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U. S. NAVAL TECHNICAL MISSION TO JAPAN
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From: Chief, Naval Technical Mission to Japan.
To : Chief of Naval Operations.

Subject: Target Report - Japanese Naval Guns and Mounts, Article 2 - AA Machine Guns and Mounts.

Reference: (a)"Intelligence Targets Japan" (DNI) of 4 Sept. 1945.

1. Subject report, covering parts of Targets O-46(N) and O-47(N) of Fascicle O-1 of reference (a), is submitted herewith.

2. The investigation of the target and the target report were accomplished by Lt. Comdr. R. A. Hay, USNR, and Lt. Comdr. R. V. Taborelli, USNR.

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JAPANESE NAVAL GUNS AND MOUNTS
ARTICLE 2
AA MACHINE GUNS AND MOUNTS

"INTELLIGENCE TARGETS JAPAN" (DNI) OF 4 SEPT. 1945

FASCICLE O-1, TARGETS O-46(N) AND O-47(N)

FEBRUARY 1946

U.S. NAVAL TECHNICAL MISSION TO JAPAN

SUMMARY

ORDNANCE TARGETS

JAPANESE NAVAL GUNS AND MOUNTS-ARTICLE 2
AA MACHINE GUNS AND MOUNTS

The machine gun armament used by the Japanese Navy on surface craft, submarines, land bases, and for landing forces ranged in caliber from 40mm to 7.7mm. There were no guns having exceptionally high cyclic rates or muzzle velocities. The 25mm Hotchkiss gun was by far the most important of the six service guns described in this report. The 25mm gun was employed in single, twin, and triple assemblies on practically every type of vessel, constituting a major part of the defense for air strips. The Japanese rated the 25mm gun second only to the 10cm, Type 98 for anti-aircraft defense and considered it to be only slightly less effective. The installation of 40 triple and 30 single mounts of 25mm caliber on the newer battleships and aircraft carriers demonstrates that the Japanese Navy was keeping pace with the other major navies in the policy of increasing tremendously the anti-aircraft defense. However, the development of larger, faster firing guns with more accurate control was practically negligible, in spite of the fact that the need was recognized as early as 1942.

No machine gun mounts were equipped with power drives except some of the 25mm multiple type mounts. All power driven mounts were remote controlled by the Type 95 director and modifications (Shageki Sochi) which is based upon the French "Le Prieur" mechanized sight for computing. Fire control of mounts not having power drives was accomplished by the open ring sight and tracer projectiles. All aiming or control equipment appeared to be deficient for close range attacks of modern high-speed aircraft. The "Le Prieur" sight was not calibrated for sufficiently high target speeds; but even if it had been, the power drives were of insufficient capacity to follow.

The Japanese had recognized the advantage of installing many light-weight, free-swinging mounts. However, the size of the average Japanese man was a handicap in the use of this type of mount. The Japanese had not been able to design a free swinging mount carrying more than one gun, or an easily controllable mount in the 25mm size larger than the triple style. The effectiveness of a number of director-controlled guns was considered superior to that of an equal number of manual-controlled mounts, either handwheel or free swinging types.

All machine guns covered by this report are copies of foreign designs with no radical modifications. The French influence was predominant as a result of several Japanese officers having been sent to France, where they studied designs and production methods.

The scarcity of high quality materials and machine tools prevented satisfactory mass production methods and the adoption of new designs. For example, the 40mm Bofors, which was captured in 1942 and considered a desirable addition to the armament, was not produced in time to be used in the war. Also, the few assemblies completed would not function satisfactorily.

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REFERENCES

Location of Target:

Yokosuka Naval Arsenal.

Kure Naval Arsenal.

Kamega Kubi Naval Ordnance Proving Ground.

KURAHASHI SHIMA (near KURE).

Japanese Personnel who Assisted in Gathering Documents:

Comdr. (Tech) Jiro ICHINOI, IJN

Japanese Personnel Interviewed:

Capt. (Tech) T. YOKOYAMA, IJN - a specialist in the design and production of machine guns and mounts, especially the 25mm, which he studied in France.

Capt. (Tech) F. IWASHIMA, IJN - a gun expert in the Navy Technical Department, TOKYO, in which capacity he was largely responsible for gun research and the planning of gun armament installations of ships.

Capt. (Tech) M. YASUNAMI, IJN - a specialist in machine guns at Kure Naval Arsenal. This officer studied machine guns in France.

Comdr. (Tech) J. ICHINOI, IJN - a specialist in anti-aircraft gun mounts and sights.

Capt. (Tech) M. AKIMOTO, IJN - an ordnance designer familiar with guns and mounts in general.

M. KASHIWABARA - Asst. Engr. at Yokosuka Naval Arsenal. This man was reputedly one of the leading Japanese authorities on the 40mm Bofors gun and mount.

J. MINATO - a ballistician of 20 years experience at the Kure Naval Arsenal.

INTRODUCTION

The object of this investigation was to cover the history, general characteristics, and employment of all caliber machine guns and mounts used on surface craft, submarines, and land bases by the Imperial Japanese Navy. After preliminary investigations disclosed that only two such guns were modern enough to warrant study, the others were treated only from a historical and general standpoint. The two modern guns were the 25mm Hotchkiss and the 40mm Bofors, although the latter was so new to the Japanese naval service that it never actually received service use. The 25mm Hotchkiss was investigated comprehensively because of its widespread use, the high regard in which it was held by the Japanese, and its relative unfamiliarity to the U.S. Navy. The 40mm Bofors was studied from the standpoint of seeking any significant changes in design from that of American models.

In addition to guns and mounts, the associated items of sights, power drives, and ammunition supply equipment are included in the report.

The information presented, except that of the U.S. Army reports, is based on: (1) interrogation of Japanese designers (naval officers and civilian engineers), (2) examination of seized drawings and pamphlets, and (3) a cursory examination of seized equipment. In connection with the interrogations, a questionnaire prepared by the authors was furnished to the Japanese for completion from memory, personal notes, and whatever other means they had at their disposal. The U.S. Army reports were made prior to the end of the war and appear to be based solely on examination of captured equipment.

Information on the 25mm gun is presented in the questionnaire outline form, and is supplemented by U.S. Army Ordnance Technical Intelligence Reports Nos. 34 and 37 appended hereto as Enclosures (A) and (B), respectively. The Army reports, received from the 5250th Technical Intelligence Company, give excellent detailed operating data and instructions for stripping and assembly. The Army reports are based on examination of captured land-base guns and mounts. The equipment was of Navy manufacture and of very similiar design to that used aboard ships. The 25mm guns and mounts sent to the U.S.A. by NavTechJap will be found to differ slightly from these described in the Army reports.

It originally was intended that the same items of information required by the questionnaire would be obtained for all guns. However, because of the unimportance and obsolescence of guns other than the 25mm Hotchkiss and 40mm Bofors, a condensed report will be made for such guns. U.S. Army Ordnance Technical Intelligence Report No. 11, appended hereto as Enclosure (D), is included to supplement the report on the 7.7mm Vickers gun. The Army report covers an aircraft gun, but is pertinent because the basic design of the AA gun was very similiar.

THE REPORT

Part I - GENERAL

A. Development of the Machine Gun Armament Program

1. Total MG armament of the Navy prior to the time of expansion started in 1935

40mm Vickers type ..... approximately 50 guns
12.7mm Vickers type ..... approximately 400 guns
7.7mm Vickers type ..... approximately 700 guns
7.7mm Lewis type ..... approximately 300 guns

All of the above were of foreign design and all were of foreign manufacture, except a few 7.7mm Vickers type guns which were manufactured in Japan after the Navy bought the license in 1930.

2. Important changes made during the expansion years.

a. The 40mm Vickers was declared obsolete and was replaced by the 25mm Hotchkiss.

b. The 13.2mm Hotchkiss replaced the 12.7mm Vickers.

c. Large quantities of 7.7 Lewis guns were imported but the 7.7mm Vickers gun gradually became favored because of its lighter weight, more reliable operation, and higher cyclic rate.

d. Production of the 40mm Bofors was started in 1943 when a sample (captured) was available. War experience showed the need for a larger gun. Production difficulties were many and the war ended prior to its release to service.

3. Production at the start of 1945

25mm mounts (with guns as required) 2100 singles per month
200 twins or triples per month. 13.2mm mounts (with guns as required) 1200 per month.

B. Questionnaire on Employment of Machine Guns with Answers Supplied by Japanese Personnel Interrogated

Q: Which machine gun is the most effective as a AA weapon?
A: The 25mm Hotchkiss, because it was the largest machine gun in service during World War II, and had been developed most extensively.

Q: What naval gun (not necessarily a machine gun) was considered the best AA weapon in World War II?
A: The 65/10cm Type 98 gun.

Q: Were any of the AA machine guns, in the same or similar design, used as aircraft armament?
A: The 7.7mm Lewis was used as a flexible gun and the 7.7mm Vickers as a fixed gun, but both of these were approaching obsolescence for aircraft use and were being replaced. The 25mm Hotchkiss was experimented with as an aircraft gun but abandoned in favor of a 30mm gun of a different type.

Q: Were any of the machine guns, ordinarily regarded as the aircraft type, installed in surface craft and, if so, for what purpose?
A: No. (However, seized drawings showed two such applications; one being a 20mm Oerlikon twin turret on a small speed boat, and the other being a 20mm Oerlikon single, free-swinging mount for only low angle use, on a similar type of vessel. Both of these appeared to be special applications with no outstanding capabilities, so the subject was not pursued further.)

Q: Which AA machine gun has the most rugged and reliable mechanism?
A: The 25mm Hotchkiss was the most reliable, with the 13.2mm Hotchkiss running a close second, since it is basically the same, but apparently not perfected to quite the same degree.

Q: Which is considered more effective, a large number of single free-swinging mounts, or an equal number of guns in mounts with drives?
A: The latter was more effective. (The single free-swinging mounts were less advantageous to the Japanese Navy than to the U.S. Navy because: (1) the mount design and the small stature of the men made the gun more difficult to control, and (2) the Japanese single mounts lacked lead computing sights.)

Q: What measures were being taken to permit more sustained firing?
A: Little progress had been made in this direction. More attention was being given to such obvious matters as the training of the crew and location of the ready ammunition boxes than had formerly been the policy. Water cooling systems were avoided because of the added manufacturing complications and the maintenance difficulties. A crude method of cooling, by placing wet cloths on the barrel, was sometimes practiced. Quick removal of barrels was recognized as being desirable but the designs were not changed to make such action possible. The development of ammunition supply equipment of greater capacity appeared to be nil.

Q: What were the recent tendencies in research and development in machine guns?
A: (1) Increasing the caliber.
(2) Increasing the rate of fire.
(3) Standardization of ammunition for anti-aircraft and aircraft guns, in order to simplify production.
(4) Increasing the muzzle velocity beyond 900 meters/sec. (2950 ft/sec.)

Part II - 25mm HOTCHKISS GUN AND MOUNT

A. History.

1. Origin of design A decision was reached in 1935 to adopt the French 25mm Hotchkiss machine gun to replace the 40mm Vickers gun, which was difficult to manufacture and unsatisfactory for additional reasons. Japaness naval officers and engineers had been to France in the preceding years to study its design and production facilities. An order was placed for a few guns and mounts to be made according to Japanese requirements, specifying a cyclic rate of 180 to 200 shots per minute, and a projectile weight of 250 grams. The guns and mounts, made according to Japanese specifications were known as Type J.

2. Firing trials and beginning of mass production Firing trials were held at YOKOSUKA Naval Arsenal in 1935. Shortly thereafter, mass production was started there.

3. Shipboard installations Shipboard installations in quantity were first made in 1936, using manual drive twin mounts of both French and Japanese manufacture.

4. Important changes in design made by Japan

a. Barrel and Mechanism.

(1) A gun was designed for submarine use, employing numerous parts of stainless steel.

(2) Several parts of the breech mechanism, including the breech casing or receiver, were changed from forgings to castings.

(3) The original flash hider of simple conical type was replaced by the more effective Rheinmetall (German) design.

b. Mount.

