R-9423.1

NOVEMBER 1944

NAV-16-V-T 221

TECHNICAL AIR INTELLIGENCE CENTER

56

REPORT # 21

EXAMINATION OF JAPANESE "BROWNING" MACHINE GUN

Issued by the Division of Naval Intelligence
By
Combined Personnel of United States and British Services
for the Use of Allied Forces

TECHNICAL AIR INTELLIGENCE CENTER
NAVAL AIR STATION ANACOSTIA D C

TAIC REPORT NO. 21
November 1944

EXAMINATION OF JAPANESE "BROWNING" MACHINE GUN

OSRD REPORT NO. 4178
BY BATTELLE MEMORIAL INSTITUTE
FOR WAR METALLURGY COMMITTEE
DIV. 18, NATIONAL DEFENSE RESEARCH COMMITTEE

ISSUED BY THE DIVISION OF NAVAL INTELLIGENCE
BY
COMBINED PERSONNEL OF UNITED STATES AND BRITISH SERVICES
FOR THE USE OF ALLIED FORCES

TECHNICAL AIR INTELLIGENCE CENTER
NAVAL AIR STATION
ANACOSTIA, D.C.

DISTRIBUTION: SEE PAGE 13

EXAMINATION OF JAPANESE "BROWNING" MACHINE GUN

FOREWORD

A Japanese aircraft "Browning" .50 caliber machine gun (BMI #437 - CEE #2950) Serial #2349, manufactured in November 1942, was received from the Technical Air Intelligence Center, Naval Air Station, Anacostia, D. C. for metallurgical examination. The gun was captured at Lae, New Guinea, on September 16, 1943, complete and in good working order. It had been used for a nominal period of time on a Japanese fighter OSCAR.

Markings found on the gun are recorded in Figure 3 of the Appendix. The weapon weighed 51-1/2 pounds when received.

SUMMARY

Seventeen per cent of the metal parts used in the manufacture of the Japanese "Browning" .50 caliber machine gun were made from tungsten steel, three per cent from nickel-chromium steel, and the remainder were unalloyed. The steels were made in the basic open hearth or electric furnace with graded scrap forming a large part of the charge.

The weapon was copied from an early American model with minor modifications. Heat treatments were simpler than American practices, and flame hardening was used extensively. An interesting feature was chromium plating in the bore of the barrel.

ECONOMIC CONSIDERATIONS

The gun shows manufacturing methods similar to other Japanese guns examined and displayed good workmanship. Bearing parts possessed a good finish while a large number of exterior surfaces showed hand finishing. No brazed or stamped parts were used.

Contrary to American and German practices, but in keeping with their own, the Japanese used high-carbon tungsten steel (carbon .59% - .67%, tungsten 1.7% - 2.2%) in parts subjected to extreme wear. Residual amounts of other alloying elements indicate the use of graded scrap in the furnace charges.

The extensive use of flame hardening on the parts is an indication of conservation of heat-treating equipment.

DISCUSSION OF RESULTS

The Japanese "Browning" machine gun as-received and disassembled is shown in Figures 1 to 3, inclusive, in the Appendix. While this gun was obviously copied from an early American design, some features are of interest and are discussed in detail.

The bore of the barrel of this gun was chromium plated from the shoulder of the chamber to the muzzle. Very little wear had occurred at each end where the plating showed a thickness of .000080 inch. The plating was almost entirely removed from the shoulder up to about 6 inches back of the muzzle. The chromium plating seemed to have a satisfactory adherence, as there was no evidence of flaking off. This barrel had apparently had considerable service.

Type of Steel

Each part was spark tested and carefully inspected. Those showing unusual features were analyzed and the results shown in Tables 1 and 2 in the Appendix.

Twenty parts were found to contain tungsten in liberal amounts. The use of tungsten steels in machine guns appears to be standard Japanese practice as evidenced in previous reports submitted on this project. The choice of this alloy appears to be on the basis that these parts are subjected to extreme wear. However, as evidenced by the physical tests made on the gun barrel (Table 3), it is doubtful that the wear resistance of tungsten steels would be improved over that of a plain carbon steel of equal hardness. The carbon and tungsten levels used are not high enough to produce wear-resistant, free tungsten carbide particles, and the parts are not massive enough to require any alloying element for hardenability.

The steels appear to have been made in the basic open hearth or electric furnace. They were silicon and aluminum killed. The residual amounts of various alloying elements indicate the use of considerable scrap in the charges. Aluminum may have been added in some cases for grain size control.

A minor number of small parts were made from high-sulphur screw stock for its free machining qualities.

Heat Treatment

Seventy-two per cent of the 115 parts examined were heat treated. This is a high percentage for Japanese practice, but the treatments appear simpler than American specifications since only the firing pin and the extractor were differentially hardened. The bolt, for example, was uniformly heat treated to a lower hardness than specified on the American counterpart. Hardening of wearing parts was accomplished by flame heating and quenching.

