INTERRUPTERS

RECIPROCATING BAR TYPE

PIECE-PART DATA AND REPLACEMENT PROCEDURES

1. GENERAL

1.01 This section covers the information necessary for ordering parts to be used in the maintenance of reciprocating-bar-type interrupters (149, 152, 160, 161, 164, 165, 166, and 167 types). It also covers approved procedures for replacing these parts.

1.02 This section is reissued to revise the piece-part data covering the 149- and 152-type interrupters, to add piece-part data for the D-179974 interrupter, and to revise the List of Tools and Materials. Detailed reasons for reissue will be found at the end of the section.

1.03 Part 2 of this section covers the piece-part numbers and the corresponding names of the parts which it is practicable to replace in the field in the maintenance of these interrupters. No attempt should be made to replace parts not designated. Part 2 also contains explanatory figures showing the different parts. This information is called Piece-Part Data.

1.04 Part 3 of this section covers the approved procedures for the replacement of the parts covered under Part 2. This information is called Replacement Procedures.

1.05 Procedures for the replacement of the cam-shaft bushings are covered in Section 163-651-811.

2. PIECE-PART DATA

2.01 The figures included in this part show the various piece parts in their proper relation to other parts of the apparatus. The piece-part numbers of the various parts are given together with the names of the parts as listed by the Western Electric Company Merchandise Department.

2.02 When ordering parts for replacement purposes, give both the piece-part number and the name of the part. For example, P-160491 Spring Assembly. Do not refer to the section number or to any information shown in parentheses following the piece-part numbers.

2.03 Where the names of the piece parts shown on manufacturing drawings differ from those in general use in the field, the latter names, in general, are shown in parentheses.

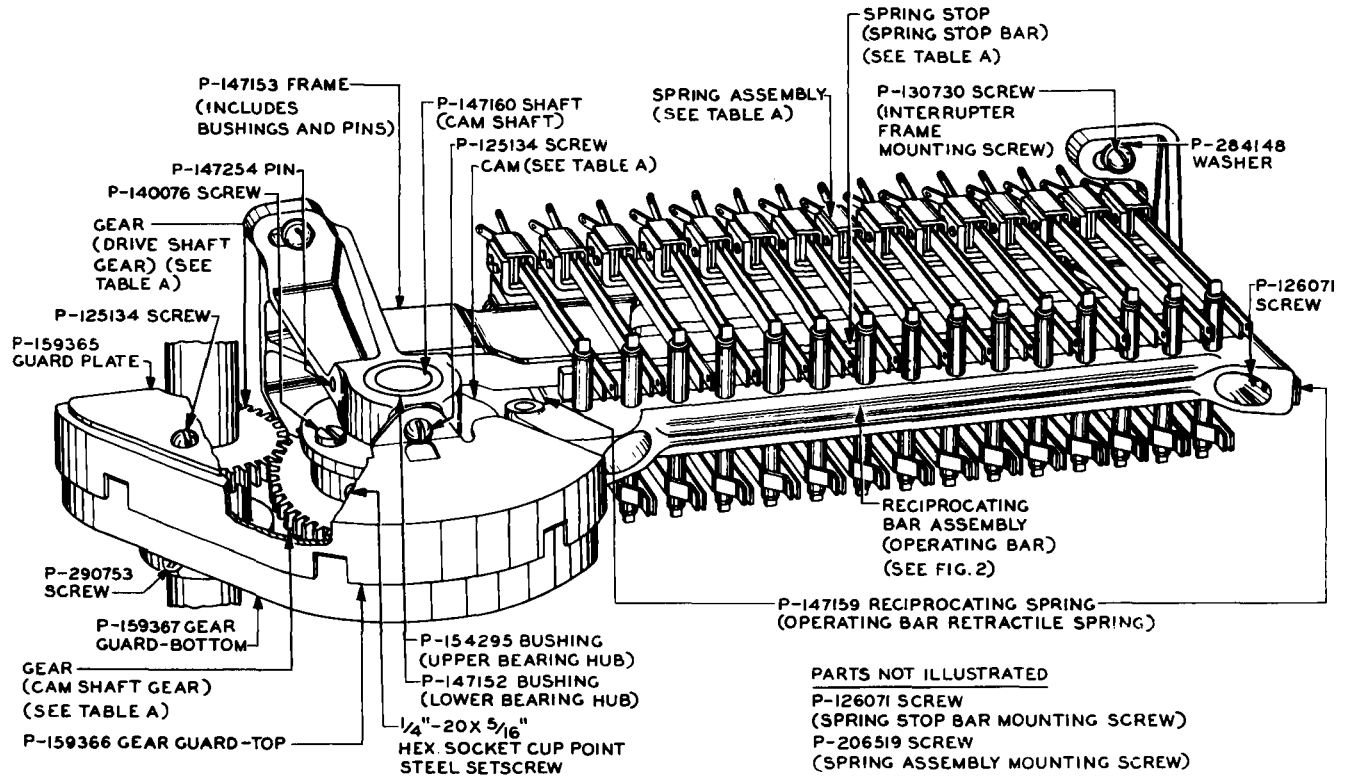
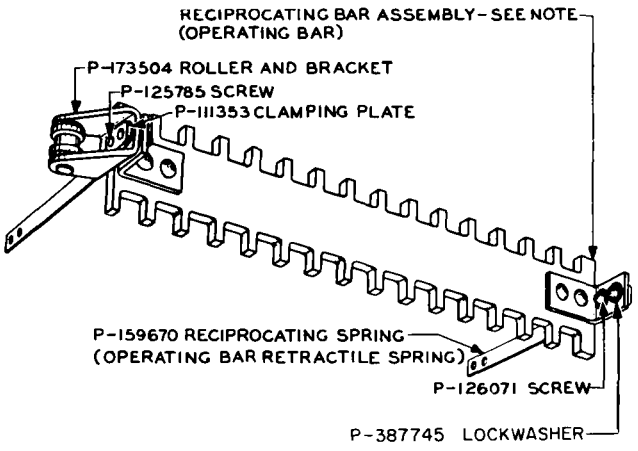


Fig. 1 – 149-Type Interrupter



Note: When necessary to replace the reciprocating-bar assembly on a 149- or 152-type interrupter equipped with a metallic reciprocating bar as shown in Fig. 1 or 3, order the D-85832 reciprocating bar assembly. This assembly includes all the parts illustrated in Fig. 2. Parts other than the reciprocating bar required for replacement purposes on interrupters equipped with the D-85832 reciprocating bar assembly shall be ordered in accordance with this figure. If necessary to replace the reciprocating bar on these interrupters, order the complete D-85832 reciprocating bar assembly.

Fig. 2 – D-85832 Reciprocating Bar Assembly (operating bar)

TABLE A — VARIABLE PARTS FOR 149-TYPE INTERRUPTERS (see note 2)

CODE NO.	CAM	SPRING STOP (spring stop bar)	GEAR (drive-shaft gear) SEE NOTE 1	GEAR (cam-shaft gear) SEE NOTE 1	SPRING ASSEMBLY
149A	P-147171	P-147161	P-147168	P-147166	—
149B	P-147172	P-147161	P-147168	P-147166	P-160489
149C	P-154140	P-147162	P-154583	P-154582	P-160489
149D	P-154141	P-147161	P-147168	P-147166	—
149E	P-147171	P-147161	P-147168	P-147166	—
149F	P-147171	P-147161	P-147168	P-147166	—
149G	P-147172	P-147161	P-154553	P-147166	—
149H	P-147172	P-147161	P-154553	P-147166	P-160489
149J	P-154615	P-147162	P-154617	P-154616	P-160498
149K	P-154581	P-147162	P-154580	P-154579	P-160489
149L	P-147173	P-147162	P-147169	P-147167	P-160489
149M	P-154141	P-147161	P-147168	P-147166	P-160489
149N	P-154141	P-147161	P-147168	P-147166	—
149P	P-154623	P-147161	P-147169	P-147167	—
149R	P-147171	P-147161	P-147168	P-147166	—
149S	P-147172	P-147161	P-154553	P-147166	P-160489
149T	P-154141	P-147161	P-147168	P-147166	P-160489
149U	P-147172	P-147161	P-147168	P-147166	P-147203
149W	P-154581	P-147162	P-154580	P-154579	P-160489
149Y	P-147172	P-147161	P-154553	P-147166	—
D-22729	P-147172	P-147161	—	P-147166	P-147202
D-22730	—	P-147161	—	P-147166	P-147203
D-22731	P-147171	P-147161	—	P-147166	P-147203
D-22736	—	—	—	—	P-147203
D-22737	—	—	—	—	P-147202
D-22738	—	P-147162	—	P-147166	P-147202
D-22748	P-147173	P-147162	—	—	P-147202
D-44330	P-154581	P-147161	P-154580	P-154579	P-160489
D-46483	P-154141	P-147161	P-147168	P-147166	—
D-76932	P-154779	P-147161	P-147168	P-147166	P-147203
D-76933	P-154749	—	ESA-273314-1	—	P-147203
D-76934	P-154753	—	ESA-273314-1	—	P-147202
D-76935	P-154788	P-147162	P-147168	P-147166	P-147202
D-77029	P-154140	P-147162	P-154617	P-154616	P-160489
D-85502	P-147171	P-147161	P-147168	P-147166	—

Note

1. On 149-type interrupters, it is not necessary to replace gears in pairs.
2. Piece parts which are not listed in Table A are no longer available from the Western Electric Company. If an interrupter cannot be repaired with parts on hand and the piece parts required are no longer available from the Western Electric Company, replace the interrupter with the equivalent 160-type interrupter.