(1) A power drive for remote control was devised.

(2) Triple and single mounts were designed and used. The design for the former was completed in 1941; for the latter in 1943.

(3) Submarine mounts of single, twin, and triple types, were designed and used.

5. Japanese design, production, and operation experts

Name	Rank	Specialty*	Position
M. HORI	Rear Adm.	G	Chief of MG Section of Toyokawa Arsenal at wars end.
K. KATSUTA	Rear Adm.	M	Retired 1944
M. MATSUO	Rear Adm.	G&M - p	Navy Technical Department
T. YOKOYAMA	Capt. (Tech)	G&M - p	Navy Technical Department
H. MISHINA	Capt. (Tech)	G&M - p	Navy Technical Department
M. YASUNAMI	Capt. (Tech)	G&M - p	Kure Naval Arsenal
M. NAKAMURA	Lt.Comdr.(Tech)	G&M - p	Yokosuka Naval Arsenal
T. SAJI	Lt.Comdr.(Tech)	G&M - d	Yokosuka Naval Arsenal
S. KIKKAWA	Asst. Engr.	G&M - d	Yokosuka Naval Arsenal
M. KASHIWABRA	Asst. Engr.	G&M - d	Yokosuka Naval Arsenal
K. OISHI	Asst. Engr.	G&M - d	Yokosuka Naval Arsenal
YOSHIZUMI	Asst. Engr.	G&M - o	Yokosuka Gunnery School
KATO	Asst. Engr.	G&M - o	Yokosuka Gunnery School

* G - guns d - design
M - mounts o - operation
p - producer

B. Gun Barrel

1. Type ..... air-cooled

2. Total length ..... 1500mm (59.1")

3. Total weight 43kg (94.816)

4. Rifling details

a. Bore diam. (land to land)-Normal ..... 25mm (0.984")
Actual ..... ±0.04mm
b. Twist ..... right hand, 1 in 25 cals.
c. Number of grooves 12
d. Depth of grooves ..... 0.25mm (0.0098")
e. Length of rifling ..... 1350mm (53.2")

5. Internal ballistics

a. Muzzle velocity ..... 900m/s (2950 ft/sec) using a 250 gram (0.551b) projectile
b. Bore shape ..... straight
c. Designed bore pressure .... 27kg/mm^2 (17.10 long tons/in^2)
d. Charge weight ..... 105 to 110 grams (0.23 to 0.24 lb)

6. Life of barrel. There was evidently no definite figure of rounds fired or gauge reading for determining retirement from service. Figures on barrel life ranging from 3000 to 15,000 equivalent service rounds were obtained from various sources. It was stated that experiments had been conducted at KURE and although poor flight (tumbling) had been expected to commence somewhere between 3000 and 6000 rounds (perhaps based on the French data of 6000 rounds for barrel life), the Japanese estimate was found to be seriously in error. Stable flight was still obtained after over 20,000 rounds of firing. Velocity loss was determined from this experiment to be 150 m/s (492 ft/sec) at 16,000 equivalent service rounds and 220 m/s (710 ft/sec) at 23,000 equivalent service rounds. In the design and use of sights and directors for the 25mm gun the fire control section considered 100 m/s (328 ft/sec) as the maximum acceptable velocity loss. The only gauge used for measuring wear was the star gauge. Thus it appears that the Japanese did not have a standard policy for replacing worn barrels, inasmuch as they lacked a definite criterion for determining barrel life.

7. Construction. The barrel proper is a forging, but is not strictly of monobloc construction, since the cooling-fin jacket serves the additional function of strengthening the breech end. The chemical composition and mechanical properties of the barrel forging steel are as follows.

C	0.55-0.70	P	<0.04
Si	0.2 -0.35	S	<0.04
Mn	0.4 -0.65	Cr	0.5-0.8

Yield strength ..... 70Kg/mm^2 (99,400 psi)
Ultimate strength ..... 100 kg/mm^2 (142,000psi)
Hardness ..... 290 - 340 B H N
Izod impact value ..... 15 ft lb
Elongation ..... >12%
Contraction ..... >35%

8. Attachment to gun mechanism. The gun barrel is only semi-readily exchangeable. Although the barrel is secured to the breech mechanism by screw threads, the gas cylinder connection complicates the removal and installation. The minimum time for exchange is five minutes. Two men, spanner wrenches, and a hammer are required.

9. Flash hider. A flash hider was fitted on all barrels for the purpose of decreasing the flash, blast, and noise. The original simple conical type was gradually being replaced by the Rheinmetall design which

was adopted during the war. The Rheinmetall type also acted as a muzzle brake, but its value as such was negligible (2 or 3mm reduction in recoil).

10. Research projects to increase life. None were in progress at the end of the war. Previously, chrome plating of the bore had been tried, but since the results were not outstanding, the process was not adopted.

C. External Ballistic.

Maximum range ... 7500 meters (8200 yds.) at approx. 50° elevation.
Maximum ordinate ..... 5500 meters (6020 yds.)
Maximum effective range ..... 3000 meters (3280 yds.)

D. Mechanism.

1. Designation ..... Type 96

2. Principal of operation ..... gas

3. Characteristics

a. Cyclic rate: Standard ..... 220 shots/minute
Minimum ..... 200 shots/minute
Maximum ..... 260 shots/minute
b. Length of recoil ..... 110mm (4.33")
c. Weight ..... 72 Kg (159lb)
d. Method of cocking ..... Manual
e. Provision for single fire ..... Provided
f. Provision for changing rate: by changing the gas control valve setting, the rate may be varied between the limits given above. The fourth position is the standard setting.
g. Recoil buffer liquid ..... 600 cc (0.63qt) of equal parts of water and glycerine.

4. Major stoppages.

a. Broken firing pin ..... This stoppage was cleared by installing a spare part, and remedied by improving the heat treatment, shape, and machining during manufacture. The life was increased from the former figure of 250 rounds to 4000 rounds by changing the shape from a long thin point to a nearly conical point.
b. Insufficient recoil ..... This stoppage was cleared by cleaning, lubricating, and hand-fitting the operating parts. In the case of submarine guns, the trouble was never remedied.

5. Safety.

a. Devices

A safety mechanism locks the cocking lever of the rear box of the casing when the indication is on "SAFETY". Also, there is an interlock mechanism at the rear end of the feed box, which automatically locks the breech bolt about 2mm rearward of the cocked position when the magazine has been emptied.

b. Practices

Precautions should be taken to allow for the possibility of a runaway gun. This action was traced to wear which caused an improper shape of the interlock mechanism, resulting in firing being initiated by the shipping of a new magazine.

E. Mount.

1. Types and designations. Single, twin, and triple mounts were in service. Type 96, built in numerous models, was the latest; Type 94 and Type 95 were built in France. A table of the various models in service follows:

Model	No. of Guns	Use	Control
1	Single, twin, & triple	Surface craft and land bases	Single is free swinging, twin and triple have gearing and handwheel control.
2	Twin & triple	Surface craft	Similiar to Model 1.
3	Single	Surface craft	Free swinging.
4	Single, twin, & triple	Submarines	Same as Model 1, however, single mount can be lowered into submarines by hand.
4 mod 1	Single	Submarines	Free swinging. Mount cannot be lowered into submarine.
4 mod 2	Single	Submarines	Free swinging. Mount can be lowered into submarine from remote station by mechanical drive.
5	Twin & triple	Submarines	Manual gear drive.
6	Single	Land use-on 2 wheel carriage	Free swinging.
8	Single	Land use-on 2 wheel carriage	Free swinging.
10	Single	Torpedo boats	Traverse by body inside ring; elevation by manual gear drive.

2. Characteristics.

	Weight	Depression and elevation limits	Train limits
Single	185 Kg (407 lb)	-10° to +85°	None
Twin	1100 Kg (2420 lb)	-10° to +85°	720° for Model 2
Triple	1800 Kg (3960 lb)	-10° to +85°	None

3. Armor. Armor was not usually supplied as part of the mount. An exception is a Ducol steel* shield furnished on some of the multiple mounts of YAMATO class battleships, but even here the primary purpose was protection against blast. Splinter shields were provided around some gun mounts as part of the ship.

*Ducol Steel - approximately equivalent to U.S. High Tensile Steel.

4. Disposal of fired cartridge cases. No special means were provided. When the cases started to pile up, the crew had to sweep them away. Ejection was a problem at high elevation and stoppages were frequent.

5. Firing area control.

a. Firing cut out: In the case of the power driven mounts, a cam arrangement was used to break the firing circuit.

b. Limit stops: Limit stops were used to break the power supply for the driving motors.

c. Cease firing warning: Telephones were provided, but proved to be ineffective.

F. Power Drive.

1. Designation and type: The power drive was not designated separately, but as part of the Type 95 Machine Gun Fire Control Arrangement. The Ward-Leonard system was used on the mount and received signals from the Type 95 director (Shageki Sochi).

2. Control: The methods available were remote only, or manual only.

3. Characteristics.

a. Maximum rate of train (all guns firing) - 18°/ second.
b. Maximum rate of elevation (all guns firing) - 12°/ second.
c. Quantity of driving motors: 2 separate motors were used; 1 for the elevation drive and 1 for the train drive, but of the same design and rating.
d. Rating of driving motors: 1 hp, 220V, 3.6 A, continuous for no load, 10 minutes for half load, and 3 minutes for full load.
e. Protection of power drive from water and dirt: The protection was mediocre. This motor was of the splash proof type. The usual methods of moisture exclusion by felt and paper gaskets, white lead, and grease packing were practiced.

G. Ammunition Supply.

The ammunition supply equipment was of simple design and of small capacity. Fifteen round magazines were used and no loading machinery was provided. Although the cyclic rate was 220 rounds per minute, the small capacity of the magazine and the frequent exchanges necessary reduced the number of rounds that could be fired in a minute to about 110.

H. Sights.

The standard sights used consisted of the following:

1. Le Prieur (commonly call "LPR") mechanical lead computing sight.
2. Open ring sight.
3. Optical ring sight (etched glass).

The Le Prieur sight was used extensively on multiple mounts, either with or without power drives. In the former case, the Le Prieur sight was standby equipment in case the director failed. Because of the complicated construction and the resultant shortage of Le Prieur sights, the policy during the war was to reserve the majority of them for shipboard manual, multiple mounts on which the need was greater. The single open ring type sight was used on single

mounts and all land base mounts. A few optical ring sights were in service, but were considered unsatisfactory.

I. Employment.

1. Inventory. The total quantity of 25mm guns and mounts (all types) manufactured by Japan was stated to be 33,000 and 20,000 respectively.

2. Shipboard installations. The most recent 25mm armament was stated to be as follows:

Type of Ship	Name	No. of Assemblies		
		Triple	Twin	Single
Battleships	YAMATO and MUSASHI	40	None	30
	NAGATO and MUTSU	30	None	30
	ISE and HYUGU	40	None	30
	YAMASHIRO Class, FUSO Class, and KONGO Class	20	6	30
Aircraft Carriers	SHOKAKU and ZUIKAKU	40	None	30
	RYUJO Class and HAYATAKA Class	20	None	30
Cruisers First Class		18	None	16
Cruisers Second Class		12	None	10
Destroyers		4	4	10

General arrangement drawings of the machine gun armament on vessels ranging in size from first class cruisers to suicide motorboats are included in Enclosure (E). Some of these drawings do not represent the latest armament, but they were the most recent available at the time of writing.

3. Ground use.

a. Permanent - Approximately 2500 guns in single, twin, and triple mounts were used in this manner.

b. Portable - Approximately 100 guns in single and twin mounts were used in this manner. The single mounts were moved on two wheel carriages, and the twin mounts on four wheel trucks.

4. Number of men in crew, and duties of each.

Type of Mount	Men	Duties
Triple, manual-controlled	9	1 pointer, 1 trainer, 1 sight setter, and 2 loaders per gun
Twin, manual-controlled	7	Same as above
Single, free swinging	3	1 gun layer, 1 loader, and 1 gun captain

J. Japanese Appraisal of the Deficiencies of the 25mm Assemblies.

The deficiencies are listed below in the decreasing order of seriousness:

1. The multiple mounts cannot be trained and elevated rapidly enough, either by power or manual drive.

2. The sight was inadequate for high speed targets.

3. The vibration is excessive, causing a loss of accuracy in fire control.

4. The capacity of the ammunition supply equipment is too small, causing interrupted fire and a greatly reduced operating rate.