Method of Manufacture

Of a total of 115 parts available for examination, the following distribution according to manufacturing method was made:

22% - Forged and machined
42% - Machined from bar stock
11% - Coiled wire springs
14% - Cut from rod or wire
11% - Cut from plate or sheet

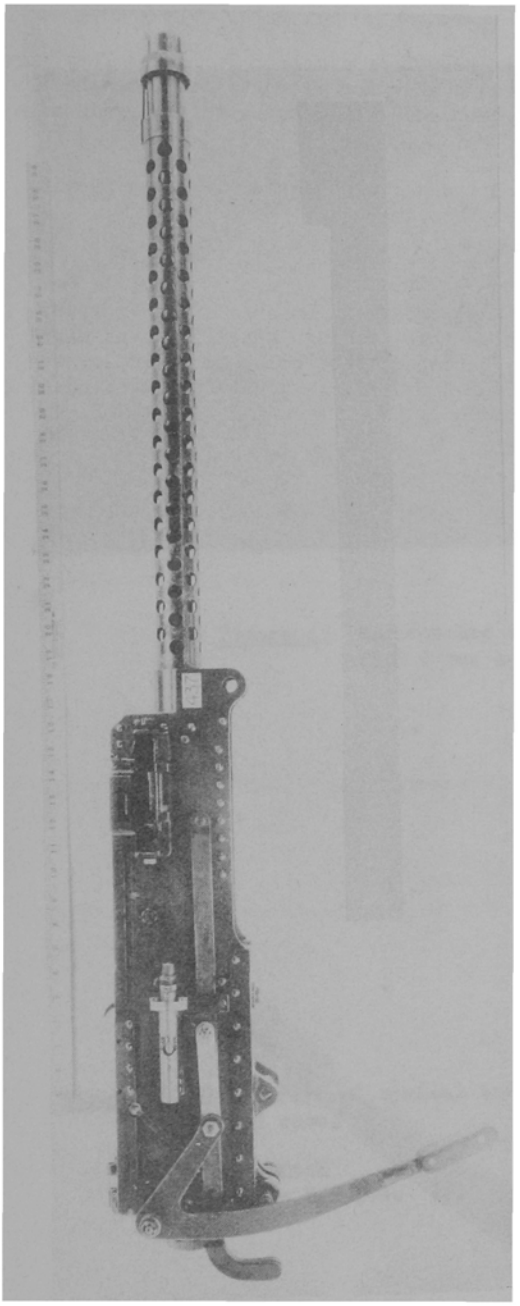
These ratios are in proportion to other Japanese machine guns examined. However, the advantage of forging was largely lost through improper forging and machining.

Careful examination of the barrel revealed that it had been rifled rather than broached.

Exterior Coatings

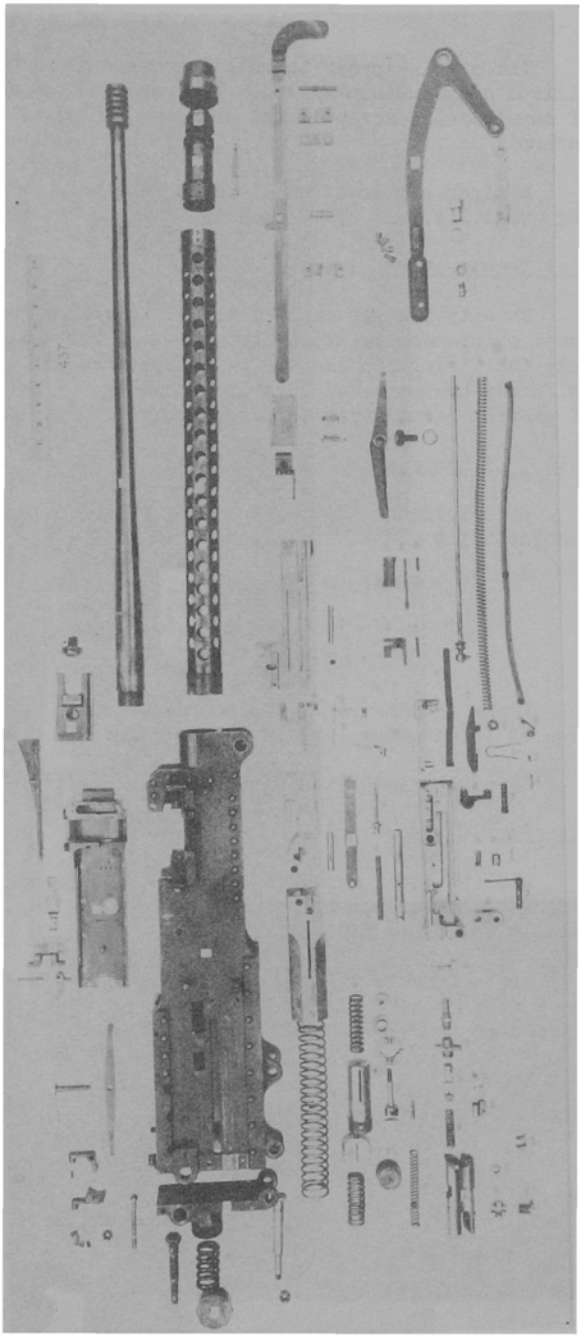
All the outer parts of the gun were given an oxide chemical treatment by dipping to produce a dark dull finish. This treatment, while producing some corrosion resistance, is designed principally to reduce reflectivity.

The automatic trigger housing (#97) was nickel plated .00006" on the entire exterior surface; the auxiliary hand-cocking lever extension (#112) was cadmium plated .0002"; and the breech lock depressors (#17) were chromium plated .00005" over the flame hardened wearing surface.