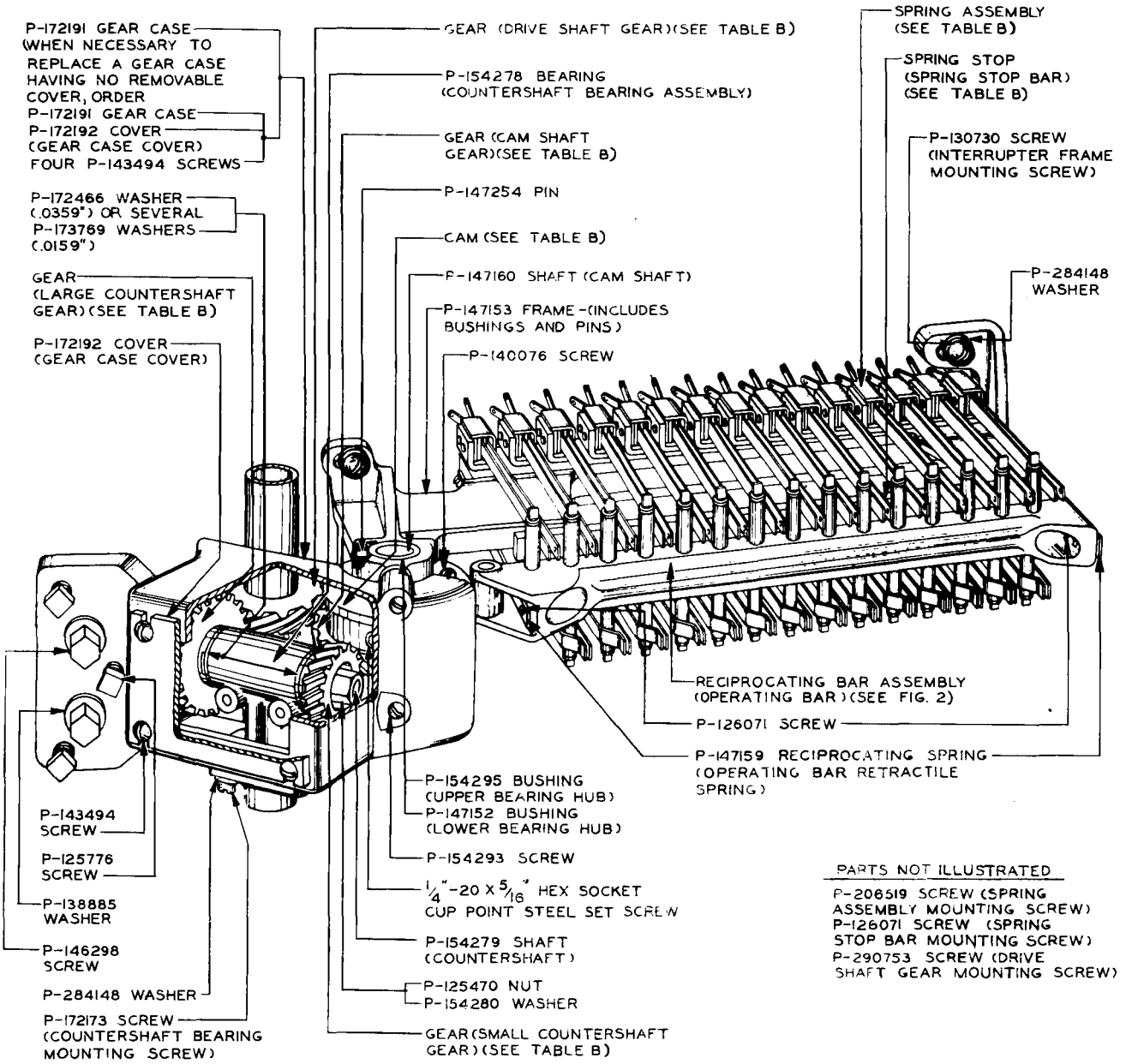


Fig. 3 – 152-Type Interrupter

TABLE B – VARIABLE PARTS FOR 152-TYPE INTERRUPTERS (see note 3)

CODE NO.	CAM	SPRING STOP (spring stop bar)	GEAR (drive-shaft gear) SEE NOTE 1	GEAR (large counter-shaft gear) SEE NOTE 1	GEAR (cam-shaft gear) SEE NOTE 1	GEAR (small counter-shaft gear) SEE NOTE 1	SPRING ASSEMBLY	GEAR AND BEARING ASSEMBLY SEE NOTE 2
152A	P-154273	P-154294	P-173918	P-173914	P-173912	P-173913	—	P-290411
152B	P-154272	P-147161	P-173742	P-173758	P-173749	P-173755	—	P-290410
152C	P-154272	P-147161	P-173742	P-173758	P-173749	P-173755	—	P-290410
152D	P-154765	P-147162	P-173918	P-173914	P-173912	P-173913	P-160489	P-290411
152E	P-159208	P-147161	P-173742	P-173758	P-173749	P-173755	—	P-290410
152F	P-159241	P-147162	P-173742	P-173758	P-173749	P-173755	P-160489	P-290410
152G	P-154765	P-147162	P-173918	P-173914	P-173912	P-173913	P-160489	P-290411
152H	P-154765	P-147162	P-173918	P-173914	P-173912	P-173913	P-160489	P-290411
152J	P-154272	P-147161	P-173742	P-173758	P-173749	P-173755	—	P-290410
D-77028	P-154765	P-147162	P-173918	P-173914	P-173912	P-173913	P-160489	P-290411

Notes

1. When a gear requires replacement, the piece-part number of which is not listed in the above table, order both gears of the meshing pair as listed in this table; also order two P-290753 screws for mounting the drive-shaft gear.
2. This assembly consists of the large and small countershaft gears, countershaft, bearing assembly, and associated nuts, washers, etc, but does not include the assembly mounting screws (P-172173 screw) which should be ordered separately if required.
3. Piece parts which are not listed in Table B are no longer available from the Western Electric Company. If an interrupter cannot be repaired with parts on hand and the piece parts required are no longer available from the Western Electric Company, replace the interrupter with the equivalent 161-type interrupter.