5. The muzzle blast is heavy, creating the problem of protection for personnel and material.

K. Seized Equipment.

Four mounts of each of the three types, complete with guns, were shipped to the U.S.A. from Sasebo Naval Gun Factory, Sasebo Navy Yard, KYUSHU, under the following NavTechJap Equipment Numbers:

Type	NavTechJap Equipment No.
25mm, Type 96, Twin AA MG	JE10-3201-0,1,2,3
25mm, Type 96, Triple AA MG	JE10-3202-0,1,2,3
25mm, Type 96, Single AA MG	JE10-3203-0,1,2,3

A considerable quantity of ammunition of various types, including a plentiful supply of the practice type (inert projectiles) for gun testing, also was seized and shipped.

Part III - 40mm BOFORS GUN AND MOUNT

A. History.

The 40mm Bofors gun was adopted by the Japanese Navy after a sample was made available by the capture of a gun and mount at SINGAPORE in 1942. It was adopted in the sense that drawings were made, production started, and plans made for shipboard installations. However, such installations were not effected, because operation of the guns had not been perfected. Before the assembly was captured in 1942, the Japanese were interested in the Bofors gun, but had little information about it other than that available in catalogs. While the Japanese naval officers were studying machine guns in France during the 1930's, an attempt was made to examine the Bofors, but they were denied the privilege. Firing trials were conducted in the spring of 1943 at the Torigasaki range of the Yokosuka Naval Arsenal. Mass production (5 to 7 guns per month) was attained by October 1944. The guns and mounts were built at the Yokosuka Naval Arsenal and at the private civilian plant, Hitachi Manufacturing Company, HITACHI. The type of assembly manufactured was the U.K. and U.S.A. Army design, which has a single air-cooled gun in a mount having manual elevation and train drives. The major changes in design made by the Japanese were: (1) the increase of barrel length from 2160mm (85.1") to 2400mm (94.57"), and (2) the adoption of the Rheinmetall type of flash hider, which proved to be unsatisfactory. Of the various Japanese personnel interrogated, Mr. M. KASHIWABARA, an assistant engineer at the Yokosuka Naval Arsenal, was found to be most familiar with the Bofors gun.

B. Description.

1. Gun barrel.

a. Designation ..... Type 5 (1945)
b. Cooling ..... Air
c. Total length ..... 2400mm (94.5")
d. Total weight ..... 160Kg (234 lb)
e. Rifling details
Bore diameter (land to land) ..... 40mm (1.575")
Twist ..... right hand, 1 in 30 cals.
Number of grooves 16
Depth of grooves ..... 0.25mm (0.0098")
Length of rifling ..... 2000mm (78.8")
f. Internal ballistics
Muzzle velocity: 900 m/s (2950 ft/sec) using a 2.21 lb projectile. (860 m/s was obtained before increasing the powder charge and barrel length).
Bore shape: straight
Designed bore pressure: 26 Kg/mm^2 (16.50 long tons $/in^2$)
Charge weight: 300 grams (0.665 lb) Japanese powder. (The powder charge of the captured ammunition was 280 grams).
g. Life of barrel ..... unknown
h. Construction ..... monobloc by forging
i. Attachment to mechanism ..... Same as original design
j. Muzzle attachments: Original flash hider was replaced by Rheinmetall design.

2. External ballistics.

a. Maximum range: 10,000 meters (10,900 yards) at approximately 50° elevation.
b. Maximum ordinate: 8000 meters (8750 yards) at 90° elevation.
c. Maximum effective range: 3000 meters (3280 yards). This low value is attributable to poor fuze design. Self-destruction ammuntion was not used.

3. Mechanism.

a. Designation ..... Type 5 (year 1943)
b. Principle of operation ..... Same as original
c. Characteristics
Rate of fire ..... 120 shots per minute
Length of recoil ..... 216mm (8.5")
d. Weight ..... 356 Kg (784 lb)
e. Provision for changing rate: recoil buffer throttling rod adjustment allows an adjustment of ± 10 shots per minute from the standard rate.
f. Major stoppages - Poor manufacturing caused improper seating of rounds and jamming of parts. Starwheels and extractors were frequently mismated.

4. Mount.

a. Designation ..... Type 5 (year 1945)
b. Number of guns 1
c. Drive ..... manual
d. Weight ..... 850 Kg (1870 lb)
e. Depression and elevation limits ..... -10° to $+95^{\circ}$

f. Train limits ..... none
g. Armor ..... none

5. Ammunition supply.

a. Method ..... clip
b. Capacity ..... 4 rounds
c. Lubrication of ammunition ..... Oiling practiced to improve extraction

6. Sight. The simple open sight was used.

C. Seized Equipment. Several 40mm Bofors assemblies of Japanese manufacture were sent to the U.S.A. under NavTechJap Equipment No. JE21-3200.

Part IV - 40mm VICKERS GUN AND MOUNT

A. History.

From the time of its adoption in 1925, until it was declared obsolete in 1935, a few 40mm Vickers machine guns were imported from England each year. In 1935, when the Japanese had decided to replace this 40mm gun with the 25mm Hotchkiss machine gun, there were only about fifty 40mm assemblies installed on ships. The total number of 40mm assemblies in use during World War II was 200.

B. Description.

The antiquity of the models last used by the Japanese makes a thorough description useless and unnecessary; however, for the sake of recognition, a few features (characteristics) are given here.

1. Gun barrel.

a. Type ..... Water-cooled Vickers
b. Over-all length ..... 62 inches
c. Total weight ..... 152 lbs
d. Twist ..... 1 turn in 20 calibers, right hand
e. Grooves ..... 12 of 0.016" depth
f. Chamber ..... slight taper
g. Muzzle velocity ..... 1965 f.s. (2 lb projectile)
h. Bore ..... straight
i. Weight of charge ..... 96 gm
j. Expected life ..... 15,000 e.s.r.
k. Construction ..... monobloc
l. Attachment ..... flash hider

2. External ballistics.

a. Maximum range ..... 6200 yards at 50° elev
b. Maximum ordinate ..... 4200 yards at 85° elev
c. Maximum effective range ..... 3300 yards

3. Mechanism.

a. Type ..... Vickers Recoil
b. Length ..... 36.5"
c. Weight ..... 600 lbs
d. Rate of fire ..... 200 spm

4. Mount.

a. Type ..... Vickers design of singles and twins
b. Weight
Single ..... 1455 lbs
Twin ..... 5190 lbs
c. Travel limits
Train ..... unlimited
Elevation ..... -5° to +85°
d. Working circle (diameter)
Single ..... 126"
Twin ..... 142"
e. Brake load (twin) ..... 2200 lbs
f. Controls ..... all manual, none with power drives

5. Ammunition supply. The rounds were linked into 50-round belts. An attempt to use 100-round belts was unsuccessful.

Part V - 13.2mm HOTCHKISS GUN AND MOUNT

A. History.

When in 1935 the Japanese Navy had decided to manufacture machine guns in order to become independent of foreign countries, the Hotchkiss type of mechanism was most favored by ordnance personnel. Although the major problem at the time was the establishment of facilities for manufacturing the 25mm. Hotchkiss, the 13.2mm Hotchkiss, which was chosen to replace the obsolete 12.7mm Vickers, also warranted facilities for its manufacture. The production of the 13.2mm gun by the Japanese was limited, and the main supply of these guns had to be imported. The intention was, however, to eventually establish sufficient facilities to manufacture all the 13.2mm guns to be used by the Navy. At the end of the war, the production of the 13.2mm machine guns was 1200 per month.

B. Description.

1. Gun barrel.

a. Type ..... Air-cooled
b. Over-all length ..... 39.5"
c. Total weight ..... 43.7 lbs
d. Twist ..... 1 turn in 32 calibers, left hand
e. Grooves ..... 8 of 0.006" depth
f. Chamber ..... tapered
g. Muzzle velocity ..... 2600 f/s (0.12 lb projectile)
h. Bore ..... straight
i. Bore pressure ..... 19.00 long tons per sq. in.
j. Weight of charge ..... 15 grams
k. Attachment to mechanism ..... The barrel is secured to the breech mechanism by screw threads for easy installation and removal. The gas cylinder connections retard the rapid exchange of barrels. Two men using a hammer and a spanner wrench can complete an exchange in five minutes.
l. Flash hider ..... simple cone

2. External ballistics.

a. Maximum range ..... 6550 yds at 50° elevation
b. Maximum ordinate ..... 4350 yds at 85° elevation
c. Maximum effective range ..... 1650 yds

3. Mechanism.

a. Type ..... Hotchkiss gas-operated
b. Length ..... 16"
c. Weight ..... 48.5 lbs
d. Rate of fire ..... 450 spm (adjustable 425 - 475)

4. Mount.

a. Type ..... Japanese 93
b. Weight
Single ..... #1 - 470 lbs #6 - 249 lbs #7 - 249 lbs
Twin ..... 692 lbs
Quad ..... 2565 lbs
c. Travel limits
Train ..... unlimited
Elevation ..... $+85^{\circ}$ -15°
d. Working circle
Single and Twin ..... 79"
Quad ..... 95"

5. Ammunition supply. Magazines of a shape similar to those for the 25mm guns held 30 rounds each.

Part VI - VICKERS 7.7mm GUN AND MOUNT

A. History.

The importation from England of the Vickers 7.7mm machine gun began in 1925. The few that were bought were installed aboard ships. In 1930 the Japanese Navy bought the license to manufacture the Vickers gun, but production was small. Five years after acquiring the license, the Navy had produced only 200 guns; ammunition still was being imported. The decision of the Japanese Navy to produce the 13.2mm Hotchkiss in large quantities relegated the 7.7mm Vickers to the background along with the 7.7mm Lewis.

B. Description.

The general features are given here primarily as aids in recognizing this gun.

1. Gun barrel.

a. Type ..... Water-cooled
b. Over-all length ..... 28.4"
c. Total weight ..... 4 lbs
d. Twist ..... 1 turn in 33 calibers, left hand
e. Grooves ..... 5 of 0.008" depth
f. Chamber ..... slight taper
g. Muzzle velocity ..... 2440 f/s (0.025 lb projectile)
h. Bore ..... straight
i. Weight of charge ..... 2.5 grams

2. External ballistics.

a. Maximum range ..... 4400 yards at 50° elevation
b. Maximum ordinate ..... 3300 yards at 85° elevation
c. Maximum effective range ..... 1000 yards

3. Mechanism.

a.	Type	Vickers Recoil
b.	Length	11.0"
c.	Weight	26.5 lbs
d.	Rate of fire	900 spm

4. Mount.

a.	Type	Japanese 92, Model F
	Tripod of adjustable height 12" to 30"	
b.	Weight	57.3 lbs
c.	Travel limits	
	Train	unlimited
	Elevation	-25° to $+85^{\circ}$
d.	Working Circle (diameter)	78.8"
e.	Brake load	275 lbs
f.	Control	free swinging

5. Ammunition supply. The rounds were used in 100 round belts.

Note: Enclosure (D) describes the Vickers 7.7mm aircraft gun which differs in many details from the water-cooled gun, but is basically similiar to it.

Part VII - LEWIS 7.7mm GUN AND MOUNT

The 7.7mm Lewis machine gun, first adopted in 1925, was imported and never manufactured by the Japanese. In 1935, the Vickers 7.7mm was considered sufficiently better because of its light weight and higher cyclic rate to be the substitute for the Lewis. The plan to replace the Lewis with the Vickers of Japanese manufacture was initiated in 1935, but the supplementary plan to import Lewis guns was also adopted. The imported Lewis guns were intended to offset any shortages during the organization of facilities for the manufacture of the Vickers guns.

The Lewis gun used by the Japanese was not different from the British design, which was also being used by the United States. The insignificance of this gun in all three countries justifies the omission of data describing its design and operation.