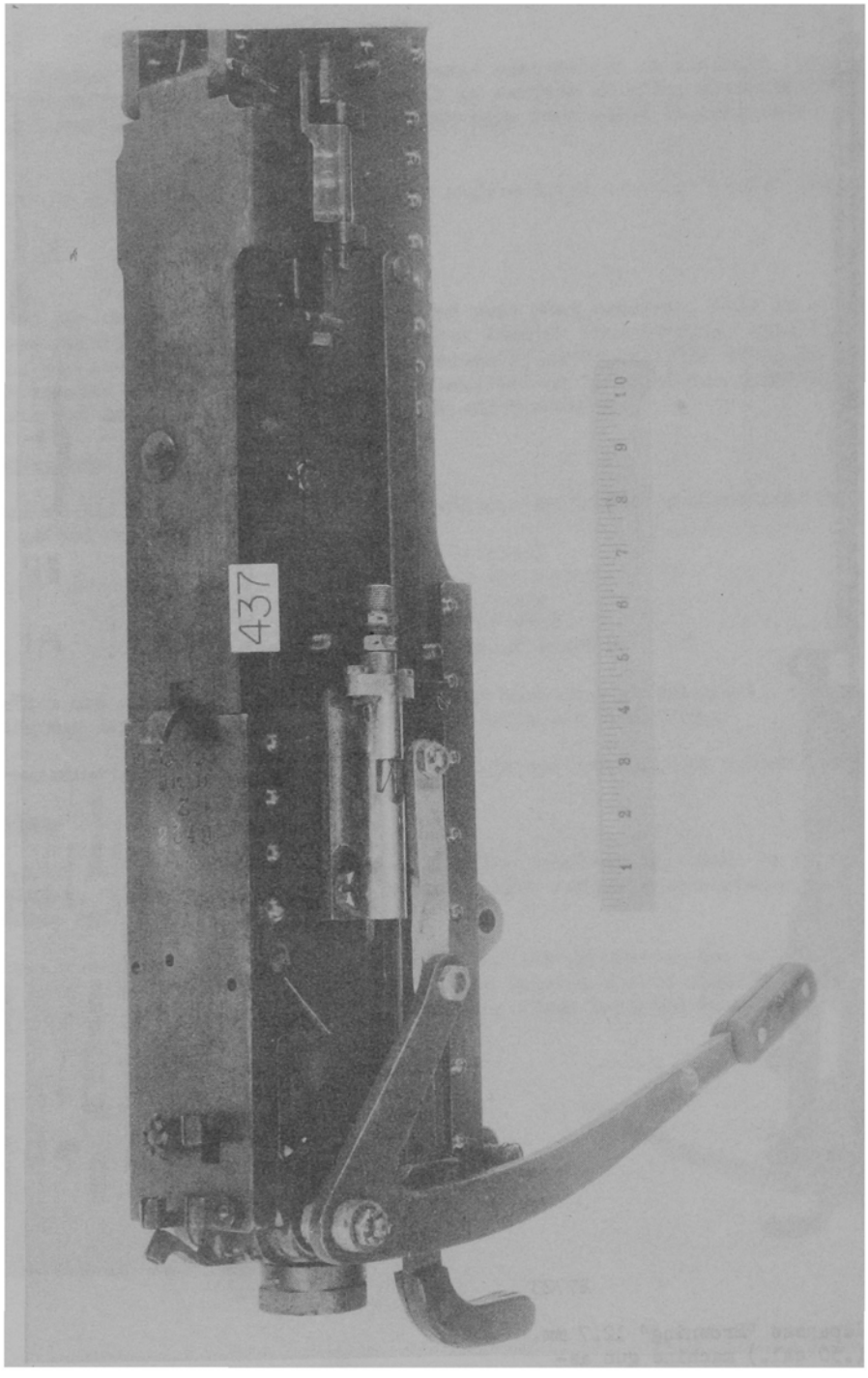
27723

Figure 1. Japanese "Browning" 12.7 mm. (.50 cal.) machine gun as-received. (BMI #437) - (CEE #2950)



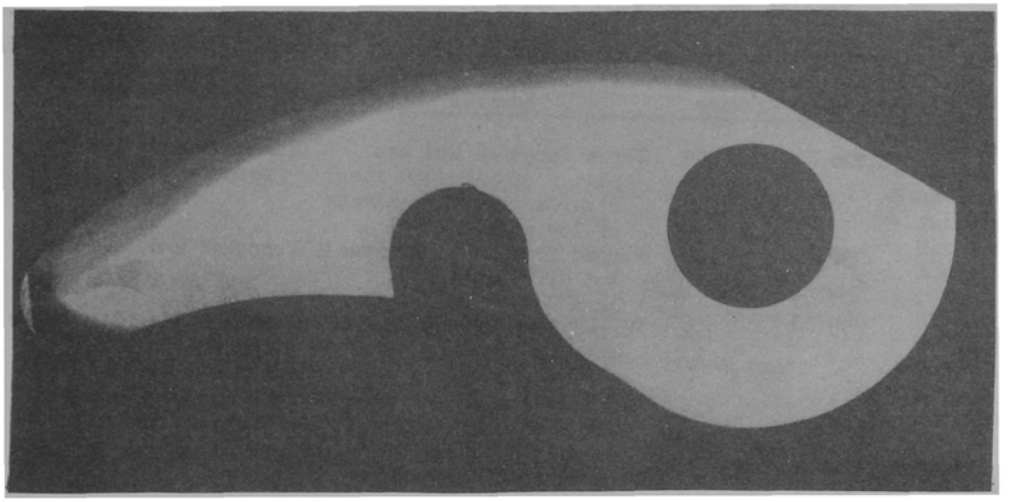
30821

Figure 2. Japanese "Browning" 12.7 mm. machine gun disassembled.