TABLE C — VARIABLE PARTS FOR 160- AND 164-TYPE INTERRUPTERS

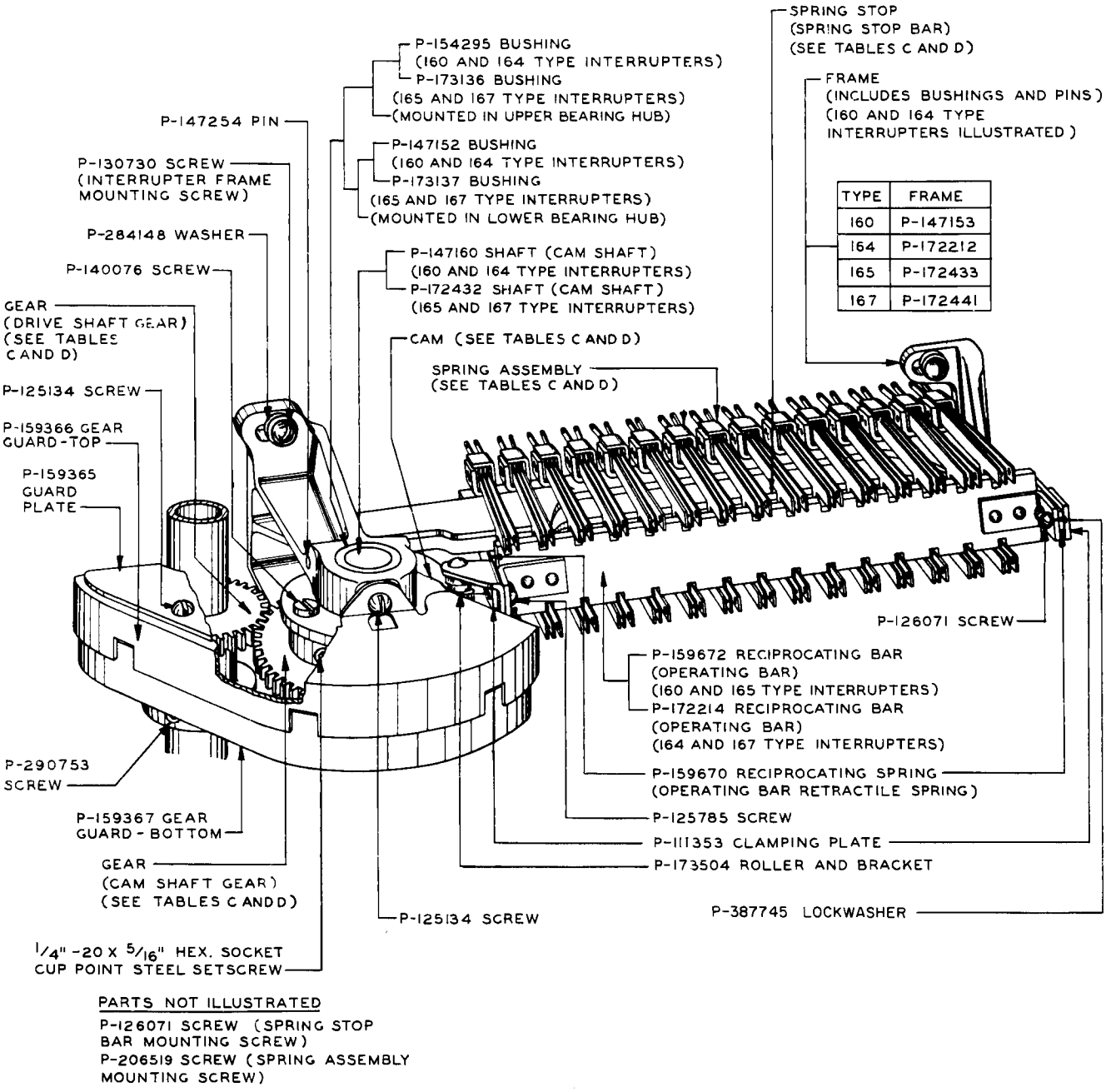
CODE No.	CAM	SPRING STOP (spring stop bar) SEE NOTE 1	GEAR (drive-shaft gear) SEE NOTE 2	GEAR (cam-shaft gear) SEE NOTE 2	SPRING ASSEMBLY
160A	P-147171	P-173719	P-147168	P-147166	P-160496
160B	P-154140	P-173719	P-154583	P-154582	P-160493
160C	P-154141	P-173719	P-147168	P-147166	P-160496
160D	P-147171	P-173719	P-147168	P-147166	P-160496
160E	P-147171	P-173719	P-147168	P-147166	P-160496
160F	P-147172	P-173719	P-154553	P-147166	P-160495
160G	P-147172	P-173719	P-154553	P-147166	P-160492
160H	P-154615	P-173719	P-154617	P-154616	P-160497
160J	P-154581	P-173719	P-154580	P-154579	P-160492
160K	P-147173	P-173719	P-147169	P-147167	P-160492
160L	P-173729	P-173719	P-147168	P-147166	P-160492
160M	P-154141	P-173719	P-147168	P-147166	P-160495
160N	P-154623	P-173719	P-147169	P-147167	P-159656
160P	P-147171	P-173719	P-147168	P-147166	P-160495
160R	P-147172	P-173719	P-147168	P-147166	P-160496
160S	P-154581	P-173719	P-154580	P-154579	P-160492
160T	P-147172	P-173719	P-154553	P-147166	P-160496

TABLE C — VARIABLE PARTS FOR 160- AND 164-TYPE INTERRUPTERS (cont)

CODE No.	CAM	SPRING STOP (spring stop bar) SEE NOTE 1	GEAR (drive-shaft gear) SEE NOTE 2	GEAR (cam-shaft gear) SEE NOTE 2	SPRING ASSEMBLY
160U	P-147172	P-173719	P-154553	P-147166	P-160496
160W	P-147172	P-173719	P-154553	P-147166	P-160496
160Y	P-147172	P-173719	P-154553	P-147166	P-160492
160AA	P-154140	P-173719	P-154583	P-154582	P-160492
160AB	P-154140	P-172163	P-154617	P-154616	P-172162
160AC	P-154140	P-173719	P-154583	P-154582	P-160492
160AD	P-172164	P-173719	P-154617	P-154616	P-160492
160AH	See Note 3	P-172605	See Note 3	See Note 3	P-172611
160AS	P-173089	P-172605	P-154580	P-154579	P-172611
160AW	P-173126	P-172163	P-154583	P-154582	P-172209
D-45488	P-147172	P-173719	P-154553	P-147166	P-160492
D-46197	P-154581	P-173719	P-154580	P-154579	P-160492
D-46248	P-154141	P-173719	P-147168	P-147166	P-160496
D-46737	P-173729	P-173719	P-147168	P-147166	P-160492
D-46991	P-154581	P-173719	P-154580	P-154579	P-160492
D-47206	P-154581	P-173719	P-154580	P-154579	P-160492
D-47851	P-154581	P-173719	P-154580	P-154579	P-160492
D-48127	P-172765	P-173719	P-147169	P-147167	P-172424
D-77865	ESL-301644-1	P-173719	P-154583	P-154582	P-160493
D-81298	P-154141	P-173719	P-147168	P-147166	P-160495
D-91884	P-147172	P-173719	P-154553	P-147166	P-160492
D-92155	P-173127	P-172163	P-154583	P-154582	P-173125
D-140469	P-154141	P-173719	P-147168	P-147166	P-160495
D-140505	P-154141	P-173719	P-154553	P-147166	P-160496
D-140512	P-154141	P-173719	P-154553	P-147166	P-160496
D-140697	P-154141	P-173719	P-154553	P-147166	P-160495
D-140698	P-147172	P-173719	P-147168	P-147166	P-160492
D-140699	P-147172	P-173719	P-147168	P-147166	P-160495
D-140700	P-154141	P-173719	P-154553	P-147166	P-160496
D-157652	P-154140	P-173719	P-154583	P-154582	P-160492
164A	P-154141	P-173830	P-154583	P-154582	P-172209

Notes

1. The piece-part numbers of the spring stops shown in this column are those for flexible spring stops which are replacements for both rigid (see Fig. 7) and flexible (see Fig. 8) types. When ordering a replacement for a rigid type, it will be necessary to order, in addition, the P-173721 screw and P-173722 washer (see Fig. 8). When ordering a replacement for a flexible type, it will be necessary to order only the spring stop.
2. On 160- and 164-type interrupters, it is not necessary to replace the gears in pairs.
3. When necessary to replace a gear or cam of a 160AH interrupter that is equipped with P-172716 or P-172717 gears, order a cam and complete set of gears specified for the 160AS interrupter. When necessary to replace a gear or cam of a 160AH interrupter equipped with a P-154579 or P-154580 gear, order P-154579 gear, P-154580 gear, or P-173089 cam as required.