ENCLOSURE (A)

JAPANESE 25 MM AA-AT GUN, TYPE 96

5 December 1943

Intelligence Report No. 34
Ordnance Intelligence Section
Office of the Chief Ordnance Officer, USASOS
A.P.O. 501.

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For your information and file.

ALAN C. JOHNSTON,
Major, Ord. Dept.,
Intelligence Officer.

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ENCLOSURE (A), continued

1. DESCRIPTION

The Japanese 25mm AA-AT Type 96, Model 2 gun was made in 1942 and bears a Manufacturer's No. 10423. The nameplate bore the name of Yokosuka Naval Dockyard and Serial No. Yoko No. 1169. This gun is an air cooled, magazine fed, gas and blowback operated weapon. It was found dual mounted on an excellently constructed antiaircraft mount. Triple mounts are known to exist. The recoil of the gun is taken up by two hydrospring recoil cylinders mounted on either side of the weapon and fixed to the mount. A separate report will be issued describing the mount.

This gun was made for naval service, although it was used on a land mount against aircraft and tanks. This weapon had an excellent parkerized finish throughout and was very well constructed.

2. GENERAL DATA

a. Tube

(1)	Caliber (25mm)	0.9875"*
(2)	Length of barrel	59.125"
(3)	Length of rifling	52.375"
(4)	No. of lands	12
(5)	No. of grooves	12
(6)	Width of lands	0.109"
(7)	Width of grooves	0.141"
(8)	Diameter across grooves	1.0045"*
(9)	Depth of grooves	0.0085"
(10)	Twist of lands (uniform)	1 turn per 25.2"
(11)	Twist of lands in degress	7°-30'
(12)	Thickness of barrel (muzzle end)	0.388"*
(13)	Thickness of barrel (breech end)	0.742"*
(14)	Tube contruction	Monobloc
(15)	Length of chamber	4.516"
(16)	Length of forcing cone	0.625"
(17)	Length of neck	0.969"
(18)	Diameter of chamber	1.641"*
(19)	Diameter of chamber tapers to	1.0625"*
(20)	Weight of tube, cooling fins, gas cylinder attachments	88.5 lbs
(21)	Diameter of gas port in tube	0.153"*

b. Fins

(1)	Inside diameter at breech end	2.875"
(2)	Outside diameter at breech end	3.625"
(3)	Depth of fins at breech end	0.375"
(4)	Inside diameter at muzzle end	2.375"
(5)	Outside diameter at muzzle end	3.125"
(6)	Depth of fins at muzzle end	0.375"
(7)	Average thickness of fins	0.375"
(8)	Average air space between fins	0.375"
(9)	Number of fins	36

c. Gas Port

(1)	Diameter of gas port from tube	0.153"*
(2)	Diameter of gas port to gas cylinder	0.153"*
(3)	Diameter of relief ports in regulator needle 3	0.157"*

(4) Calibration on gas port bracket
(nine giving the maximum cyclic rate) 0,1,2,3, 9

Gas Cylinder

(1) Diameter of gas cylinder ..... 1.5625"*
(2) Diameter of gas cylinder inlet ..... 0.235"*
(3) Outside length of gas cylinder ..... 5.4375"
(4) Inside depth of gas cylinder ..... 5.125"

e. General

(1) Overall length of weapon, including flash hider ..... 7' 6.375"
(2) Weight of weapon complete ..... 246 lbs
(3) Model of gun ..... Type 96, Model 2
(4) Date of manufacture 1942
(5) Rate of fire ..... Unknown

f. Magazine and Carrier

(1) Weight of magazine ..... 14 lbs
(2) Number of rounds per magazine 15
(3) Weight of magazine carrier empty ..... 21.0 lbs
(4) Number of magazines in carrier 2

*(Note: Measurements marked with an asterisk were taken with a micrometer)

3. NOMENCLATURE (Figures 1(A), 2(A) and 4(A))

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(2) Rear buffer housing, pin
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(5) Rear buffer plungers
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4. CONSTRUCTION (Figures 1(A), 2(A), 3(A) and 4(A))

a. Tube - The tube proper is of monobloc construction, tapering from the breech to the muzzle end. It contains nine righthand tapered Acme threads, which fix the tube to the receiver. The thread is 0.1875 inches thick at the pitch circle and has a 0.469 inch diameter locking recess. Cooling fins, cast in sections, are pressed over the tube and are fixed in place with tapered pins. The fin sections are not uniform in length, i.e. from the breech end the first section contains 14 fins and is 12 inches long. The second section has only 4 fins and contains the gas cylinder bracket and is 3.125 inches long. The third section contains 11 fins and is 8.5625 inches long. The fourth section contains 4 fins and the gas regulator bracket, and is 3.3125 inches long. The fifth section contains 2 fins and the front sight mount, and is 2 inches long. The fins taper in diameter from a maximum at the receiver end to a minimum at the muzzle end. The diameter across fins at the receiver end is 3.625 inches and the diameter between fins at the receiver end is 2.875 inches. At the muzzle end the diameter across fins is 3.125 inches and the diameter between fins is 2.375 inches. The average thickness of fins is 0.375 inches and the pitch of the fins is 0.750 inches.

The end of the tube is machined to receive the flash hider. Sixteen left hand machine threads fix the flash hider to the barrel.

The gas cylinder and bracket which are an integral part of the second fin section have an overall length of 5.4375 inches and an inside depth of 5.125 inches. The diameter of the gas cylinder is 1.5625 inches and the diameter of the gas inlet is 0.235 inches.

b. Gas Port and Gas Regulator - The gas port adjustment bracket located on the fourth cooling fin increment has a 0.153 inch diameter gas entry port, and a 0.235 inch diameter gas port to gas cylinder. On the front of the gas bracket are detent calibrations marked from 0 to 9, inclusive, in units of one. A gas regulator assembly, composed of the gas regulator and sleeve pinned together with a tapered pin, screws into the gas regulator bracket. The gas regulator is constructed with three 0.157 inch diameter relief parts located at 120° of each other and in the needle (seating) end of the gas regulator, and relieves into the 0.4375 inch discharge port in the gas regulator. The relieved gas is discharged toward the muzzle end of the gun. When adjusting the regulator valve, the maximum gas relief is attained when the arrow on the regulator reads zero,

and therefore the lowest cyclic rate. When the arrow on the regulator knob points to detent nine, the needle valve is seated, and therefore there is no gas relief. This will result in a maximum cyclic rate. Relief is attained by the gas escaping through the three relief ports near the regulator needle base and relieving to atmosphere through the hollow center of the gas regulator. The regulator sleeve knob in knurled.

There is a gas port cleaning plug at the base of the gas port bracket. A 9.5 inch long section of tubing connects the gas port with the gas cylinder.

c. Flash Hider - A tapered flash hider 14.125 inches long fixes to the end of the barrel by a length of left hand thread. The end diameter of this flash hider is 3.0625 inches, and its effective length is 12.125 inches.

d. Gas Piston Cover - To the rear of the gas piston bracket, and connecting to the base of the receiver, is located the gas piston cover. It is built of 0.625 inch steel and is of stamped and welded construction.

e. Receiver - The receiver is of two piece construction, consisting of the receiver proper, and the bottom and slide. The two parts interlock with a "T" sliding joint, and are riveted in place at the front end.

(1) Bottom and slide - The base of the receiver is dove-tailed construction to permit movement in its mount. It contains a 2 inch wide by 13.5 inch long ejection slot located 7 inches back from the barrel end. Near the rear end of the ejection slot are two protruding eyes which mount a rubber bumper. This rubber bumper protects the receiver base from the bruising effects of the ejected shell cases. On top of the base are two slides on which the gas piston slide rides. These slides are 0.375 inches wide by 24.625 inches long and extend back from the barrel end to the receiver.

(2) Receiver proper - The receiver proper is a shaped casting which contains a recess on either side for the driving springs. These recesses are 30.875 inches long, and extend through the length of the receiver housing. It opens to the inside. Outside the right spring of the receiver proper is the operating rack gear slide which is shaped to retain the operating rack gear. Near the top of the inside of the receiver are two bolt slides 23.5625 inches long by 1.03125 inches high by 0.469 inches thick and located on either side of the receiver. They extend forward from the back plate. On these bolt slides, and 16½ inches forward from the back plate, is located the shaped breechlock shoes. They are fixed in place by studs 1.5625 inches in diameter. These studs are staked and fixed in place by 0.3125 inch tapered dowel pins. Immediately ahead of the breech lock shoes is a shaped break in the bolt slide. This break is 1.250 inches long at the top and 3.500 inches long at the bottom. Integral with the receiver proper and located on either side immediately outside the shoes are two shaped recoil coupling brackets 4.3125 inches long by 2.875 inches high by 0.4375 inches thick. On top of the receiver is an opening 11.875 inches long by 3.50 inches wide, shaped to receive the magazine latch assembly. Immediately back of the magazine latch assembly opening and on top of the receiver is a 1.625 inches long by 0.50 inches wide opening shaped to receive the ejector. At the top of the receiver are two eyes which retain the 0.4375 inches pin holding the magazine latch assembly. One and one half inches to the rear of the ejector slot and on top of the receiver is a 1.125 inch square slot into which fits the magazine bolt release

latch. Three-fourths of an inch to the rear of the magazine bolt release latch and on top of the receiver is the shaped trigger safety guide recess and three detent recesses for selective firing positions. On top and to the left rear of the receiver are located the trigger cam stud, safety lever stud, and the trigger arm stud. Nuts and cotter pins lock the former and latter in place.

At the rear of the receiver is a shaped opening into which fits the back plate. A 1.0625 inch pin through the side of the receiver holds the back plate in place. The tube end of the receiver is threaded to receive the tube, and a tube lock stud fixes the tube in place. The ejector is a shaped piece in the top rear of the receiver and operates in the ejector recess in the top of the bolt.

The overall dimensions of the receiver are 31.125 inches long by 5.875 inches wide by 6.75 inches high; total weight is 73 lbs.

Receiver Group

(1) Recoil connecting bracket - The recoil connecting "T" track is on the side of the receiver proper. Attached and braced to the outside of the bracket is a connecting eye which fits into a 0.8125 inch hole drilled into it. The eye accomodates the recoil piston rod connector pin. The casting is 6 inches long by 2.25 inches wide by 2.75 inches high. This recoil connecting bracket is mounted on the opposite side of the charging handle.

(2) Charging rack gear - The charging rack gear fits into a "T" track on the right bottom side of the receiver. At the front inside end of the charging rack gear is the gas piston slide engaging lug. The recess on the inside is solely to lighten the piece. The charging rack gear overall dimensions are 17.75 inches long by 0.75 inches wide by 1.313 inches high, and it has 27 teeth. Length of gear is 13.25 inches.

(3) Recoil connecting bracket and charging handle gear box: - The recoil connecting bracket is the same as one designed above except for being opposite hand and being integral with the charging handle gear box. On the outside of the casting and located at the top center of the recoil connecting bracket is a bracket which accomodates the magazine latch assembly pin. The dimensions of the gear box are 8.50 inches long by 5.375 inches wide by 0.875 inches deep. At the front end of the gear box is a recess 4.875 inches wide by 4.875 inches long by 0.375 inches deep. This recess accomodates the rack drive gear and has 27 teeth. Attached to this rack drive gear is a fixed charging handle pinion gear having 12 teeth. These two gears are retained in the gear box by a stud shaft 0.875 inches in diameter and 1.563 inches long. A second stud spacer 0.875 inches long by 0.875 inches in diameter seats at the rear center end of the gear box and also limits the movement of the segment gear. The charging handle segment gear has a square hole to receive the square shaft of the charging handle. This segment gear has 13 teeth which mesh with the charging handle pinion gear. Its movement is limited by the limit lug, and it rests on a brass flanged bushing bearing.

On top of this gear case and assembly sits the gear case cover, which is fixed in place by the spacer studs and is held together by two 0.375 inches by 0.813 inch counter sunk cap screws, and two 0.375 inch by 1.50 inch and 1.938 inch countersunk bolts with nuts.