27722

Figure 3. Close-up view of housing assembly attachments



3X 31309

Figure 4. Macroetched view of the accelerator showing flow lines and flame-hardened area.

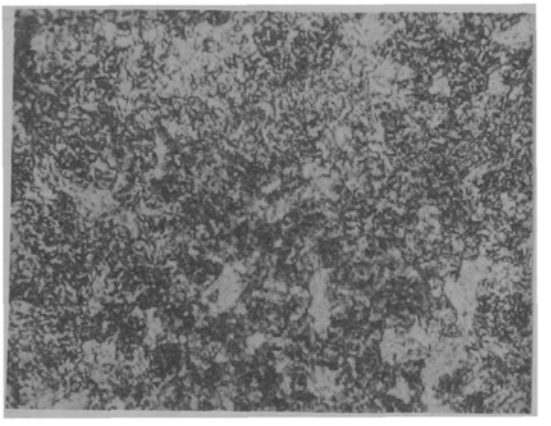


Figure 5. Micrograph of typical tungsten steel core.

Nital Etch 1000X
Vickers Hardness 280

TABLE 1. DETAILS OF MANUFACTURE OF JAPANESE "BROWNING" .50 CALIBER MACHINE GUN (BMI #437 - CEE #2950)

Part No.	Name	Weight, Grams	Hardness, Vickers		Remarks	Microstructure and Heat Treatment
1	Housing Assembly	8,825		248	Three forgings and two plates of SAE 1080 steel riveted together. Rivets of low carbon steel.	Quenched and highly tempered.
2	Housing Cover	736		268	Forged from SAE 1080 steel. Not differentially hardened.	Quenched and tempered.
3	Housing Cover Latch	27		312	Forged from medium carbon steel.	Quenched slightly below the critical range and tempered.
4	Housing Cover Latch Guide	53		258	Two pieces machined from bar stock and fusion welded together.	Quenched and tempered. Heat treated after welding.
5	Housing Cover Latch Spring	7		-	Stamped from high carbon steel sheet.	-
6	Housing Cover Latch Pin	4		536	Cut from medium carbon steel rod.	Quenched and tempered.
7	Housing Cover Guide	127	core case	255 613	Forged from medium carbon steel. Flame hardened case .05" on wearing surface.	Quenched and tempered. Flame heated and quenched.
8	Barrel	2,975		295	Forged from tungsten steel. Rifled bore.	Quenched and tempered.
9	Barrel Extension	1,320	core case	258 689	Forged from tungsten steel. Flame hardened in groove corners only.	Quenched and tempered. Shows small MnS inclusions. Flame hardened.
10	Barrel Jacket	909		220	Machined from SAE 1040 steel bar stock or tubing.	Annealed. Excess MnS inclusions.
11	Barrel Jacket Extension	291		351	Machined from medium carbon steel bar stock or tubing.	Quenched and tempered.
12	Barrel Booster	95		273	Machined from tungsten steel bar stock.	Quenched and tempered.
13	Barrel Booster Retainer	144		267	Machined from medium carbon steel bar stock.	Quenched and tempered.
13A	Barrel Booster Retainer Lock	8		580	Machined from medium carbon steel sheet.	Quenched and slightly tempered.
14	Breech Lock	151	core case	480 733	Machined from tungsten steel bar stock. Flame hardened on top wearing surface.	Quenched and tempered core. Flame heated .065" and quenched.
15	Breech Lock Cam	284		292	Forged from low tungsten steel.	Quenched and tempered.
16	Breech Lock Cam Bolt	38		187	Machined from mild carbon steel bar stock.	Normalized.
17	Breech Lock Depressors	22	core case	505 795	Machined from medium carbon steel bar stock. Flame hardened on wearing surface and chrome plated .00005".	Core quenched slightly below critical range and tempered. Shows undissolved carbides. Case flame heated .08" and quenched.
18	Breech Lock Depressor Pin	1		195	Machined from low carbon steel bar stock.	Normalized. Shows MnS inclusions.
18A	Breech Lock Pin	15		483	Machined from tungsten steel bar stock.	Quenched and tempered.
18B	Breech Lock Spring	-		-	High carbon steel strip.	-

TABLE 1. (CONT.)