TYPE	FRAME
160	P-147153
164	P-172212
165	P-172433
167	P-172441

Fig. 4 – 160-, 164-, 165-, and 167-Type Interrupters (160- and 164-type interrupters illustrated)

TABLE D — VARIABLE PARTS FOR 165- AND 167-TYPE INTERRUPTERS

CODE NO.	CAM	SPRING STOP (spring stop bar) SEE NOTE 1	GEAR (drive-shaft gear) SEE NOTE 2	GEAR (cam-shaft gear) SEE NOTE 2	SPRING ASSEMBLY
165A	P-147171	P-173719	P-147168	P-147166	P-172424
165B	P-154140	P-173719	P-154583	P-154582	P-172425
165C	P-154141	P-173719	P-147168	P-147166	P-172424
165D	P-147171	P-173719	P-147168	P-147166	P-172424
165E	P-147171	P-173719	P-147168	P-147166	P-172424
165F	P-147172	P-173719	P-154553	P-147166	P-172426
165G and D-98042	P-147172	P-173719	P-154553	P-147166	P-172427
165H	P-154615	P-173719	P-154617	P-154616	P-172428
165J	P-154581	P-173719	P-154580	P-154579	P-172427
165K and D-98043	P-147173	P-173719	P-147169	P-147167	P-172427
165L and D-98044	P-173729	P-173719	P-147168	P-147166	P-172427
165M	P-154141	P-173719	P-147168	P-147166	P-172426
165P	P-147171	P-173719	P-147168	P-147166	P-172426
165R	P-147172	P-173719	P-147168	P-147166	P-172424
165S	P-154581	P-173719	P-154580	P-154579	P-172427
165T	P-147172	P-173719	P-154553	P-147166	P-172424
165U	P-147172	P-173719	P-154553	P-147166	P-172424
165W	P-147172	P-173719	P-154553	P-147166	P-172424
165AA	P-154140	P-173719	P-154583	P-154582	P-172427
165AB	P-154140	P-172163	P-154617	P-154616	P-172429
165AC and D-99758	P-154140	P-173719	P-154583	P-154582	P-172427
165AD	P-172164	P-173719	P-154617	P-154616	P-172427
165AE	P-154141	P-173719	P-147168	P-147166	P-172424
165AF	P-172601	P-173719	P-172602	P-172603	P-172427
165AG	P-172601	P-173719	P-172602	P-172603	P-172427
165AH	See Note 3	P-172605	See Note 3	See Note 3	P-172624
165AJ	P-154141	P-173719	P-147168	P-147166	P-172424
165AK	P-154623	P-173719	P-147169	P-147167	P-172424
165AL	P-172765	P-173719	P-147169	P-147167	P-172424
165AM	P-172770	P-172605	P-154617	P-154616	P-172624
165AN	P-173039	P-172163	P-172602	P-172603	P-172429
165AP	P-154581	P-173719	P-154580	P-154579	P-172427

TABLE D — VARIABLE PARTS FOR 165- AND 167-TYPE INTERRUPTERS (cont)

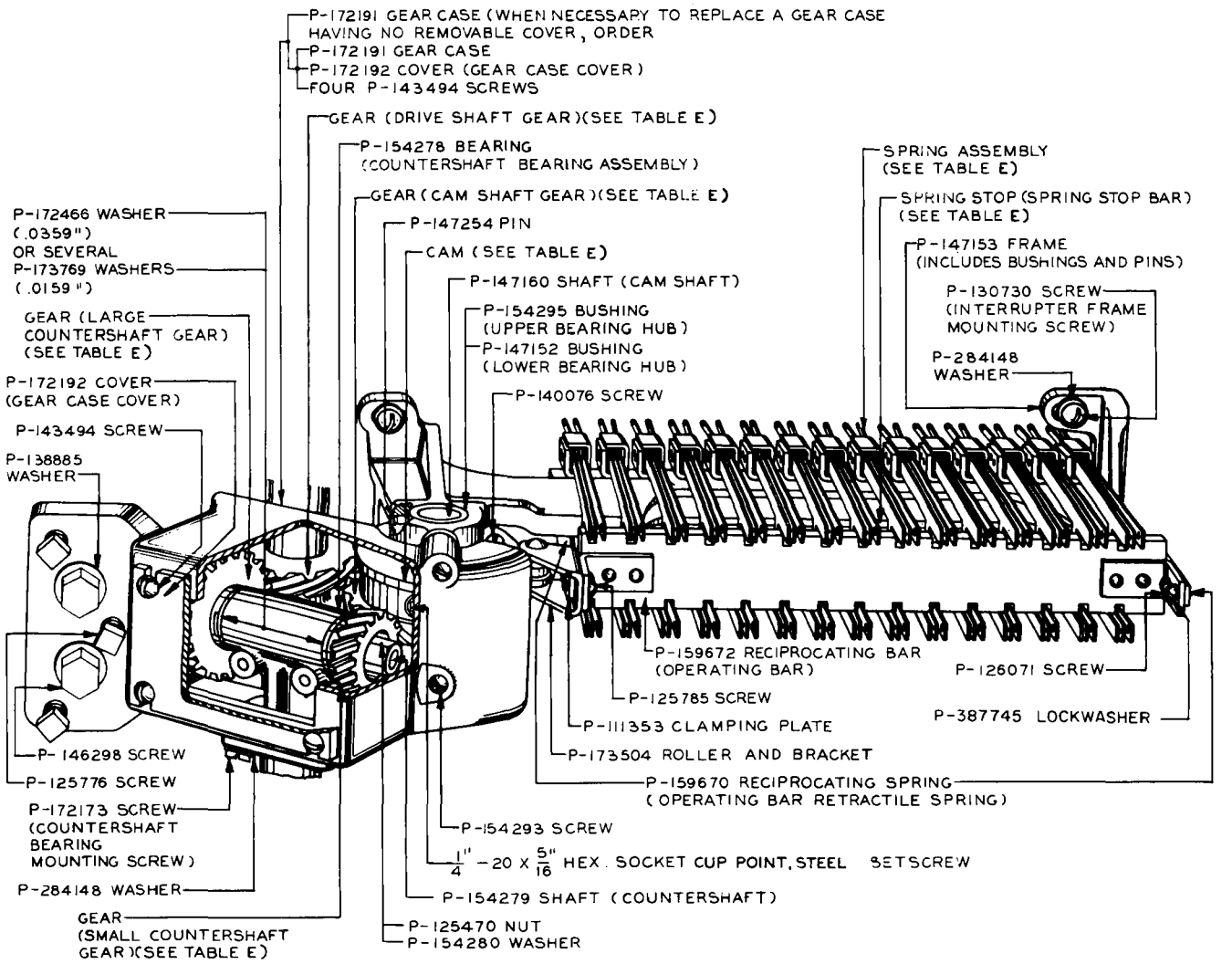
CODE NO.	CAM	SPRING STOP (spring stop bar) SEE NOTE 1	GEAR (drive-shaft gear) SEE NOTE 2	GEAR (cam-shaft gear) SEE NOTE 2	SPRING ASSEMBLY
165AR	P-173098	P-172163	P-172602	P-172603	P-172429
165AS	P-173089	P-172605	P-154580	P-154579	P-172624
165AT	P-173112	P-172163	P-172602	P-172603	P-172429
165AU and D-98045	P-173127	P-172163	P-154583	P-154582	P-173125
165AW	P-173126	P-172163	P-154583	P-154582	P-172431
165AY	P-147172	P-173719	P-154553	P-147166	P-172426
165BA and D-98046	P-154581	P-173719	P-154580	P-154579	P-172427
165BB	P-172765	P-173719	P-147169	P-147167	P-172424
165BC	P-154623	P-173719	P-147169	P-147167	P-172424
165BD and D-98047	P-173616	P-173719	P-147169	P-147167	P-172427
165BE	P-173617	P-173719	P-147169	P-147167	P-172427
165BF and D-98048	P-173628	P-173719	P-147169	P-147167	P-172424
165BG and D-98049	P-173729	P-173719	P-147168	P-147166	P-172427
165BH	P-173964	P-173719	P-147168	P-147166	P-172424
165BJ	P-173963	P-172163	P-147168	P-147166	P-172429
165BK	P-173963	P-172163	P-147168	P-147166	P-172429
165BL and D-92154	P-147171	P-172163	P-147168	P-147166	P-172431
D-92153	P-147172	P-172163	P-154553	P-147166	P-172431
D-140506	P-154141	P-173719	P-154553	P-147166	P-172424
D-140507	P-154141	P-173719	P-154553	P-147166	P-172424
D-140692	P-147172	P-173719	P-147168	P-147166	P-172424
D-140693	P-147172	P-173719	P-147168	P-147166	P-172427
D-140694	P-147172	P-173719	P-147168	P-147166	P-147424
D-140711	P-172765	P-173719	P-147169	P-147167	P-147424
D-140814	P-172765	P-173719	P-147169	P-147167	P-147424
D-179974	P-173098	P-173719	P-172602	P-172603	P-172427 ←
167A	P-154141	P-173830	P-154583	P-154582	P-172431

Notes

1. The piece-part numbers of the spring stops shown in this column are those for flexible spring stops which are replacements for both rigid (see Fig. 7) and flexible (see Fig. 8) types. When ordering a replacement for a rigid type, it will be necessary to order, in addition, the P-173721 screw and P-173722 washer (see Fig. 8). When ordering a replacement for a flexible type, it will be necessary to order only the spring stop.