The charging handle is 17.5 inches long with a hand grip at its end, a recess at about its center to receive the charging handle plunger latch, and a square shaft which fits into the hole in the segment gear. This handle fits into the rear center hole in the gear case, is held in place with a washer and nut, and is locked with a cotter pin.

g. Bolt Group

(1) Gas piston slide - The gas piston and gas piston slide are one piece that has an overall length of 26.25 inches. The length of the gas piston, including piston rod, is 4.5 inches; the diameter of the piston is 1.594 inches. The piston is constructed with two 0.5625 grooves to provide a seal for the gas pressure. The center of the gas piston slide has an ejector slot corresponding with the ejector slot in the bottom of the receiver. Integral with the slide and attached to the sides of the gas piston slide are the driving spring stops, which fit into the driving spring recesses in the sides of the receiver. On top of the slide and located immediately to the rear of the ejection slot is a bolt limit lug. The opening just behind the bolt limit lug serves only to lighten the construction. Immediately behind this opening is a shaped bolt connecting link recess. Through this section of the gas piston slide is a hole provided for a 0.4375 inch pin which fixes the bolt connector link to the slide. In the bottom of the bolt connector link recess is located the sear engaging insert. The top surface of the gas piston slide between the bolt limit lug and the firing pin securing bracket provides a breech lock cammed surface. At the rear of the gas piston slide is located the firing pin securing bracket.

(2) Firing pin - The firing pin is "T" shaped, 7.125 inches long and 0.3125 inches in diameter, and is held in place by the firing pin securing bracket located on the top rear end of the gas piston slide. This pin is provided with 4 grooves.

(3) Breech lock connecting link - The breech lock connecting link is 3.3125 inches long by 1 inch wide by 1 inch deep, and contains a lightening hole in its center. At the bottom end of the link is a 0.531 inch by 0.469 inch oval hole for the slide-connecting link pin. At the opposite end of the bolt connecting link is a 0.469 inch hole provided for the breech lock connecting pin. The breech lock connecting pin is 3.125 inches long by 0.469 inches in diameter.

(4) Breech lock - The breech lock consists of two matched and shaped sections with overall dimensions of 4.25 inches long by 1.75 inches wide by 1.25 inches thick. Each piece contains a 0.469 inch hole at the rear for the breech lock connecting pin. At the front end of the breech lock section is a 0.406 inch hole provided for a bolt connecting link pin.

(5) Bolt - Located on top of the shaped bolt casting is the ejector recess running the full length of the bolt. Just under the ejector recess is the firing pin guide hole extending through to the face of the bolt. At approximately the center of the bolt is the breech lock connector, through which is a 0.406 inch hole where the breech lock connector pin fixes the bolt to the breech lock. The face of the bolt is recessed 0.1875 inches at the bottom where the extractor is located. Behind this extractor is the extractor spring. This spring has 2.06 inches free length and 0.375 inch diameter coils, constructed from 0.094 inch wire. There are 15 turns. The overall

dimensions of the bolt are 6.875 inches long by 3.125 inches wide by 3.063 inches in height. The weight of the bolt group is 27.5 lbs.

h. Driving Spring Assemblies - The driving spring assemblies consist of four springs, two being used on each side. These are connected by a spring connector in the center. The spring connector is 4 inches long by 0.5625 inches in diameter, with a 0.125 inch wide flange in the center. Each set of springs has 79 and 73 turns, respectively, with free lengths of 23 inches and 21.25 inches. The diameter of the coil is 0.75 inches and it is constructed from 0.094 inch wire.

i. Back Plate Group

(1) Back plate - The overall dimensions of the back plate, including handles, is 7.75 inches wide by 6 inches long by 0.4375 inches thick. Near the top of the back plate is a 0.50 inch hole for the back plate lock plunger. On the front of the piece are two driving spring connectors to which are attached (with pins) the 14.5 inch long driving spring guides. The front side is also provided with two "T" tracks to which is fixed the rear buffer housing.

(2) Rear buffer housing - Overall dimensions of the rear buffer housing are 6.5 inches long by 3.125 inches wide by 5.75 inches high. This housing contains the back plate latch (spring and plunger), and it is shaped to fit the "T" tracks in the front of the back plate. Near the bottom of the rear buffer housing are two shaped recesses provided for the two rear buffer guides. Through the 1.063 inch hole in the center of the housing, a rear buffer housing pin fixes same in place. This pin is 4.75 inches long by 1.063 inches in diameter and contains a spring loaded latch on one end. It holds the rear buffer housing in place in the receiver. A shaped recess in the back buffer housing accomodates the sear actuating arm. A 0.219 inch hole near the bottom of the rear buffer housing retains a pivot pin for the sear actuating arm and also acts as a guide pin for the sear housing. The top of the rear buffer housing is grooved to accomodate the sear actuating arm protector.

(3) Rear buffer discs and plungers - The plungers are 3.125 inches long by 0.25 inches in diameter with a head on one end. Eleven sets of 4 lenticular steel washers per set alternate on the plunger to provide the buffer action to the bolt assembly on recoil. The outside diameter of these washers is 0.75 inches with a thickness of 0.031 inches.

(4) Sear housing - The sear housing is a machine casting which recesses into the bottom of the rear buffer housing and houses the sear and sear spring assembly. Near the front end of this casting is a 0.375 inch hole which accomodates the sear pivot pin. There is also a 0.25 inch hole through which fits the sear stop pin. A 0.625 inch by 0.250 inch slot accomodates a sear actuating arm pivot pin which acts as a guide for the sear housing. Two rear buffer plunger guides are set in two protruding eyes on the outside of the sear housing.

(5) Sear - The sear is 4.25 inches long by 1 inch wide by 0.688 inches thick. Near the front end it has a 0.156 inches deep engaging notch, a 0.375 inch hole which accomodates the sear pivot pin about which the sear actuates, and a recess for the sear spring. The length of the sear pivot pin is 1.594 inches. The free length of the

sear spring is 1.875 inches, outside diameter 0.5 inches, size of wire 0.063 inches, and it has 14 turns.

(6) Sear actuating arm - The sear actuating arm is approximately 6.5 inches long by 1 inch wide and tapers from the sear actuating arm pin hole to the end. The sear actuating arm pin hole is 0.25 inches in diameter.

j. Sear Operating Mechanism

(1) Sear operating arm - The sear operating arm is a V-shaped piece with a roller on its free end and a 0.563 inch hole which mounts on the sear operating arm stud, and a 0.313 inch hole which accomodates a pin that attaches the sear operating arm to the sear operating arm cam.

(2) Sear operating arm cam - The sear operating arm cam is a shaped piece which has a 0.563 inch hole at one end, and mounts on a sear operating arm cam stud. The back end of the sear operating arm cam attaches to the sear operating arm by a pin which rides in a slotted hole measuring 0.156 inches wide by 0.75 inches long.

k. Trigger Safety Selector Latch Assembly - The trigger safety latch assembly is composed of the semi-automatic arm and the selector arm. The two are pinned together at about the center of the semi-automatic arm and the assembly is mounted on the top of the receiver with the semi-automatic arm stud. The selector arm is V-shaped with a spring loaded knob at its base. This spring loaded knob and pin drop into detents in the top of the receiver, giving either safe, or semi-automatic operation.

l. Magazine Latch Assembly

(1) General - The magazine receiver casting has overall dimensions of 15.5 inches long by 4.25 inches wide by 4 inches wide at the forward end. It is shaped to receive the magazine. At the front end is an integral locking lug, and it is shaped at the rear end to receive the magazine latch assembly pin. A cover fits on top of this magazine casting and is held in place by an axis pin. Hinge plates are spot welded to the side of this casting and on top of the cover. Closed and open positions of the cover are maintained by two leaf springs. At the rear of the magazine latch assembly is located the magazine release mechanism comprising:

(a) Magazine latch lever - The magazine latch lever is held in place by the magazine latch lever pin. This magazine latch lever rests against the face of the magazine latch.

(b) Magazine latch - The magazine latch is a shaped piece that rests in the rear of the magazine receiver, its position being determined by the magazine bolt holding spring and plunger.

(c) Magazine bolt holding latch - The magazine bolt holding latch fits into the rear of the magazine and is held in place by the magazine bolt holding latch bushing. The lever arm maintains its position by pressure applied by the magazine bolt holding spring and the plunger, which acts against the face of the lever. On the bottom rear end is the bolt engaging lug. At the front end is a spring loaded plunger which holds the bolt engaging lug down so that it will engage the bolt when the magazine is removed from the gun. Upon assembly of the gun the

magazine latch is held in place by the magazine latch assembly mounting pin, which has an extended lock spring.

m. Front Sight - The front sight is of the open type and dovetails into its mount located at the top and between the front two cooling fins. A spring loaded arm fixes the lower end of the sight into a recess in the mount, thus holding the sight fixed in its mount.

n. Magazine - The magazine housing is of stamped and welded construction and has the following dimensions: 17 inches by 10.5 inches by 3.75 inches in depth. In its sides are four 3.5 inch diameter inspection holes which also serve to lighten the construction. The magazine housing is press formed from 0.085 inch thick sheet iron. Four lugs are welded to the sides of the magazine housing to seat the magazine into the magazine receiver. At the feed end of the magazine is located a shaped ammunition follower which has attached to one end a magazine follower limit latch. To this shaped ammunition follower is a fixed a folding leaf spring. To the other end of the folding leaf spring is attached a spring holding plate which is held in place by the 0.121 inch thick magazine cover plate. A fixing lug in the spring holding plate locks the cover plate in place. The magazine holds 15 rounds when filled, and its empty weight is 14 pounds.

o. Magazine Carrier - The magazine carrying case is 17.25 inches high, 12.5 inches wide, and 9.25 inches deep. It is constructed from 0.042 inch thick sheet metal and lined with 5/16 inch lumber. The carrying case contains wood separating strips, and has a capacity of two magazines. Two 1.5 inch wide leather strips are riveted to the top to act as magazine protectors A self tightening latch locks the cover in place when in a closed position. Two handles are riveted to the side of the carrying case. The weight of this carrying case (empty) is 21 pounds and its finish is navy grey.

5. DISASSEMBLY AND ASSEMBLY (Figures 1(A) and 2(A))

The following disassembly covers the left gun. Slight changes will be necessary for the right gun.

a. Field Stripping

(1) To remove the back plate (9) and rear buffer housing (1), depress the rear buffer housing pin latch (3) to the right. Drive out the rear buffer housing pin (2). Caution must be used in removing this pin, as the driving springs are compressed with considerable tension against the back plate.

(2) Remove back plate (9) to the rear and withdraw with driving spring guides (23).

(3) Pull the charging lever (52) to the rear.

(4) Remove the driving springs (25) and driving spring connectors (24).

(5) Slide the bolt group out the rear of the receiver (84).

b. Detailed Disassembly of Groups

(1) Back plate group

(a) To remove the back plate (9) from the rear buffer housing (1), depress the back plate lock plunger (6), and slide the back plate (9) up from the buffer housing (1).

(b) To remove the driving spring guides (23) from the back plate (9), drift out the driving spring guide pins (24).

(c) To remove the back plate spring (7) and lock plunger (6), drive out the back plate lock plunger pin(8).

(d) To remove the sear housing (10) and the sear actuating arm (11), drive out the sear actuating arm pivot pin (12) to the left.

(e) Slide the sear housing (10) out to the rear of the rear buffer housing (1).

(f) Remove the rear buffer disc (4) and rear buffer plungers (5).

(g) To remove the sear assembly from the sear housing (10), depress the sear (17) and drive out the sear stop pin (18), release the sear (17), and drift out the sear pivot pin (19). Then remove the sear (17) and the sear spring (20).

(h) To remove the sear operating arm protector (21) from the top of the rear buffer housing (1), slide the sear operating arm protector (21) to the rear and left.

(i) To remove the driving springs (25) from the driving spring connectors (26), slide the springs (25) off the connectors (26).

(2) Bolt group

(a) To remove the bolt (28) from the gas piston slide (27), drift out the slide connecting link pin (34), raise the connecting link (32) and the bolt (28) from the gas piston slide (27), and slide forward off the firing pin (35).