Part No.	Name	Weight, Grams	Hardness, Vickers		Remarks	Microstructure and Heat Treatment
19	Belt Feed Cover	84		345	Forged from medium carbon steel bar stock.	Quenched below critical range and tempered. Shows undissolved carbides.
20	Belt Feed Pawl	35		360	Machined from medium carbon steel bar stock.	Quenched below critical range and tempered. Shows undissolved carbides.
21	Belt Feed Pawl Arm			458	Forged from medium carbon steel. Riveted to pawl.	Quenched and tempered. Shows undissolved carbides.
22	Belt Feed Pawl Pins	3		218	Cut from medium carbon steel rod.	Hot rolled and normalized.
23	Belt Feed Pawl Spring	1		-	High carbon steel coiled wire spring.	Cold drawn.
24	Belt Feed Lever	152		337	Forged from medium carbon steel bar stock. Flame hardened on tips. Not differentially hardened.	Quenched below critical range and tempered. Shows MnS inclusions and undissolved carbides. Flame heated .36" and quenched.
25	Belt Feed Lever Bolt	27		295	Machined from medium carbon steel bar stock.	Normalized.
26	Belt Feed Lever Washer	2		200	Cut from low carbon steel sheet.	Rolled and normalized.
27	Cartridge Feed Retainer	22	core case	383 713	Machined from medium carbon steel bar stock. Flame hardened on wearing surface.	Core quenched and tempered. Case flame heated .08" and tempered.
28	Cartridge Feed Hinge Pin	7		174	Machined from medium carbon steel bar stock.	Spheroidized condition.
29	Cartridge Feed Retainer Spring	-		-	High carbon steel coiled wire spring.	Cold drawn.
30	Cartridge Receiver Stop	62		270	Machined from medium carbon steel bar stock.	Quenched and highly tempered. Shows undissolved carbides.
31	Cartridge Receiver Pin	3		-	Low carbon steel.	Hot rolled and normalized steel. Hot headed and annealed.
32	Bolt	1,556		303	Machined from tungsten steel bar stock.	Quenched and tempered.
33	Bolt Decelerator	64	core case	265 713	Machined from tungsten steel bar stock. Flame hardened on wearing surface.	Quenched and tempered. Case heated by flame and quenched.
34	Bolt Decelerator Hinge	19	pin arm	258 168	Pin machined from medium carbon steel bar stock. Arm cut from high carbon steel strip. Pin machined down at head and used as rivet to attach arm.	Pin rolled and normalized. Arm spheroidized.
35	Bolt Decelerator Spring	1		-	High carbon steel coiled wire spring.	Cold drawn.
36	Bolt Decelerator Spring Cap	5		319	Machined from medium carbon steel bar stock.	Quenched and tempered.
37	Bolt Decelerator Spring Cap Locking Pin	37		415	Cut from drawn wire.	Cold drawn.
38	Bolt Release Lever	40		405	Forged from medium carbon steel.	Quenched and tempered.

TABLE 1. (CONT.)

Part No.	Name	Weight, Grams	Hardness, Vickers		Remarks	Microstructure and Heat Treatment
39	Bolt Release Lever Pin	16		490	Machined from tungsten steel bar stock.	Quenched and tempered.
40	Accelerator	168	core case	360 628	Forged from tungsten steel. Flame hardened on wearing surface (see Figure 4).	Core quenched slightly below critical range and tempered. Case flame heated .08" and quenched.
41	Accelerator Pin	27		423	Cut from medium carbon steel rod.	Quenched and tempered. Shows small amounts of undissolved carbides.
42	Accelerator Catch	93	core case	280 700	Forged from tungsten steel. Flame hardened on working surface.	Quenched and highly tempered. Shows titanium nitride and MnS inclusions. Flame hardened .25" and quenched.
43	Accelerator Catch Lock Pin	3		245	Cut from mild carbon steel rod.	Rolled and rapidly cooled.
44	Accelerator Lock Spring	19		510	Cut from high carbon steel sheet.	Quenched and tempered.
45	Firing Pin	13	back point	575 883	Forged from tungsten steel bar stock.	Differentially quenched and uniformly tempered.
46	Firing Pin Spring	11		-	High carbon steel coiled wire spring.	Cold drawn.
47	Firing Pin Spring Container	55		388	Machined from tungsten steel bar stock.	Quenched and tempered. Shows MnS inclusions.
48	Firing Pin Spring Stop Pin	8		379	Cut from medium carbon steel rod. End machined down and used as rivet to attach arm.	Quenched and tempered. Shows excess carbides.
49	Firing Pin Spring Stop Arm			419	Cut from medium carbon steel sheet.	Quenched and tempered. Shows excess carbides and titanium nitride inclusions.
50	Sear	18		395	Forged from Ni-Cr-W steel but not differentially hardened.	Quenched and tempered.
51	Sear Spring	1		-	High carbon steel coiled wire spring.	Cold drawn.
52	Sear Slide	5		395	Machined from low Ni-Cr steel bar stock.	Quenched and tempered.
53	Cocking Lever	17		404	Forged from tungsten steel.	Quenched and tempered.
54	Driving Spring Rod	99		186	Machined from mild carbon steel. Head and rod one piece.	Hot rolled and normalized.
55	Outer Driving Spring	81		608	High carbon steel coiled wire spring.	Cold drawn.
56	Inner Driving Spring	33		-	High carbon steel coiled wire spring.	Cold drawn.
57	Extractor	82	core case	280-379 432	Forged from tungsten steel. Flame hardened and differentially heat treated.	Differentially quenched and uniformly tempered. Flame heated .055" and quenched.
58	Extractor Depressor	16		608	Stamped from high carbon steel sheet.	Quenched and slightly tempered.
59	Extractor Cam Guide	35	core case	312 509	Forged from medium carbon steel.	Quenched and tempered. Flame hardened .04" on edges and quenched.