2. On 165- and 167-type interrupters, it is not necessary to replace the gears in pairs.

3. When necessary to replace a gear or cam of a 165AH interrupter that is equipped with P-172716 or P-172717 gears, disregard note 2 and order a cam and complete set of gears specified for the 165AS interrupter. When necessary to replace a gear or cam of a 165AH interrupter equipped with a P-154579 or P-154580 gear, order P-154579 gear, P-154580 gear, or P-173089 cam as required.



PARTS NOT ILLUSTRATED

P-206519 SCREW (SPRING ASSEMBLY MOUNTING SCREW)
P-290753 SCREW (DRIVE SHAFT GEAR MOUNTING SCREW)
P-126071 SCREW (SPRING STOP BAR MOUNTING SCREW)

Fig. 5 – 161-Type Interrupter

TABLE E — VARIABLE PARTS FOR 161-TYPE INTERRUPTERS

CODE NO.	CAM	SPRING STOP (spring stop bar) SEE NOTE 5	GEAR (drive-shaft gear) SEE NOTE 6	GEAR (large counter-shaft gear) SEE NOTE 6	GEAR (cam-shaft gear) SEE NOTE 6	GEAR (small counter-shaft gear) SEE NOTE 6	SPRING ASSEMBLY	GEAR AND BEARING ASSEMBLY SEE NOTES 1 AND 2
161A	P-154273	P-154294	P-173918	P-173914	P-173912	P-173913	P-160500	P-290411
161B	P-154272	P-173719	P-173742	P-173758	P-173749	P-173755	P-160495	P-290410
161C	P-154765	P-173719	P-173918	P-173914	P-173912	P-173913	P-160492	P-290411
161D	P-159208	P-173719	P-173742	P-173758	P-173749	P-173755	P-160496	P-290410
161E	P-159241	P-173719	P-173742	P-173758	P-173749	P-173755	P-160492	P-290410
161F	See Note 3	P-173719	See Note 3	See Note 3	See Note 3	See Note 3	P-160492	See Notes 3&4
161G	P-154272	P-173719	P-173742	P-173758	P-173749	P-173755	P-160495	P-290410
161H	P-159241	P-173719	P-173743	P-173759	P-173749	P-173755	P-160492	P-290412
161J	P-154765	P-173719	P-173918	P-173914	P-173912	P-173913	P-160492	P-290411
161K	P-154272	P-173719	P-173742	P-173758	P-173749	P-173755	P-160496	P-290410
161L	P-154765	P-173719	P-173918	P-173914	P-173912	P-173913	P-160492	P-290411
161M	P-159241	P-173719	P-173742	P-173758	P-173916	P-173915	P-160492	P-290413
161N	P-159241	P-173719	P-173919	P-173917	P-173916	P-173915	P-160492	P-290414
161P	P-159241	P-173719	P-173743	P-173759	P-173750	P-173756	P-160493	P-290415
161AA	P-173140	P-173719	P-173744	P-173760	P-173751	P-173757	P-160492	See Note 4
161AG	P-173962	P-173719	P-173743	P-173759	P-173749	P-173755	P-160493	P-290412
D-47036	P-159241	P-173719	P-173743	P-173759	P-173749	P-173755	P-160492	P-290412
D-48885	See Note 3	P-173719	P-173744	D-48885-4A	D-48885-1A	D-48885-3A	P-160492	D-48885-2A
D-85501	D-85501-4	P-173719	D-85501-2	D-85501-3	P-173749	P-173755	P-160497	D-85501-1
D-85547	P-159241	P-173719	P-173919	P-173917	P-173916	P-173915	P-160492	P-290414
D-86393	P-159241	P-173719	P-173742	P-173758	P-173916	P-173915	P-160492	P-290413

Notes

1. On all interrupters except 161F and 161AA interrupters, this assembly consists of the large and small countershaft gears, countershaft, bearing assembly, and associated nuts and washers. Other parts should be ordered separately if required.
2. On 161F and 161AA interrupters, this assembly consists of the gear case, cover, mounting screws, and washers in addition to those parts covered in note 1.
3. When it is necessary to replace a gear or the cam of a 161F interrupter, order a complete set of gears and a cam specified for the 161AA interrupter. This change shall be made in order to obtain smoother operation of the interrupter since the 161AA interrupter operates at one-half the cam speed of the 161F interrupter and the cam cutting angles are more favorable. If subsequent replacement of a gear or the cam is required, order the part in accordance with the information specified for the 161AA interrupter.
4. When it is necessary to replace the gear and bearing assembly on 161F or 161AA interrupters, order P-173937 gear and gear case assembly. This assembly includes, in addition to the parts of the gear and bearing assembly, the gear case, gear case cover, and associated screws, the bearing assembly mounting screws and the adjusting setscrews.
5. The piece-part numbers of the spring stops shown in this column are those for flexible spring stops which are replacements for both rigid (see Fig. 7) and flexible (see Fig. 8) types. When ordering a replacement for a rigid type, it will be necessary to order, in addition, the P-173721 screw and P-173722 washer (see Fig. 8). When ordering a replacement for a flexible type, it will be necessary to order only the spring stop.
6. When a gear requires replacement, the piece-part number of which is not listed in the above table, order both gears of the meshing pair as listed in this table; also order two P-290753 screws for mounting the drive-shaft gear.