(b) To remove the firing pin (35) from the gas piston slide (27), raise pin up and slide to the left.

(c) To remove the breech lock connecting link (32) from the breech locks (30) and (31), drift out the breech lock connecting link pin (33).

(d) To remove the breech lock (30) and (31) from the bolt body (29), drift out the bolt connecting link pin (29).

(e) To remove the extractor (36) and extractor spring (37), compress the extractor spring (37) located in the bottom of the bolt (28) and pry the spring (37) from its recess. Lift out the spring (37) and the extractor (36).

ENCLOSURE (A), continued

(3) Receiver group General

(a) To remove the magazine latch assembly, raise the magazine latch assembly mounting pin spring (41) to a vertical position and pull out.

(b) Lift off the magazine latch assembly.

(4) Detailed disassembly of magazine latch assembly

(a) To remove the magazine latch lever (42), drift out the magazine latch lever pin (43).

(b) Drift out the magazine bolt holding latch bushing (45) to the right, and slide the magazine bolt holding latch (46) to the rear. Pull out the magazine bolt holding latch plunger (47) and spring (48), and slide the magazine latch (49) out in the forward direction.

(c) Remove the magazine receiver cast cover (39) by driving out the axis pin.

(d) Remove the left recoil connecting bracket (50) by driving upwards.

(e) Remove the right recoil connecting bracket and charging handle gear box (51) by driving upwards.

(f) To remove the charging handle (52) from the gear box (51), pull out cotter pin and unscrew the charging lever holding nut. Remove washer located on the back side of the gear box (51). Slide out the charging handle (52).

(g) Remove the four cover holding bolts (58 and 61) and lift off the gear box cover (65).

(h) Remove the charging handle segment gear (53), charging lever pinion gear (54), rack drive gear (62), and also the stud shaft (63) and limit lug (64).

Note: In assembling these gears, the gear markings must correspond.

(i) Move the rack gear slide (66) to rear recesses in track and lift off receiver (84).

(j) To remove the rubber cartridge case bumper (67), remove the rubber cartridge case bumper cotter pin, withdraw pin (69), lift off the cartridge case rubber bumper (67) and bushing (68).

(k) To remove the ejector (49), drive forward.

(l) To remove the sear operating arm (14) and sear operating arm cam (13), pull the cotter pins and take off the nuts (15) and washers (16).

(m) To remove the safety selector latch (22), pull to the safety mark on receiver (84) and pry up.

(5) Miscellaneous group

(a) To remove the gas regulator (70), unscrew counterclockwise to move the sleeve (71) from the gas regulator (70), drift out the gas regulator sleeve pin (72).

(b) Unscrew the gas port cleaning plug (73).

(c) To remove the gas cylinder connector tubing (74), unscrew the couping nuts (75) and remove the gaskets (76).

(d) To remove the sight (82), depress the sight latch (83) and tap sideways.

(e) To remove the tube (78), remove the tube lock stud (79) and unscrew the tube counterclockwise.

(f) Remove flash hider (81) clockwise (lefthand thread).

(g) Remove the gas cylinder cover (77).

(h) To remove the cooling fins (80), drill out the lock pins and remove the sections.

(To assemble this weapon, proceed in the inverse operation)

6. OPERATION

a. General - To operate the gun, place the safety selector latch in safe position (red). Retract the charging handle all the way to the rear until the sear engages. Move the charging handle forward to its locked position. Place loaded magazine in the magazine receiver. Press the magazine down until the magazine latch engages, and the magazine bolt holding latch releases.

Note

(1) The bolt does not go forward until the sear is released.

(2) In the event no magazine is in the magazine receiver, the magazine bolt holding latch must be raised to release the bolt.

Move the safety selector latch to the desired automatic or semi-automatic position (second detent being automatic and the third being semi-automatic).

b. Cycle of Operation (manual operation) - As the charging handle is pulled to the rear, the charging handle segment gear rotates the charging handle pinion which operates the rack drive gear, which in turn operates the rack gear and slide. The piston slide engaging lug located on the front end of the slide engages a lug on the gas piston slide. As the gas piston slide starts to the rear, it operates the breech lock connecting link. As the slide moves to the rear, unlocking of the breech lock commences at about 0.391 inches. At this period the bolt remains stationary. The gas piston slide, moving to the rear, withdraws the firing pin from the face of the bolt; at about 1.563 inches unlocking is completed, and the gas piston and bolt are moving to the rear, compressing the driving spring. As the gas piston slide reaches its rear position, the magazine bolt holding latch, being held down by the magazine latch bolt holding spring and plunger, engages its recess on the top of the bolt. At this

time the sear is cammed down and engages the sear engaging lug on the bottom of the gas piston slide. The bolt has moved to the rear 10.844 inches.

A loaded magazine is inserted into the magazine receiver casting, and as the magazine is pushed down, it contacts the magazine bolt holding latch compressing the magazine bolt holding latch spring, thereby releasing the magazine bolt holding latch from the bolt, and engaging the magazine latch with the magazine.

c. Complete Cycle of Operation - As the sear operating arm cam roller contacts the sear operating arm cam, it forces the sear operating arm cam over, operating the sear operating arm. The sear operating arm being pivoted on the sear operating arm stud, the sear operating arm roller contacts the sear actuating arm pivot pin, and moves to the rear. The bottom of the sear actuating arm contacting the rear of the sear forces the rear end of the sear up and compresses the sear spring. The sear, held in the center by the sear pivot pin, is forced down, releasing the bolt assembly. As the bolt assembly is released it is driven forward by the driving springs. The top of the bolt strips a round from the magazine; the bolt proceeds forward with the round held in the face of the bolt by the extractor, and chambers the round. When the round is chambered, the forward movement of the bolt stops and the gas piston slide continues forward 1.953 inches, operating the breech lock connecting link, which forces the breech lock up into its recesses in the bolt slides. At the same time it forces the firing pin forward through the face of the bolt, firing the round.

The projectile proceeds through the barrel for about 27 inches where it passes the gas port; the gas enters the port and proceeds through the gas connector tubing into the gas cylinder, forcing the gas piston and gas piston slide to the rear. As the gas piston slide moves to the rear approximately 0.391 inches, unlocking commences and the gas piston slide moves rearward. Unlocking is completed at about 1.563 inches. The bolt being unlocked, below back pressure aids in recoil of the bolt assembly. As the bolt assembly moves to the rear and compresses the the driving springs, at about 9.625 inches the rear end of the cartridge case contacts the ejector, forcing the front end of the cartridge case down through the ejection slot in the bottom of the receiver. The bolt and slide assemblies proceed to the rear, where the gas piston slide strikes the rear buffer plungers, compressing the rear buffer discs. This completes one complete cycle.

Note: On semi-automatic fire, the sear would again engage the bolt assembly and hold it to the rear. On automatic fire, the bolt assembly would proceed forward on another cycle of operation.

7. AMMUNITION

a. Ammunition Carrier (Figure 4(A)) - The ammunition carrier, Figure 4(A), is painted grey and holds two magazine. Its cover locks with a tightening latch. The carrier is 17.25 inches high by 12.5 inches wide by 9.25 inches deep and contains a handle on either end for carrying. The carrier is constructed of metal with a wood lining and wood spacers.

b. Magazines (Figure 4(A)) - The magazines measure approximately 17 inches in height by 10.5 inches in width by 3.25 inches in depth. They have a capacity of 15 rounds and are shaped as a segment of a circle. They have a very heavy parkerized finish.

c. Ammunition - The only types of ammunition thus far known to be used in this gun are high explosive and high explosive with tracer. When packed, these rounds are fitted with a plastic nose plug which screws into the fuze cavity. When the ammunition is prepared for use, the nose is removed (in the field) and the separately-packed fuzes screwed into place. These fuzes are of the point-detonating instantaneous, supersensitive type.

d. Color Markings of Projectiles

(1) High explosive: Orange body.

(2) High explosive with tracer: Maroon body; 3mm green band at nose.

The high explosive projectile is loaded with a bursting charge of 13.2 grams of pressed tetryl. Weight with fuze is 243.2 grams.

The high explosive projectile, with tracer, contains an 11.3 gram bursting charge of the following composition:

T.N.T. (slightly impure)	65.8%
Aluminum powder	34.2%

The cavity within the projectile is divided into two sections by a metal septum. The lower cavity, 32mm deep, opens into the cartridge case and contains 9.2 grams of tracer composition, analyzed as:

Sodium nitrate	15.6%
Metallic magnesium	19.7%
Barium peroxide	58.0%
Asphaltic material	5.6%

Weight of the projectile, with fuze, is 250.7 grams.

An unusual feature of both projectiles is the fact that they have two rotating bands, the forward band being slightly smaller in diameter than the rear band. The forward band acts also as the bourrelet. It is believed that the purpose of this design is to reduce wear on the lands near the chamber.

The cartridge case is of the rimless type, made of drawn brass, is bottle-necked, and has a deep extracting groove at the base. The primer is held by an annular crimp, and the neck of the cartridge case is crimped around the rear rotating band of the projectile.

The propelling charge consist of 102 grams of single perforated graphited grains loosely loaded into the case. Grains are 2mm in diameter, and vary in length from 2.5mm to 4.5mm. The perforation is 0.5mm in diameter. Analysis of propellant is:

Nitrocellulose (graphite coated)	95.6%
Dinitrotoluene	2.8%
Centralite (diethyldiphynlurea)	1.6%

The complete round of high explosive ammunition weighs 678.7 grams: high explosive with tracer, 686.2 grams.

(Data on ammunition was obtained from Report R-12, prepared by the U.S. Navy Mobile Explosives Investigation Unit No. 1. Chemical analyses were performed by the 42nd Chemical Laboratory Co., APO 923).

ENCLOSURE (A), continued

8. JAPANESE CHARACTERS TRANSLATED

a. Name Plate on Buffer Plate

(1) Yoko No. 1169

(2) Yokosuka Naval Dockyard

(3) Left gun

(4) Type 96 25mm Machine Gun

(5) Model 2

(6) Date 1942

(7) Manufacturers No. 10423

b. Markings on Top of Receiver (firing regulation)

(1) Single

(2) Continuous

(3) Safety (marked in red)

c. Flash Hider

(1) Release

d. Base Fin-Breech End

(1) Release

e. Below Magazine Bracket Mounting Pin

(1) Release

9. COMMENTS

The weapon is well constructed, though the machining tolerances are not close. It has a very heavy parkerized finish throughout and possesses markings indicating it was designed and constructed for naval service. It is said to be a very effective gun against U.S. aircraft. These guns are known to be used in dual and triple mountings. Any one or all of the individual guns may be operated separately or simultaneously, as each gun functions independently.

A considerable number of these weapons have been found in this theater, principally on air strips.

10. PHOTOGRAPHS

a.	Complete Gun Disassembly	Figure 1(A)
b.	Complete Gun Disassembly Showing Additional Views	Figure 2(A)
c.	Plan, Rear and Front Views of the Assembled Gun	Figure 3(A)

ENCLOSURE (A), continued

d. Magazine Disassembled, Assembled and Carrying Case Figure 4(A)

Photographs were made by U.S. Army Signal Corps Unit, APO 923.

Report by Lt. Jack J. Kriz, T/3 Glenn E. Peterson, and Sgt. C. J. Kusnierek.

