive the safety plugs in place in order to avoid damaging the soft plug. To use the punch, place the safety plug in position, locate the punch at the center of the plug and tap lightly with a hammer until the plug is seated. Do not drive, tap or press on the face of the plug as this will damage the special soft material.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

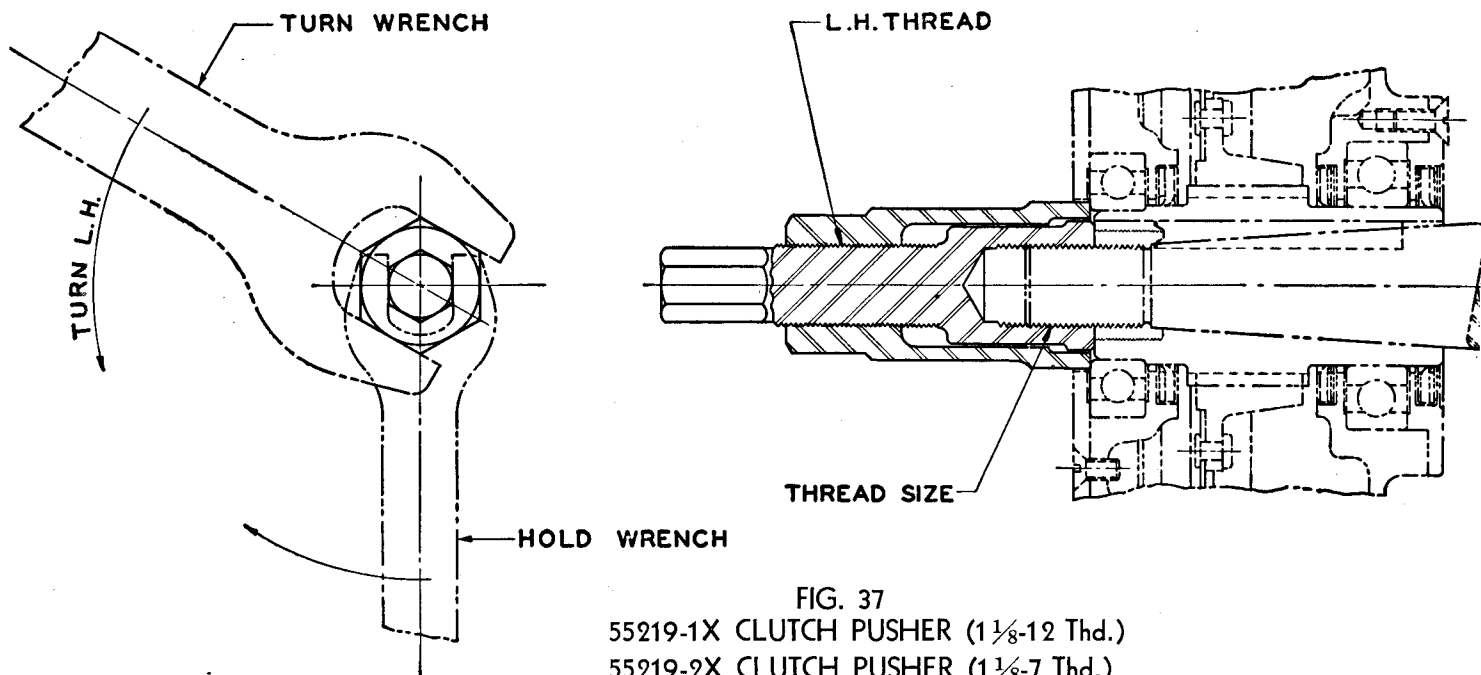


FIG. 37. 55219X CLUTCH PUSHER is a combination tool to hold the armature shaft and push the clutch securely on the taper. It may be obtained from Spicer Manufacturing and can be used for both the safety and automatic clutches, but not the 50003 Safety Clutch. It is particularly adapted for the automatic clutches as these cannot be held by other means. The pusher can

be furnished for either the 1 1/8 - 12 Thd. or the 1 1/8 - 7 Thd. on the armature shaft. To use the pusher, first push the clutch on the taper then screw the small nut on to the threaded end of the shaft as far as it will go. Hold this nut from turning and turn the large nut in a counter-clock-wise direction (Left Hand) forcing the clutch securely on the taper. Now remove the pusher and apply the regular nut and cotter.