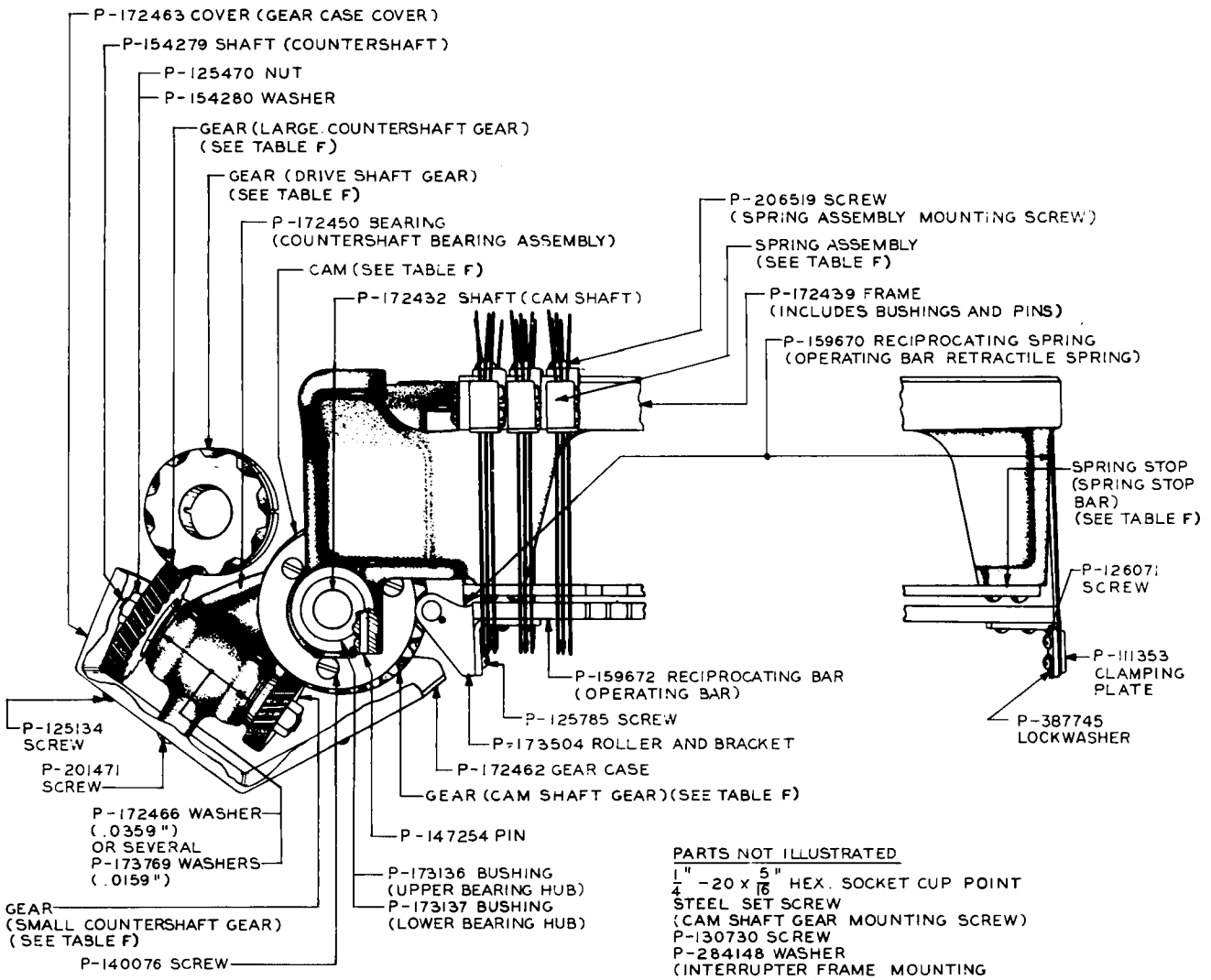


Fig. 6 – 166-Type Interrupter

TABLE F — VARIABLE PARTS FOR 166-TYPE INTERRUPTERS

CODE NO.	CAM	SPRING STOP (spring stop bar) SEE NOTE 3	GEAR (drive-shaft gear) SEE NOTE 4	GEAR (large counter-shaft gear) SEE NOTE 4	GEAR (camshaft gear) SEE NOTE 4	GEAR (small counter-shaft gear) SEE NOTE 4	SPRING ASSEMBLY	GEAR AND GEAR CASE ASSEMBLY SEE NOTE 1
166A	P-154273	P-154294	P-173744	P-173760	P-173965	P-173966	P-172430	P-173967
166B	P-154272	P-173719	P-173742	P-173758	P-173749	P-173755	P-172426	P-173752
166D	P-159208	P-173719	P-173742	P-173758	P-173749	P-173755	P-172424	P-173752
166E & D-98050	P-159241	P-173719	P-173742	P-173758	P-173749	P-173755	P-172427	P-173752
166F	See Note 2	P-173719	See Note 2	See Note 2	See Note 2	See Note 2	P-172427	See Note 2
166G	P-154272	P-173719	P-173742	P-173758	P-173749	P-173755	P-172424	P-173752
166H	P-159241	P-173719	P-173743	P-173759	P-173749	P-173755	P-172427	P-173934
166K	P-154272	P-173719	P-173742	P-173758	P-173749	P-173755	P-172424	P-173752
166N	P-159241	P-173719	P-173919	P-173917	P-173916	P-173915	P-172427	P-173935
166P & D-98051	P-159241	P-173719	P-173743	P-173759	P-173750	P-173756	P-172425	P-173753
166R	P-159241	P-173719	P-173742	P-173758	P-173916	P-173915	P-172427	P-173936
166S	P-159241	P-173719	P-173742	P-173758	P-173749	P-173755	P-172427	P-173752
166T	P-159241	P-173719	P-173742	P-173758	P-173916	P-173915	P-172427	P-173936
166U	P-159241	P-173719	P-173743	P-173759	P-173750	P-173756	P-172427	P-173753
166W	P-159241	P-173719	P-173743	P-173759	P-173749	P-173755	P-172427	P-173934
166Y	P-159241	P-173719	P-173919	P-173917	P-173916	P-173915	P-172427	P-173935
166AA & D-98053	P-173140	P-173719	P-173744	P-173760	P-173751	P-173757	P-172427	P-173754
166AB & D-98052	P-173587	P-173719	P-173743	P-173759	P-173750	P-173756	P-172424	P-173753
166AC	P-173597	P-173719	P-173921	P-173920	P-173749	P-173755	P-172427	P-173938
166AD & D-89946	P-173633	P-173719	P-173923	P-173925	P-173922	P-173924	P-172424	P-173939
166AE & D-89947	P-173637	P-173719	P-173742	P-173758	P-173926	P-173927	P-172424	P-173940
166AF	P-159241	P-173719	P-173743	P-173759	P-173749	P-173755	P-172427	P-173934
166AG	P-173962	P-173719	P-173743	P-173759	P-173749	P-173755	P-172427	P-173934
166AH	P-159241	P-173719	P-173919	P-173917	P-173916	P-173915	P-172427	P-173935
D-48489	P-159241	P-173719	P-173919	P-173917	P-173916	P-173915	P-172427	P-173935
D-88913	D-88913-1	P-173719	P-173742	P-173758	P-173749	P-173755	P-172424	P-173752

Notes

1. This assembly consists of the large and small countershaft gears, countershaft, bearing assembly, gear case and cover, and associated screws, nuts, and washers but does not include the assembly mounting screws (P-172464 screws) which must be ordered separately if required.
2. When it is necessary to replace a gear or the cam of a 166F interrupter, order a complete set of gears and a cam specified for the 166AA interrupter. This change shall be made in order to obtain smoother operation of the interrupter since the 166AA interrupter operates at one-half the cam speed of the 166F interrupter and the cam cutting angles are more favorable. If subsequent replacement of a gear or the cam is required, order the part in accordance with the information specified for the 166AA interrupter.
3. The piece-part numbers of the spring stops shown in this column are those for flexible spring stops which are replacements for both rigid (see Fig. 7) and flexible (see Fig. 8) types. When ordering a replacement for a rigid type, it will be necessary to order in addition, the P-173721 screw and P-173722 washer (see Fig. 8). When ordering a replacement for a flexible type, it will be necessary to order only the spring stop.
4. When a gear requires replacement, the piece-part number of which is not listed in the above table, order both gears of the meshing pair as listed in this table.

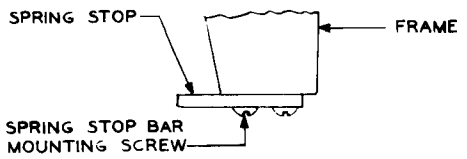


Fig. 7 – Rigid-Type Spring Type

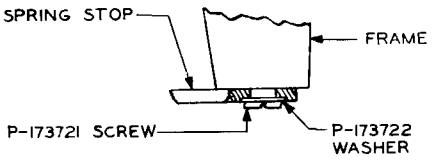


Fig. 8 – Flexible-Type Spring Stop

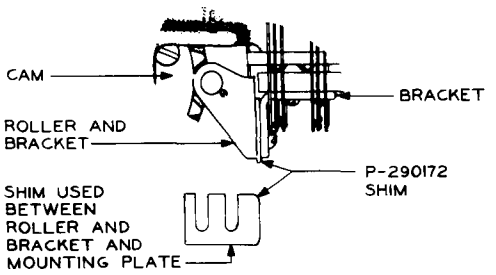


Fig. 9 – Shim

3. REPLACEMENT PROCEDURES

3.01 *List of Tools and Materials*

CODE OR SPEC NO.	DESCRIPTION
TOOLS	
147	3-1/8 Inch Screwdriver
206	30-Degree Offset Screwdriver
207	90-Degree Offset Screwdriver
245 (2 reqd)	3/8- and 7/16-Inch Open Double-End Flat Wrench
294	1/4-Inch Bristo Setscrew Wrench
310B	9/32-Inch Open Double-End Offset Wrench
418A	5/16- and 7/32-Inch Open Double-End Flat Wrench
KS-6854	3-1/2 Inch Screwdriver
KS-8097	5/8- and 7/16-Inch 12-Point Offset Box Wrench
R-2485	5/32-Inch Allen Socket Screw Wrench
R-2671	1/8-Inch Allen Socket Screw Wrench
—	P-Long-Nose Pliers
—	3-Inch C Screwdriver (or the replaced 3-inch cabinet screwdriver)
—	4-Inch E Screwdriver (or the replaced 4-inch regular screwdriver)
MATERIALS	
KS-7860	Petroleum Spirits
KS-14666	Cleaning Cloth
—	No. 280 Aloxite Cloth
—	3/8-Inch Rod or Dowel
—	Wood or Fiber Wedge (see 3.21)

3.02 No replacement procedures are specified for screws or other small parts where the replacement procedure consists of a single operation.

3.03 Before making any replacement of any part of the interrupter, stop the associated drive. Before stopping the drive to make any of the replacements specified herein, ascertain whether it is necessary to make any of the associated circuits busy. Circuits which are so affected shall be made busy in the approved manner.

3.04 After making any replacement of parts of an interrupter, the part or parts replaced shall meet the readjust requirements involved as specified in Section 163-651-701. Other parts whose adjustments may have been directly disturbed by the replacing operations shall be checked to the readjust requirements, and an over-all operation check shall be made of the interrupter before restoring the circuit to service.