TABLE 1. (CONT.)

Part No.	Name	Weight, Grams	Hardness, Vickers	Remarks	Microstructure and Heat Treatment
60	Extractor Cam Guide Nut	5	153	Machined from low carbon steel bar stock.	Normalized.
61	Extractor Cam Guide Spring	1	570	High carbon steel wire clip.	Cold drawn.
62	Ejector	9	293	Forged from medium carbon steel bar stock.	Quenched and tempered.
63	Ejector Spring	-	-	High carbon steel coiled wire spring.	Cold drawn.
64	Ejector Pin	1	261	Cut from medium carbon steel rod.	Quenched and highly tempered.
65	Recoil Housing	795	284	Forged from tungsten steel. Carburized case .011".	Quenched slightly below the critical range and tempered. Case is quenched and tempered showing undissolved carbides.
66	Main Recoil Spring	127	362	SAE 1070 Modified steel coiled wire spring.	Cold drawn. Decarburized surface.
67	Secondary Recoil Spring	46	326	SAE 1080 steel coiled wire spring.	Cold drawn.
68	Spring Buffer Tube	146	266	Machined from medium carbon steel bar stock.	Quenched and highly tempered. Shows undissolved carbides.
69	Spring Buffer Tube Rod	45	435	Machined from medium carbon steel bar stock.	Quenched and tempered. Shows MnS inclusions and undissolved carbides.
70	Spring Buffer Tube Guide	33	220	Hot headed from medium carbon steel.	Annealed after heading operation.
71	Spring Buffer Tube Cap	16	179	Machined from mild carbon steel screw stock.	Normalized.
72	Spring Buffer Tube Head	29	302	Machined from low tungsten steel bar stock.	Quenched and tempered. Shows excess carbides.
73	Spring Buffer Tube Inner Spring	8	-	High carbon steel coiled wire spring.	Cold drawn.
74	Spring Buffer Tube Outer Spring	29	562	High carbon steel coiled wire spring.	Cold drawn and tempered. Decarburized .004".
75	Spring Buffer Tube Seat	62	400	Machined from tungsten steel bar stock.	Quenched and tempered. Shows large amounts of MnS inclusions.
76	Spring Buffer Tube Cover	72	core 300 case 700	Machined from SAE 1070 modified steel bar stock. Face flame hardened.	Quenched and tempered. Base flame heated and quenched.
77	Spring Buffer Tube Pin	4	284	Cut from medium carbon steel rod.	Quenched and tempered. Shows signs of decarburization.
78	Auxiliary Buffer Spring	65	500	SAE 1080 steel coiled wire spring.	Quenched and tempered. Decarburized .003".
79	Back Plate	850	300	Forged from SAE 1080 carbon steel.	Quenched and highly tempered. Shows excess carbides.
80	Back Plate Cap	99	144	Machined from medium carbon steel bar stock.	Highly annealed.
81	Back Plate Bolt	111	240	Ditto	Annealed.
82	Back Plate Bolt Nut	5	150	Machined from mild carbon steel bar stock.	Normalized.
83	Back Plate Latch Pin	17	374	Machined from medium carbon steel bar stock.	Quenched and tempered.

TABLE 1. (CONT.)

Part No.	Name	Weight, Grams	Hardness, Vickers		Remarks	Microstructure and Heat Treatment
84	Back Plate Lock Bolt	61		260	Machined from AISI - A5130 steel bar stock.	Normalized.
85	Pin Cocking Lever	11		440	Forged from medium carbon steel.	Quenched and tempered.
86	Trigger Bar Extension	64	core case	385 689	Machined from tungsten steel.	Quenched and tempered. Carburized case .04" on ends.
87	Trigger Bar Extension Pin	17	pin arm	400 175	Pin cut from medium carbon steel bar stock. Arm cut from high carbon steel strip. Pin machined down at head and used as rivet to attach arm.	Pin quenched and tempered. Arm spheroidized.
88	Mechanical Trigger	23		660	Forged from medium carbon steel.	Quenched and slightly tempered.
89	Mechanical Trigger Spring	-		-	High carbon steel coiled wire spring.	
90	Mechanical Trigger Guide	33	weld metal	134 190	Welded bar stock and curved metal of medium carbon steel.	Not heat treated after welding. Normalized.
91	Mechanical Trigger Screws	1		292	Machined from mild carbon steel.	Quenched and highly tempered.
92	Mechanical Trigger Nut	3		-	Cut from mild carbon steel.	-
93	Automatic Trigger	6	core case	365 700	Machined from Ni-Cr steel bar stock.	Quenched and tempered. Carburized .04" deep on tip.
94	Automatic Trigger Retainer	10	core case	376 680	Machined from Ni-Cr steel bar stock.	Quenched and tempered. Carburized on wearing surface .04" deep.
95	Automatic Trigger Piston	30	core case	374 708	Ditto	Ditto
96	Automatic Trigger Spring	8		536	High carbon steel coiled wire spring.	Cold drawn wire.
97	Automatic Trigger Housing	255		124	Machined from low carbon steel bar stock. Nickel plated on exterior .00006".	Annealed.
98	Automatic Trigger Butterfly Nut	25		160	Machined from medium carbon steel bar stock.	Rolled and annealed.
99	Automatic Trigger Pressure By-pass	25	steel copper	164 133	Machined from medium carbon steel bar stock and copper bushed.	Steel normalized. Copper cast.
100	Automatic Trigger Housing Bolts	3		205	Headed from mild carbon steel.	Hot headed and annealed.
101	Automatic Trigger Housing Attachment Bolts	16		-	Headed from mild carbon steel.	Hot headed and annealed.
102	Automatic Trigger Housing Attachment Nuts	11		218	Cut from mild carbon steel bar stock.	Normalized.
103	Automatic Trigger Housing Attachment Washers	4		216	Cut from mild carbon steel bar stock.	Normalized.
104	Hand Cocking Lever	410		200	Hook bent from medium carbon steel.	Normalized.
105	Hand Cocking Lever Stud	18		350	Machined from medium carbon steel bar stock.	Quenched below critical range and tempered.
106	Hand Cocking Lever Pin	11		410	Cut from medium carbon steel rod.	Quenched below critical range and tempered.