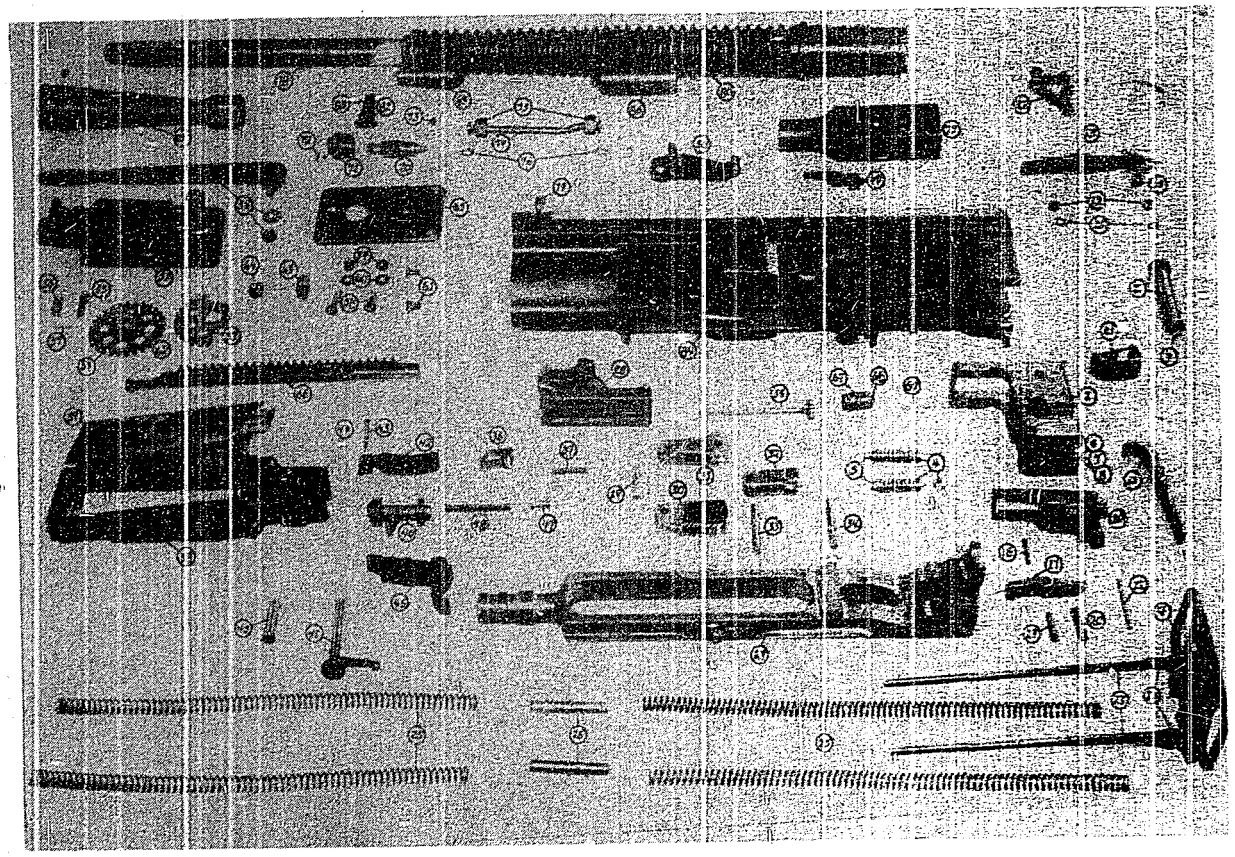
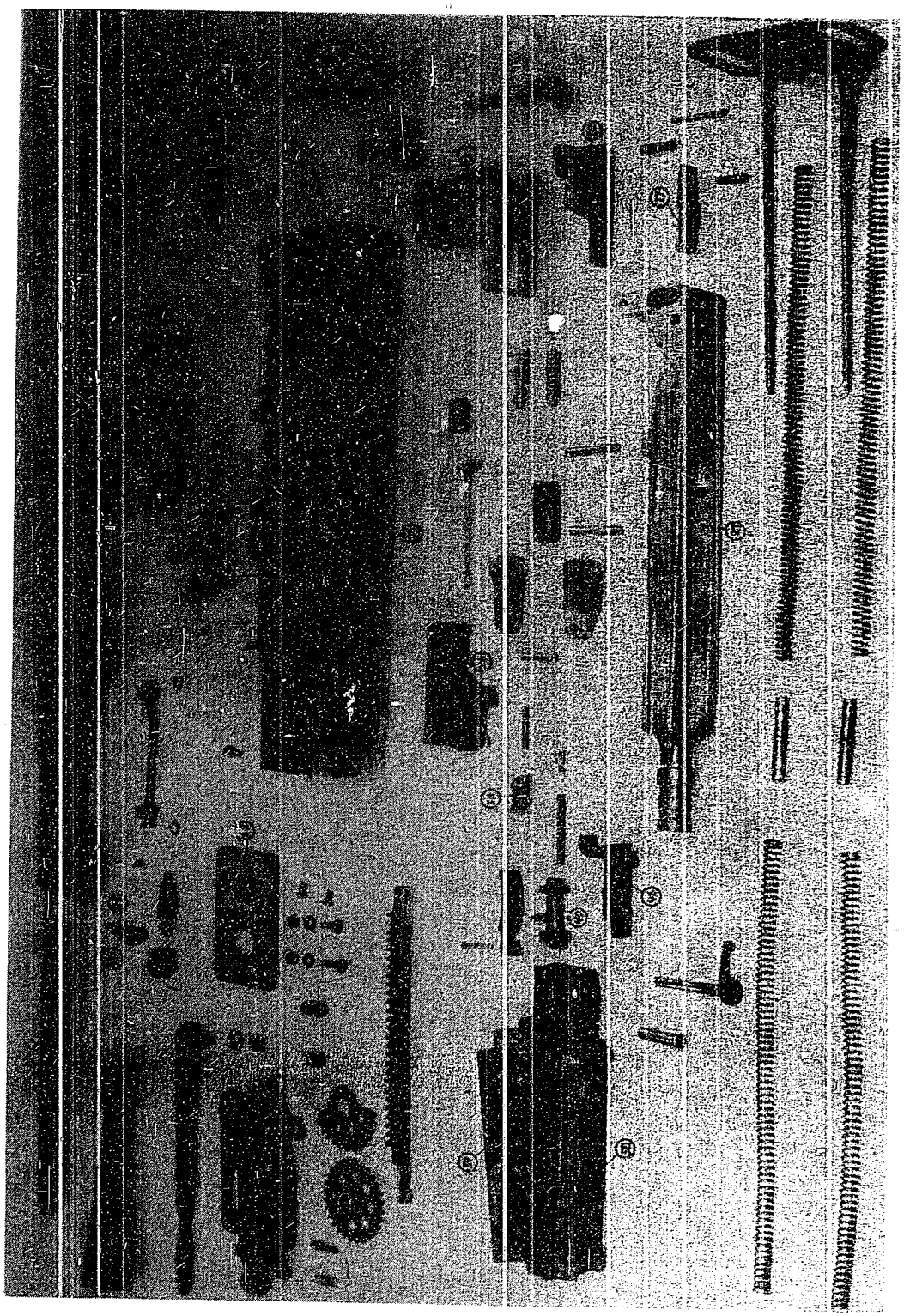


Figure 1(A)

COMPLETE GUN DISASSEMBLY

ENCLOSURE (A), continued



SWETA TRANSLATION UNITWORKS, VARANASI, UTTAR PRADESH
(91% complete)

ENCLOSURE (A), continued

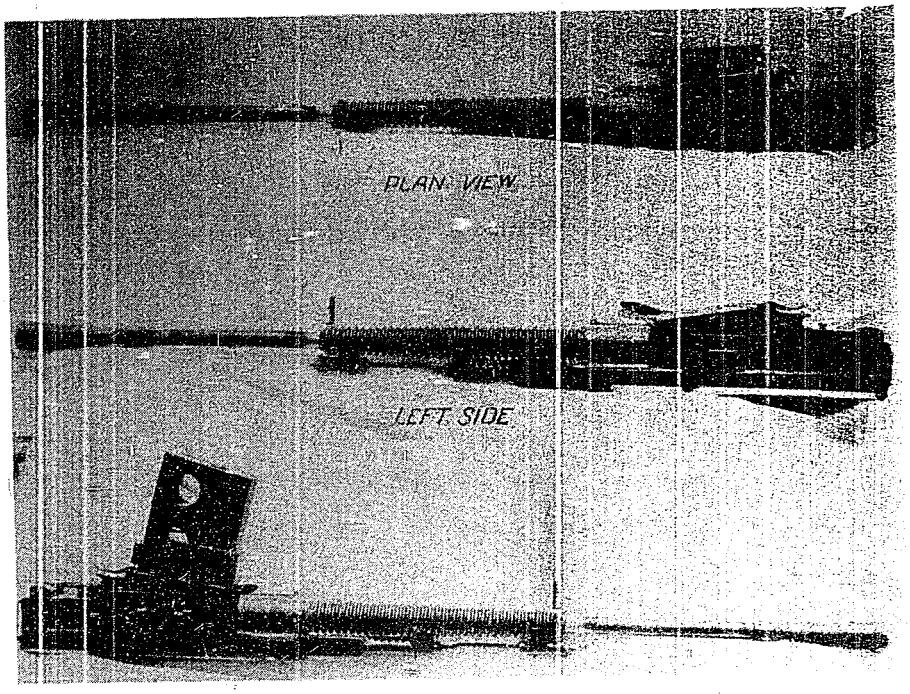


Figure 3(A)

PLAN, REAR AND FRONT VIEWS OF THE ASSEMBLED GUN.

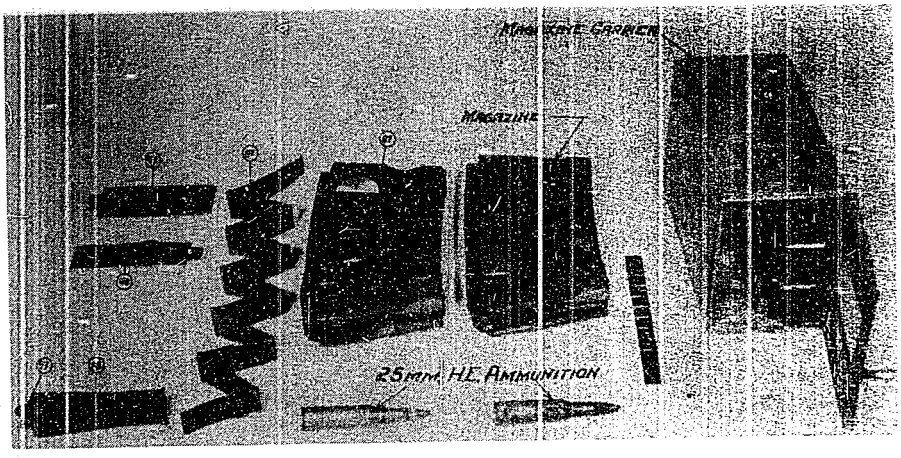


Figure 4(A)

MAGAZINE DISASSEMBLED, ASSEMBLED; AND CARRYING CASE

ENCLOSURE (B)

JAPANESE 25 MM GUN DUAL MOUNT

5 January 1944

Intelligence Report No. 37,
Ordnance Intelligence Section,
Office of the Chief Ordnance Officer, USASOS,
A.P.O. 501

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For your information and file.

ALAN C. JOHNSTON
Major, Ord. Dept.,
Intelligence Officer.

ENCLOSURE (B), continued

TABLE OF CONTENTS

ENCLOSURE (B), continued

1. DESCRIPTION

This Japanese 25mm gun dual mount was designed for naval service. However, it was adapted to a ground stand for protection against aircraft, and as such, is principally used around air strips. The mount is generally found elevated on a stand which is set on a flat solid foundation, usually a concrete pad. When using open sights as shown in the accompanying photographs, Figures 1(B) and 2(B), at least four men are required to operate this gun assembly and mount. Two men load and handle the ammunition, the third handles the traversing mechanism, and the fourth operator undoubtedly directs the operations, handles the elevating mechanism, and fires the guns with his foot controls. The fourth operator may, if he so chooses, also operate the traversing mechanism. A crank and handle is provided for this purpose.

Two 25mm AA-AT Type 96, Model 2 guns, described in Ordnance Intelligence Section Report No. 34 issued by this office, are mounted in a cradle and fixed by pins to four hydro-spring recoil cylinders which are also mounted in the cradle. The cradle is held in the mount by two trunnions, about which elevating action takes place. A segment gear at the bottom of the carriage fixes the position of the weapons and the cradle in elevation anywhere between limits of - 10 degrees to + 80 degrees. It receives its position from a worm which in turn receives its movement from the elevating handwheel through a train of gears and shafts.