3.05 Before replacing any part covered herein, check whether the replacing part is covered with a protective film of grease. If it is, remove the grease with KS-7860 petroleum spirits and then lubricate the part, if required, as covered in Section 163-651-701.

Drive-Shaft Gear

3.06 To replace a drive-shaft gear, remove the vertical drive shaft from the frame and the apparatus mounted on the shaft as covered in Section 159-735-801 except in those cases covered by 3.07 and 3.08. Loosen the gear hub clamping screws with the 3-inch C screwdriver or, if the screw is a hexagon socket setscrew, the R-2485 wrench, and remove the gear from the shaft. Substitute the new gear and tighten the clamping screws securely. Remount the apparatus that was removed in order to remove the gear and the vertical drive shaft as covered in Section 159-735-801.

3.07 If the interrupter is mounted at the top of the frame so that the drive-shaft gear is above the top bearing on the vertical drive shaft, proceed as follows. On 149-, 160-, 164-, 165-, and 167-type interrupters, remove the gear guard mounting screws with the 3-inch C screwdriver and remove the guard. On 152-, 161-, and 166-type interrupters, remove the gear and gear case assembly as covered in 3.30 and replace the gear associated with the drive-shaft gear as covered in 3.26. Loosen the interrupter frame mounting screws with the 4-inch E screwdriver and move the interrupter to the right as far as possible, then loosen the gear hub clamping screw with the 3-inch C screwdriver or, if the screw is a hexagon socket setscrew, the R-2485 wrench, and slide the gear up and off the shaft. Place the new gear on the shaft in the proper position and tighten the mounting screw securely. Remount the gear guard or the gear and gear case assembly, reposition the interrupter, and tighten the interrupter frame mounting screws.

3.08 If the defective gear is mounted at or near the top of the shaft with only one bearing and one or no other gears above it, the gear may be replaced without removing the shaft from the frame as covered in 3.09 through 3.13. If, however, more than one gear and one bearing are mounted between the gear to be replaced and the top of the shaft, it will be more economical to remove the vertical drive shaft from the frame and replace the gear as covered in 3.06.

3.09 Remove the vertical drive-shaft guard from the frame by removing the guard mounting screws with the 4-inch E screwdriver. If, however, the guard is mounted on rotating brackets, it may be shifted out of the way without removing it from the frame.

3.10 Move the interrupters (if any) above the gear to be replaced to the right as far as possible using the 4-inch E screwdriver to loosen the mounting screws. Remove the gear guard or gear and gear case assembly from the interrupter and also from the interrupter (if any) directly above as covered in 3.07.

3.11 Remove the bearing caps and, if the bearings are equipped with graphalloy bushings (and adapters), remove them as well from at least two bearings below and from the bearing above the drive-shaft gear to be replaced as covered in Section 159-735-801. This is done in order that the end of the shaft may be moved far enough away from the frame to permit the gears to be removed.

3.12 Loosen the drive-shaft gear clamping screws with the 3-inch C screwdriver or, if the screw is a hexagon socket setscrew, the R-2485 wrench, and move the gears so that they disengage the interrupter gear teeth.

3.13 Move the end of the shaft out from the frame just far enough to permit the removal of the bearing and the gear and slide them off the end of the shaft. Mount the new gear in position, remount any other gears which have been removed, reassemble the bearings on the shaft, and remount the gear guard or gear and gear case assemblies.

3.14 After making the necessary replacement of parts and reassembling the apparatus on the vertical drive shaft, check the alignment of parts mounted on the shaft as covered in Section 163-651-701 and, if necessary, make the required adjustments.

Spring Assembly

3.15 Unsolder the leads to the spring assembly to be replaced, remove the spring assembly mounting screw from the rear of the frame with the 4-inch E screwdriver, and remove the spring assembly. Substitute the new assembly, placing it in position so that the tangs of the operating springs rest properly against the studs or side of the slot in the operating bar and the tangs of the contact springs rest properly on the spring stop bar. Then insert and tighten the spring assembly mounting screw securely.

Operating Bar Assembly
Operating Bar
Operating Bar Retractile Springs
Clamping Plate
Roller and Bracket Assembly
Spring Stop Bar

3.16 ***Operating Bar Assembly — 149- and 152-Type Interrupters Equipped With Metal Operating Bar and Without Transfer Spring Combinations:*** To replace the operating bar assembly on these interrupters, proceed as follows. With the 206 and 207 screwdrivers, remove the operating bar retractile spring mounting screws from the rear end of the retractile springs. Withdraw the operating bar from between the contact springs taking care not to damage the contacts. Mount the D-85832 operating bar assembly in place on the interrupter. To facilitate the mounting of the assembly, proceed as follows. Remove one of the two roller and bracket mounting screws from the D-85832 operating bar assembly as covered in 3.19 and loosen the other. This will permit the roller and bracket assembly to be turned aside so as to give the least interference with the cam and gear and permit the bar to be tilted and placed in position between the contact springs. Place the bar in position, taking care to see that each stud on the operating bar enters between the proper springs without distorting them and that the studs engage the springs properly. Fasten the bar in place by inserting the retractile spring mounting screws at the rear of the interrupter frame and tighten them securely. Turn the roller and bracket assembly into position and fasten it in place by tightening the mounting screws securely.

3.17 ***Operating Bar Assembly — 149- and 152-Type Interrupters Equipped With Metal Operating Bar and With Transfer Spring Combinations:*** To replace the operating bar assembly on these interrupters, proceed as follows. Protect the interrupters under the one on which the replacement is to be made by placing a KS-14666 cloth over the interrupter immediately below. Crush the bushings mounted on the studs on the lower side of the interrupter bar using the P-long-nose pliers. The cloth should catch the pieces of the broken bushings. Remove the retractile spring mounting screws using the 206 and 207 screwdrivers. To do this, it will be necessary to work from the wiring side of the frame. Remove the operating bar, pulling it forward through the operating springs. Substitute a new operating bar as covered in 3.16. Remove the cloth taking care not to drop the broken bushings.

3.18 ***Operating Bar and Other Parts — 149- and 152-Type Interrupters Equipped With D-85832 Operating Bar Assembly:*** To replace the operating bar, operating bar retractile spring, roller and bracket assembly, or spring stop bar on these interrupters equipped with the D-85832 (phenol fiber) operating bar, follow the procedures covered in 3.19 through 3.22.

3.19 ***Operating Bar — 160-, 161-, 164-, 165-, 166-, and 167-Type Interrupters:*** Remove the retractile spring mounting screws from the rear of the retractile springs with the 206 and 207 offset screwdrivers and remove the operating bar assembly. To remove these screws, it will be necessary to work from the wiring side of the frame. Remove the retractile spring mounting screws from the front of the operating bar as covered in 3.20 and remove the parts mounted on the bar. Mount the parts on the new operating bar as covered in 3.20 and 3.21. Place the assembly in position, taking care that the spring tangs properly engage the slots in the operating bar and the roller and bracket assembly are properly located. Fasten the operating bar in place by tightening the rear retractile spring mounting screws securely.

3.20 ***Operating Bar Retractile Spring and Clamping Plate:*** Remove the retractile spring mounting screws from the rear of the spring to be replaced as outlined above and remove the retractile spring mounting screws from the front of the spring or the roller and bracket mounting screws as follows. Insert the 147 screwdriver in the slot of a mounting screw and grasp the hexagonal handle of the screwdriver with the 418A wrench as shown in Fig. 10. Remove the screw by turning the screwdriver in a counterclockwise direction by means of the wrench. If necessary, replace the clamping plate at this time. Substitute the new part and securely fasten the part in place.