TABLE 1. (CONT.)

Part No.	Name	Weight, Grams	Hardness, Vickers	Remarks	Microstructure and Heat Treatment
107	Hand Cocking Lever Front Guide Bracket	29	200	Machined from mild carbon steel plate.	Normalized.
108	Hand Cocking Lever Front Guide Bracket Seat	13	316	Machined from mild carbon steel plate.	Quenched and tempered.
109	Hand Cocking Lever Rear Guide Bracket	37	182	Machined from mild carbon steel plate.	Normalized.
110	Hand Cocking Lever Cap Screws	3	226	Headed from screw stock.	Hot headed and annealed.
111	Auxiliary Hand Cocking Lever	709	100	Cut from rolled plate. Low carbon steel.	Annealed.
112	Auxiliary Hand Cocking Lever Extension	70	136	Ditto Cadmium plated .0002".	Annealed.
113	Auxiliary Hand Cocking Lever Coupling	40	203	Machined from screw stock.	Normalized.
114	Auxiliary Hand Cocking Lever Bolt	7	220	Machined from screw stock.	Normalized.
115	Auxiliary Hand Cocking Lever Bolt	4	250	Machined from screw stock.	Normalized.

TABLE 2. ANALYSES OF SELECTED PARTS OF JAPANESE "BROWNING" MACHINE GUN
(BMI #437 - CEE #2950)

Part No.	Name	Chemical			Spectrographic									
		C	P	S	Mn	Si	Ni	Cr	W	Mo	Cu	Sn	Al	V**	Ti**
1	Housing Assembly	.80	.020	.023	.55	.33	.15	.07	<.01	.016	.29	.11	.009		
8	Barrel	.60	.012	.028	.42	.32	.17	.16	2.23	.011	.24	.014	.030		
9	Barrel Extension	.61	.014	.014	.43	.20	.20	.14	1.89	.019	.31	.065	.053		
12	Barrel Booster	.64	.023	.023	.53	.47	.20	.12	2.08	.020	.28	.071	.012		
14	Breech Lock	.59	.026	.019	.48	.27	.17	.17	2.20	.017	.23	.057	.008		
15	Breech Lock Cam	.71	.020	.022	.45	.28	.17	.21	.58	.017	.23	.090	.013		
18A	Breech Lock Pin	.64	*	.025	.63	.53	.16	.12	1.85	.011	.23	.041	.008		
32	Bolt	.62	.024	.021	.47	.27	.24	.17	1.70	.022	.26	.067	.018		
33	Bolt Decelerator	.70	.034	.019	.44	.30	.20	.20	1.20	.016	.23	.042	.010		
39	Bolt Release Lever Pin	.76	.026	*	.41	.30	.13	.07	2.10	.006	.20	.043	.011		
40	Accelerator	.66	.020	.021	.47	.21	.20	.19	2.05	.26	.26	.050	.018	.026	
42	Accelerator Catch	.68	.034	.021	.44	.29	.21	.11	1.85	.008	.27	.054	.028		
45	Firing Pin	*	*	*	.58	.30	.12	.14	2.05	.013	.25	.036	.015		
47	Firing Pin Spring Container	.75	.025	.016	.42	.37	.14	.19	2.08	.021	.26	.066	.014	.033	
50	Sear	.37	.023	*	.57	.37	3.70	1.54	.08	.11	.33	.12	.019		
53	Cocking Lever	.67	.025	.011	.37	.22	.15	.18	1.70	.025	.22	.053	.014		
57	Extractor	.70	.025	.015	.54	.32	.21	.08	1.88	.012	.23	.045	.015		
65	Recoil Housing	.61	.031	.025	.46	.24	.15	.14	1.84	.017	.24	.056	.015		
66	Main Recoil Spring	.73	.020	*	.28	.23	.05	.09	<.01	.006	<.04	.004	<.005		
67	Secondary Recoil Spring	.81	.030	.037	.62	.34	.06	<.03	<.01	.005	.14	.092	.019		

TABLE 2. (CONT.)