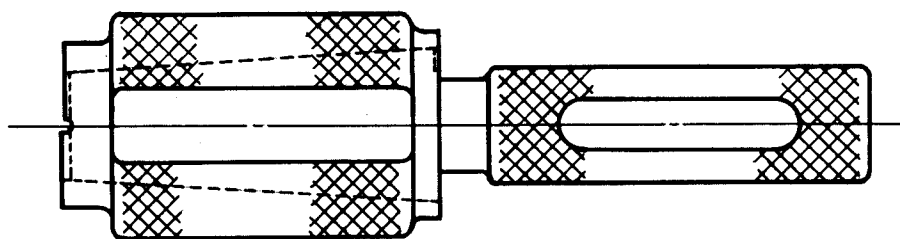


FIG. 39
55231X CLUTCH TAPER PLUG AND RING GAUGE ASSEMBLY

FIG. 39. 55231X CLUTCH TAPER PLUG AND RING GAUGE ASSEMBLY used to check

armature shaft taper and clutch hub bore taper. Parts should have 85% contact with gauges.



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

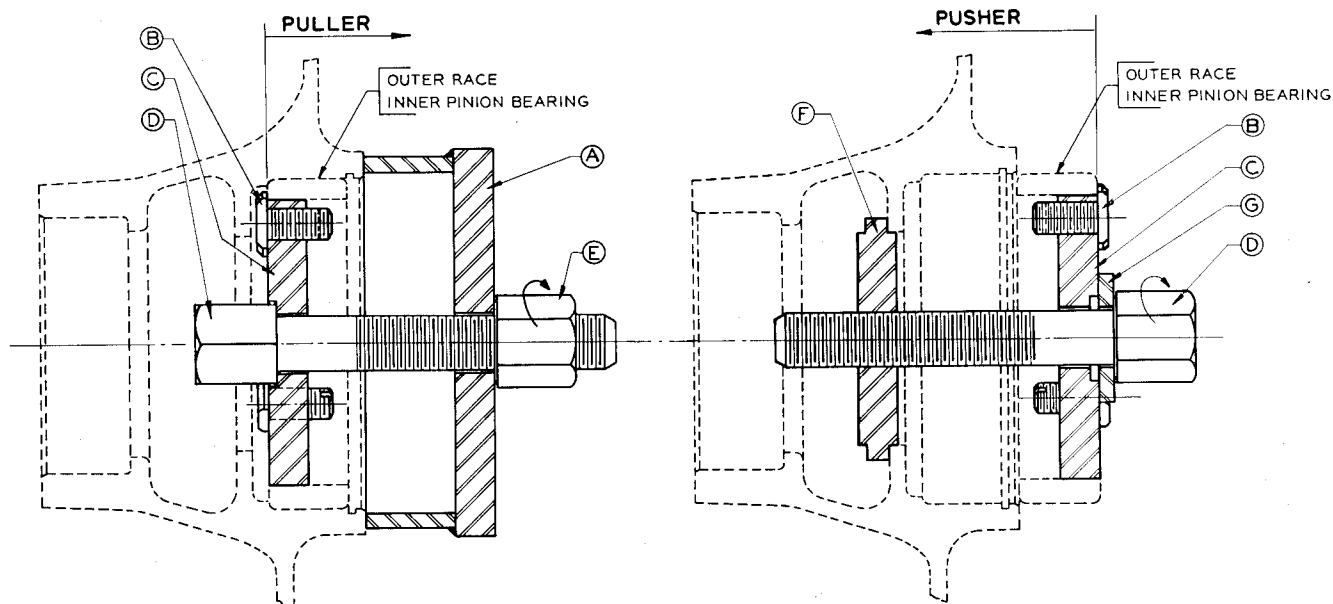


FIG. 38
72056X PINION INNER BEARING OUTER RACE PULLER AND PUSHER

FIG. 38. 72056X PINION INNER BEARING OUTER RACE PULLER AND PUSHER is used to remove and replace the outer race of the inner pinion bearing on the gear unit (Item 38, Fig. 4, 5). It is a special tool and may be purchased from Spicer Manufacturing. To use as a puller for removing the outer race, turn the three T head screws B so that they clear the bore of the race and insert plate C into position shown. Now turn the T head screws B with a screw driver so that the tangs on all three screws are squarely in the recess back of the race. Insert screw D, plate A and nut E, turning nut E clockwise forcing the race out of the housing.

To use as a pusher for replacing the race, first start the race into the housing by lightly tapping with a rawhide or copper hammer. Now insert plate C with the tangs against the outer edge of the race and put plate F inside as shown, then insert screw D through hardened washer G and screw into plate F. Turn screw D clockwise forcing the race into the housing until it is firmly seated against the shoulder.