3.21 ***Roller and Bracket — 160-, 161-, 164-, 165-, 166-, and 167-Type Interrupters Only:*** Insert a suitable wood or fiber wedge between the operating bar retractile spring and the frame so as to hold the operating bar stationary. Remove the roller and bracket mounting screws

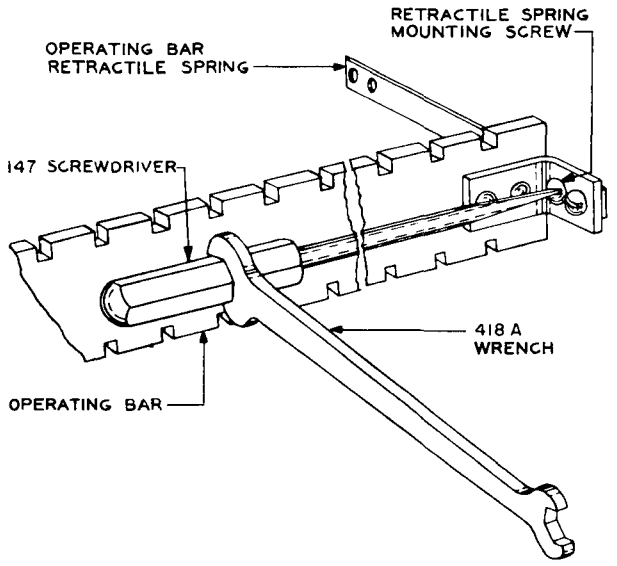


Fig. 10 – Method of Removing Retractile Spring Mounting Screws

from the left-hand end of the operating bar assembly as covered in 3.20 and remove the roller and bracket from the operating bar. Place the new roller and bracket in position, taking care that the operating bar retractile spring lies between the clamping plate and the roller and bracket, and that the roller is parallel to the camshaft as covered in Section 163-651-701. Fasten it in place by tightening the mounting screws securely. When replacing a roller and bracket assembly, it may be necessary to bend the short leg of the bracket to which the roller and bracket assembly is mounted on the operating bar, using P-long-nose pliers, in order to insure that the contact springs can be adjusted to function properly. If the operating bar retractile spring is distorted after the wedge is removed, restore the retractile spring to its former position.

Note: When replacing the roller and bracket, note the condition of the cam and, if necessary, replace it as covered in 3.26.

3.22 ***Spring Stop Bar:*** To replace the spring stop bar, remove the operating bar assembly as covered in 3.16 through 3.19. Remove the spring stop bar mounting screws with the 3-inch C screwdriver and remove the spring stop bar. Substitute the new part, taking care that the tangs of the contact springs are properly located in the slots of the spring stop bar. Insert and securely tighten the mounting screws in the mounting holes at the end of the spring stop bar nearer the cam. Place the spring washer over the special fillister-head mounting screw so that the convex surface of the washer is toward the head of the screw. Insert the screw through the mounting hole at the end of the spring stop bar further from the cam, and tighten the screw securely. Remount the operating bar assembly as covered in 3.16 through 3.19.

Cam
Camshaft
Camshaft Gear
Cam Mounting Screws
Bushings

3.23 On 149-, 160-, 164-, 165-, and 167-type interrupters, remove the gear guard mounting screws with the 3-inch C screwdriver and remove the gear guard. On 152- and 161-type interrupters, remove the gear and gear case assembly by removing the mounting screws with the KS-6854 screwdriver and remove the hexagon head gear case mounting screws with the KS-8097 socket wrench. On 166-type interrupters remove the gear and gear case assembly mounting screws with the 245 wrench and remove the gear and gear case assembly.

3.24 Where the interrupter is mounted so that there is sufficient space above and below the interrupter to permit the removal of the cam shaft, it will not be necessary to remove the interrupter from the frame. Where the interrupter is so mounted that there is insufficient space for removing the shaft, remove the interrupter from the frame as follows. Unsolder the leads to the spring assemblies. Remove the interrupter mounting screws with the 4-inch E screwdriver and remove the interrupter from the frame.

3.25 To remove the cam shaft, remove the setscrews from the cam-shaft gear hub, using the 294 wrench or, if the screw is a hexagon socket setscrew, the R-2671 wrench. Remove the shaft from the bottom of the interrupter frame. To do this, gently tap on the top of the shaft with some light instrument such as the handle of the screwdriver, taking particular care not to strike the corner of the graphite bushing since the bushing is easily chipped. Place the new shaft in position, noting that the cam shaft is in

such a position that the setscrew when inserted will rest flat against the flattened portion of the camshaft. Insert the setscrews and tighten them securely. Check that the gear is properly positioned on the shaft and that it turns freely in its bearing.

3.26 To replace the cam-shaft gear or the cam, remove one of the cam mounting screws with the 4-inch E screwdriver, then remove the cam shaft as covered in 3.25. Remove the gear and cam from the frame and remove the other two cam mounting screws with the 4-inch E screwdriver. When replacing the cam-shaft gear of 152-, 161-, or 166-type interrupters, replace the associated gear in the gear case as covered in 3.32. Mount the new cam on the cam-shaft gear or the new cam-shaft gear on the cam, inserting and tightening only two of the mounting screws. The upper surface of the cam is marked either by "TOP" or by the piece-part number. If the diameter of the hole in the new cam is too small and it cannot be mounted on the cam shaft, enlarge the hole using No. 280 Aloxite cloth wrapped around a 3/8-inch round rod or dowel stick. Take care when doing this to rotate the cam rather than the rod to minimize the tendency toward making the hole eccentric. Also do not increase the size of the hole too much as the cam should fit snugly on the shaft. Place the gear and cam in position and remount the cam shaft as covered in 3.25. Insert the third cam mounting screw and tighten it securely.

3.27 After making the replacement as described above, remount the interrupter on the frame and remount the gear guard or gear and gear case assembly on the interrupter.

3.28 ***Bushings:*** To replace a bushing, proceed as covered in Section 163-651-811.

Interrupter Frame Assembly

3.29 To replace an interrupter frame assembly, unsolder the leads to the spring assemblies. Remove the interrupter frame mounting screws with the 4-inch E screwdriver and remove the interrupter from the frame. Remove the parts mounted on the interrupter frame assembly as outlined in the procedures covering the particular parts and mount them on the new assembly. Mount the new interrupter frame assembly and the associated parts on the frame and relocate the interrupter frame as covered in Section 163-651-701.

Gear Case
Countershaft Gears
Countershaft
Countershaft Bearing Assembly
Washers

3.30 Remove the gear case from the frame as follows. On 152- and 161-type interrupters, remove the hexagonal head screws which hold the gear case to the frame with the KS-8097 wrench and remove the screws which attach the gear case to the interrupter frame with the KS-6854 screwdriver. On 166-type interrupters, remove the gear and gear case mounting screws with the 245 wrench and remove the gear and gear case from the interrupter frame.

3.31 On 152- and 161-type interrupters, remove the countershaft bearing assembly by loosening the countershaft bearing assembly mounting screws with the 310B offset wrench as shown in Fig. 11 and withdraw the countershaft bearing assembly from the gear case. On 166-type interrupters, remove the gear case from the countershaft assembly using the KS-6854 screwdriver.

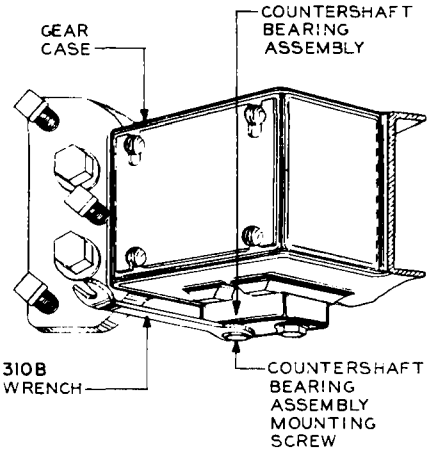


Fig. 11 – Method of Removing Countershaft Bearing Assembly

3.32 Remove the countershaft mounting nut with the 245 wrench using another 245 wrench at the opposite end, if necessary, to hold

the shaft. Remove the countershaft gears from the shaft. Withdraw the countershaft from the bearing, place the new part in position, and reassemble the countershaft gears on the shaft. Remount the countershaft bearing assembly in the gear housing in its proper position on the frame. When replacing a countershaft gear of 152-, 161-, or 166-type interrupters, replace the associated gear on the drive shaft or camshaft as covered in 3.07 or 3.08, respectively.

3.33 If the endplay of the gears is greater than 0.015 inch, insert washers as required between the gear and the bearing.

Shim

3.34 To mount a shim between the roller and bracket and the operating bar bracket, loosen the roller and bracket mounting screws as covered in 3.21. Mount the shims so that the slots in the shim are over the mounting screws and the widest leg away from the interrupter frame. Tighten the mounting screws securely.

REASONS FOR REISSUE

1. To revise Table A to delete piece parts which cannot be obtained from the Western Electric Company and to specify the P-160489 spring assembly instead of the P-160488 spring assembly.
2. To add Note 2 under Table A.
3. To revise Table B to delete piece parts which cannot be obtained from the Western Electric Company.
4. To add Note 3 under Table B.
5. To revise Table D to add piece-part data for the D-179974 interrupter.
6. To revise the List of Tools and Materials (3.01).