Part No.	Name	Chemical C	P	S	Spectrographic Mn	Si	Ni	Cr	W	Mo	Cu	Sn	Al	V**	Ti**
72	Spring Buffer Tube Head	.88	.038	*	.52	.29	.28	.23	.18	.009	.24	.068	.017		
75	Spring Buffer Tube Seat	.67	.025	.026	.42	.25	.16	.13	1.75	.016	.24	.080	.014		
76	Spring Buffer Rube Cover	.75	.038	.026	.70	.33	.13	.38	<.01	.030	.29	.14	.014		
78	Auxiliary Buffer Spring	.77	.044	.056	.76	.37	.05	<.03	<.01	<.005	.20	.14	.006		
84	Back Plate Lock Bolt	.32	.025	.024	.44	.26	.11	1.03	<.01	.22	.14	.023	.018		
86	Trigger Bar Extension	*	*	*	.52	.32	.18	.17	2.22	<.005	.16	.037	.014		
93	Automatic Trigger	*	*	*	.48	.25	3.29	1.09	<.01	<.005	.33	.058	.010		
94	Automatic Trigger Retainer	*	*	*	.30-.40	.25-.35	3.00-3.50	.90-1.10	<.01	.10-.20	.45-.55	.05-.15	<.005		
95	Automatic Trigger Piston	*	*	*	.48	.26	3.30	1.02	<.01	<.005	.21	.098	<.005		

* Insufficient sample for analysis.
** Vanadium (.004) except where shown. Titanium (.004).

TABLE 3. PHYSICAL TEST DATA* (BMI #437 - CEE #2950)

Part No.	Name	Type Steel	Per Cent Reduction of Area	Per Cent Elongation, In 2"	Yield Strength, p.s.i.	Tensile Strength, p.s.i.	Impact Charpy V-Notch, Ft. Lbs.	Hardness
1	A Housing Plates	SAE 1080	29.2	14.6	91,500	136,000	-	Rc°21
	B		40	17.8	89,000	133,000	-	
8	A Barrel		50.3	23	112,500	134,000	31	Rc°29
	B	2-1/4% Tungsten	49.8	23	112,000	134,000	33	

* Standard .505" x 2" A.S.T.M. specimens.

[redacted]

DISTRIBUTION LIST

	Copies
NAVY	
The Commanding Officer, Naval Air Station, Anacostia 20, D. C.	1
The Commanding Officer, Naval Air Station, Patuxent River, Maryland	2
BuAer, Equipment & Material Section, Room 2W36, Navy Dept.	1
BuAer, Aircraft Maintenance, Navy Department, Room 1N69	1
BuAer, Technical Information, Navy Department, Room 1W54	1
BuAer, Military Requirements, Navy Department, Room 2916	1
BuAer, Armament, Navy Department, Washington, D. C.	1
DCNO (Air), Navy Department, Room 2082	1
Op-16-Z, Munitions Bldg., Room 1226, Attn: Comdr. J. L. Riheldaffer	2
Executive Office of Secretary, Naval Research and Development, Navy Dept., Rm. 0148	1
Naval Liaison Officer, Army Air Forces Board, Orlando, Florida	1
Naval Liaison Officer, Proof Division, Army Proving Ground Command, Eglin Field, Fla.	1
BuOrd, RE-7, Navy Department, Washington, D. C.	1
ARMY	
Military Intelligence Service, Distribution Branch, War Department, Pentagon Bldg., Room 2C-800, Washington, D. C.	4
Headquarters Army Air Forces, Development Engineering Branch, M & S, Washington, D.C.	1
Army Air Forces, Materiel Command, Wright Field, Dayton, Ohio, Attn: Chief Evaluation Branch, Technical Data Laboratory	2
Research and Developments Division, Army Service Forces, Room 4E-632, Pentagon Bldg., Washington, D. C.	4
President, Army Air Forces Board, Orlando, Florida	3
Commanding General, School of Applied Tactics, Orlando, Florida	3
ALLIES	
Air Ministry, AI2(g), Whitehall, London S.W. 1	8
Air Member, New Zealand Joint Staff Mission, Munitions Bldg., Room 2501	2
Canadian Joint Staff, 2222 S Street, Washington, D. C.	
Air Member - Attn: Air Intelligence Office	4
Naval Member - Attn: Naval Intelligence Office	1
British Air Commission, 1785 Mass. Ave., Washington, D. C.	2
Royal Australian Air Force Representative, Munitions Bldg., Room 4503, Washington, D. C.	3
Naval Air Representative, Room 1W11, Navy Department, Washington, D. C.	2
MISCELLANEOUS	
National Bureau of Standards, Conn. Ave. at Upton St., Washington, D. C. Attn: Mr. W. F. Roeser	1
The National Advisory Committee for Aeronautics, 1500 New Hampshire Ave., Washington, D. C.	1
TAI UNITS	
Headquarters, Far East Air Force, A.P.O. 925, c/o Postmaster, San Francisco, Calif., Attn: Technical Air Intelligence Unit	2
ComAirPac, F.P.O., San Francisco, Calif., Attn: Technical Air Intelligence Unit	2
Hq., 14th Air Force, A.P.O. 627, c/o Postmaster, New York City, Attn: Technical Air Intelligence Unit	2
Allied TAI Unit, c/o Naval Liaison Office, A.P.O. 465, New York City, N. Y.	2