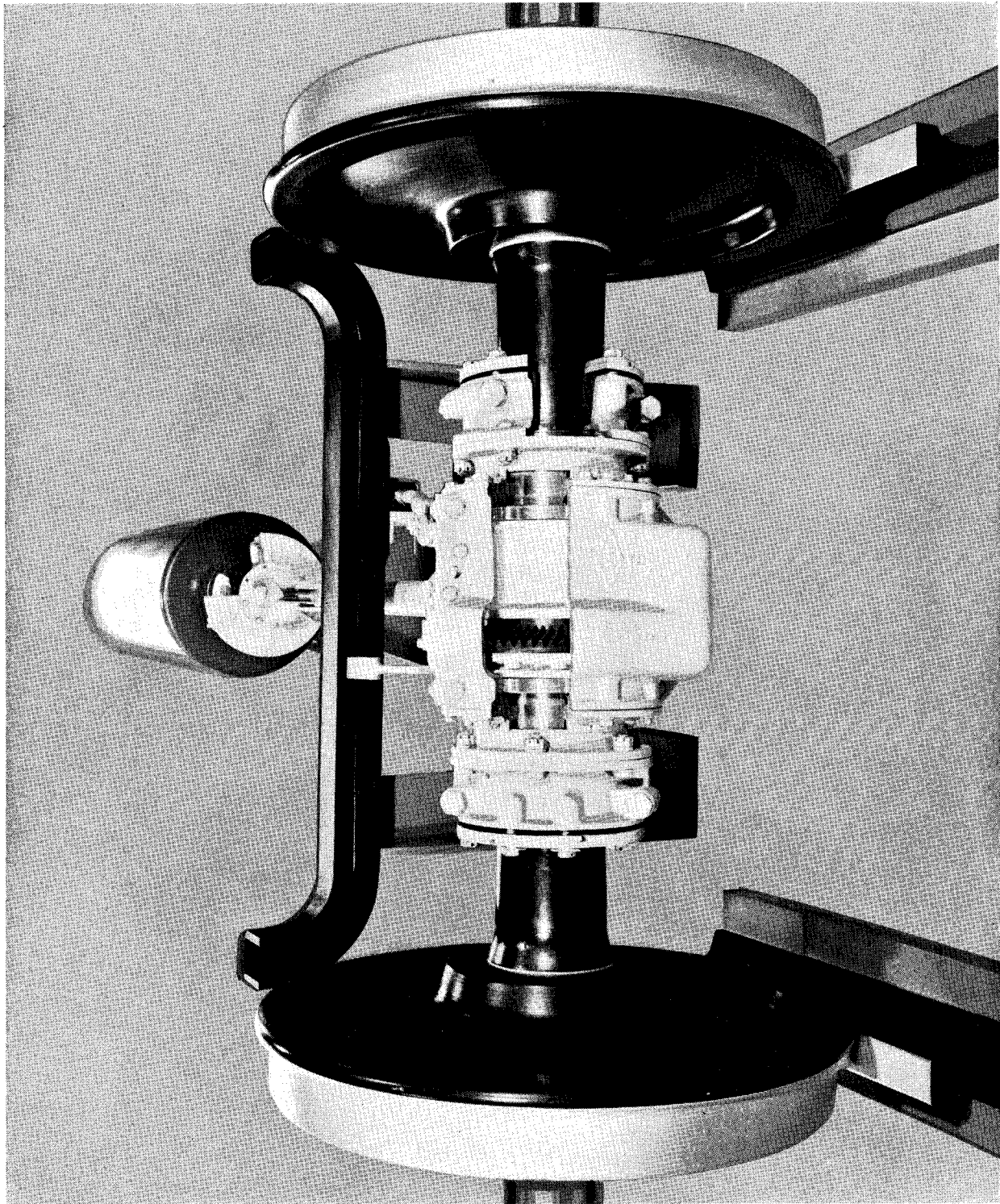
NOTE—All tools are furnished only as completely assembled tools. No separate parts for tools are available.

REPAIR PARTS

Item No.	Part	Part No.	No. Req'd. Per Tool
B	Puller Cam Screw	S-1604	3



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE



EXHIBITION DRIVE WITH CUTAWAY SECTIONS

222-11-12



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE

OTHER

Spicer

PRODUCTS

UNIVERSAL JOINTS

* * *

PROPELLER SHAFTS

* * *

TRANSMISSIONS

* * *

POWER TAKE-OFFS

* * *

HYDRAULIC TORQUE CONVERTERS

* * *

AUTOMOTIVE FRONT AND REAR AXLES

* * *

AUTOMOTIVE FRAMES

* * *

CLUTCHES



USES THE SPICER POSITIVE RAILWAY GENERATOR DRIVE