Open sights are mounted at the end of two arms (right and left) which in turn are attached to the cradle casting.

To the mount proper is attached the gearing and elevating drive, the traversing mechanism and drive with its gearing and power transmission, pedestals, firing control and its linkage, seats for the operators, equilibrators with its linkage, and connections to a remote fire control.

The traversing mechanism is motivated from the top of the pedestals through a series of gears and shafting to a worm which imparts the movement to the worm wheel fixed to the mount base. This action traverses the mount through 360°.

Firing of the weapons is performed by the gunner, No. 1 man (left side), who also controls elevation and may control traverse. This operation is performed by pressing down on foot pedals which operate through a linkage to the firing mechanism. Each pedal individually operates a gun; i.e., the left pedal operates the left gun and the right pedal operates the right gun.

The operator's seats are constructed of metal with adjustments provided for the comfort of the operators.

Two spring type equilibrators are mounted on the rear of the mount to assist in ease of elevation and depression of the cradle and weapons. Additional gearing on this mount connects to the remote control.

2. DATA

a. Recoil System (Figure 8(B))

(1) Recoil cylinder length ..... 16.938"
Recoil cylinder diameter ..... 2.625"

ENCLOSURE (B), continued

(2) Throttling rod (measurements from threaded head)

	Length	Diameter
At head		0.498"
Maximum diameter of taper	6.375"	0.664"
Taper	0.250"	0.548"
Rod Extension	2.063"	0.474"
Rod extension to end	0.188"	0.330"
Total length from head		

(3) Plunger rod

	Length	Diameter
Tit	0.250"	0.398"
Threaded section	1.500"	0.782"
Small diameter of rod	11.250"	0.866"
Larger diameter of rod taper	5.875"	0.955" to 1.030"
Plunger	0.875"	1.875"
Overall length		19.750"
Diameter of ports in plunger (located at 90°)		4 at .325"

(4) Type of packing ..... Cotton and flax

(5) Recoil fluid

Specific gravity 1.12
Viscosity at 26°C ..... 0.024 Poise
To litmus ..... Acid
Water ..... 49.8% by wt. 55% by vol.
Glycerine ..... 48.3% by wt. 45% by vol.
Residue (principally iron salts) 1.9%

(Chemical analysis by 42nd Chemical Laboratory Co, APO 923).

b. Equilibrator (Figure 7(B))

(1) Equilibrator tube length ..... 19.50 "
diameter outside ..... 2.56 "
inside ..... 2.188"
(2) Length of chain and attached link ..... 23.75 "
(3) Length of plunger rod center line of link pin ..... 21.75 "
(4) Diameter of plunger rod ..... 0.789"
(5) Spring compressed length ..... 18.813"

ENCLOSURE (B), continued

(6)	Spring free length	23.375"
(7)	Spring pitch	0.667"
(8)	Spring diameter of wire	0.319"
(9)	Length of shoulder sleeve	4.375"
(10)	Outer diameter shoulder sleeve	1.250"
(11)	Inner diameter shoulder sleeve	0.750"
(12)	Outer diameter of collar	2.000"
(13)	Outer diameter of neck	1.375"
(14)	Length of sleeve	3.875"
(15)	Length of collar	0.188"
(16)	Length of neck	0.313"
(17)	Outer diameter of bottom sleeve	1.250"
(18)	Inner diameter of bottom sleeve	0.750"
(19)	Outer diameter of shoulder	2.125"
(20)	Length of shoulder	0.563"
(21)	Length of sleeve	3.875"
(22)	Diameter of relief ports in collar	0.188"

(Standard calculated weight at 0.283 lbs per cubic inch, Total weight ..... 786.0 lbs.)

c. Cradle (Figures 16(B) and 17(B))

Maximum elevation	1425 mils
Maximum depression	175 mils
Cradle casting thickness	0.440"
Overall length of cradle	39.5"
Overall width of cradle	21.875"
Approximate depth of cradle	10"
Weight of cradle	302 pounds

Front Slide Bearings

Length	6.312"
Width	1.718"
Depth	1.187"

Rear Slide Bearings

Length	4.718"
Width	1.718"
Depth	1.187"

d. Stand Plate (Figure 9(B))

Weight	450 lbs
Worm wheel outside diameter	32.945"
Stand plate diameter	39.345"
Number of traversing ball bearings	30
Traversing ball bearing diameter	1.125"
Stand plate, approximate thickness	0.812"
Number of worm wheel dowel pins	8
Number of reinforcing ribs	8
Reinforcing rib thickness	0.398"
Rib taper (maximum at pintle)	0.0 to 2"
Number of drain and vent holes	8
Worm wheel thickness	1.016"
Worm wheel depth	1.953"
Axis pintle height	7.062"
Width of lower and upper ball races	1.578"

ENCLOSURE (B), continued

Depth of lower and upper ball races	0.781"
Outside diameter lower and upper ball races	29.825"
Inside diameter lower and upper ball races	26.781"
Outside diameter, ball rearing cage	29.825"
Number of worm wheel teeth	165
Space between ball bearings	1.825"
Worm wheel turns per inch	1.6
Lower radial thrust bearing inside diameter of inner race	4.281"
Holding down ring width (stand plate)	3.125"

e. Carriage (Figures 14(B) and 15(B))

Approximate maximum height	40.25"
Maximum width inside cheeks	22.875"
Maximum length cheek base	31.5"
Cheek front flange width	1.875"
Cheek rear flange width	3.125"
Approximete cheek thickness	0.342"
Diameter lower radial bearing seat recess	7.103"
Diameter lower radial bearing seat recess width	1.5"
Diameter of carriage underside flange	34.349"
Underside carriage flange thickness	.612"
Underside carriage flange width	2.5"
Dampers mounted at intervals	72 degrees
Carriage underside vent hole diameter	4.687"
Carriage traverse	360 degrees

f. Scales

Range of traverse in 1 degree units	0° to +180°
Range of traverse in 1 degree units	0° to -180°
Total traverse	360°
Range of elevation in 1 degree units	-10° to +80°
Total elevation range	90°
Fixed scale on cradle in 1 degree units	+25° to +35°
Total range	10°

Operating ratios

Elevation

Handcrank -- 1 turn equals	61.334 mils
Motor coupling -- 1 turn equals	5.220 mils

Traverse

Handwheel -- 1 turn equals	5.000° in Azimuth
Motor coupling -- 1 turn equals	0.278° in Azimuth

3. NOMENCLATURE

a. Recoil System (Figure 8(B))

(1)	Recoil cylinder	(5)	Recoil spring
(2)	Brass jacketed piston	(6)	Recoil valve
(3)	Piston rod	(7)	Recoil valve rod
(4)	Throttling ports	(8)	Recoil cylinder head

ENCLOSURE (B), continued

(9) Recoil cylinder head locking cotter pin
(10) Recoil cylinder fill plugs
(11) Recoil cylinder packing gland nut
(12) Leather packing ring
(13) Leather packing ring cage
(14) Cotton rope packing
(15) Brass packing gland
(16) Recoil connector attachment
(17) Recoil connector attachment taper pin

b. Equilibrator (Figure 7(B))

(18) Equilibrator tube
(19) Equilibrator tube base
(20) Equilibrator tube base drain plug
(21) Equilibrator tube mounting bracket
(22) Equilibrator tube mounting bracket studs
(23) Equilibrator spring
(24) Head bushing
(25) Base bushing
(26) Equilibrator rod
(27) Base bushing washer
(28) Base bushing nut
(29) Base bushing nut cotter pin
(30) Silent link chain
(31) Attachment lug
(32) Equilibrator cover
(33) Equilibrator cover mounting studs
(34) Equilibrator cover mounting studs washers
(35) Silent chain cover
(36) Silent chain cover mounting screws

c. Traversing Mechanism (Figures 6(B) and 15(B))

(37) Handwheel retaining nut
(38) Hand wheel
(39) Right traversing shaft housing
(40) Retaining nut locking screw
(41) Bearing retaining nut
(42) Upper ball bearing
(43) Bearing spacer
(44) Thrust bearing
(45) Manual traversing clutch
(46) Clutch yoke bearing
(47) Floating jaw
(48) Vertical traversing shaft
(49) Keys
(50) Thrust bearings
(51) Vertical shaft bevel gear ball bearings
(52) Right drive bevel gear
(53) Lower vertical shaft ball bearing
(54) Bevel gear lock washer
(55) Bevel lock nut
(56) Horizontal shaft housing
(57) Brake handle
(58) Brake bolt
(59) Brake shoes
(60) Brake spring
(61) Horizontal driven bevel gear lock nut
(62) Horizontal bevel gear lock washer
(63) Horizontal driven bevel gear
(64) Horizontal shaft
(65) Horizontal shaft outer ball bearing
(66) Bearing spacer
(67) Horizontal shaft ball bearing
(68) Internal gear clutch
(69) Clutch bevel gear
(70) Clutch yoke
(71) Yoke spacer
(72) Clutch control and shaft
(73) Spur gear inner bearing
(74) Horizontal drive spur gear
(75) Lock washer
(76) Horizontal spur gear lock nut
(77) Clutch bevel gear thrust bearing
(78) Worm drive assembly
(79) Traversing worm shaft coupling
(80) Traversing worm
(81) Traversing worm housing
(82) Remote control gear box
(83) Remote control gear box cover
(84) Remote drive connector housing
(85) Remote control connector
(86) Remote control connector coupling
(87) Remote control internal shaft coupling
(88) Shaft coupling bearing

ENCLOSURE (B), continued

(89) Remote drive spur gear
(90) Remote drive spur gear washer
(91) Remote drive spur gear lock nut
(92) Driven spur gear
(93) Clutch bevel gear drive
(94) Clutch bevel gear drive bearing
(95) Clutch bevel gear drive outside bearing
(96) Clutch bevel gear thrust bearing
(97) Clutch bevel gear drive lock washer
(98) Clutch bevel gear drive lock nut
(99) Azimuth drive spur gear
(100) Azimuth drive shaft
(101) Bearing spacer
(102) Azimuth drive shaft bearing
(103) Lock washer
(104) Lock nut
(105) Cover
(106) Azimuth idler gear
(107) Idler gear bearing
(108) Idler gear bearing spacer
(109) Idler gear lock nut
(110) Idler gear retaining cover
(111) Azimith worm
(112) Azimuth worm ball bearing
(113) Azimuth bearing retaining nut
(114) Worm drive spur gear
(115) Worm drive gear lock nut
(116) Azimuth shaft connector
(117) Azimuth shaft housing
(118) Shaft bearing retaining nut
(119) Upper azimuth shaft ball bearing
(120) Azimuth shaft
(121) Thrust bearing
(122) Lower Azimuth shaft ball bearing
(123) Azimuth worm gear
(124) Worm gear spacer
(125) Azimuth shaft lock washer
(126) Azimuth shaft lock nut
(127) Azimuth idler gear cover plate
(128) Azimuth shaft lower cover plate
(129) Azimuth worm outer cover plate
(130) Elevating crank section
(131) Elevating crank shaft bearing nut
(132) Elevating crank shaft ball bearing
(133) Left traversing column housing
(134) Foot rest bracket bolt
(135) Traversing column bolts
(136) Left horizontal shaft housing
(137) Cover plate screws
(138) Housing cover plate
(139) Bracket (azimuth housing)
(140) Cover plate
(141) Left vertical shaft drive gear
(142) Upper vertical shaft ball bearing
(143) Outer elevating crank shaft ball bearing
(144) Elevating crank shaft bearing retaining nut
(145) Left traversing drive spur gear
(146) Traversing drive bearings
(147) Bearing spacer
(148) Lock washer
(149) Traversing drive shaft lock nut
(150) Vertical traversing drive shaft
(151) Vertical shaft lower thrust bearing
(152) Vertical shaft lower roller bearing
(153) Vertical shaft bevel drive gear
(154) Vertical shaft bevel gear retaining washer
(155) Bevel gear lock screw
(156) Horizontal bevel gear lock screw
(157) Horizontal bevel gear retaining washer
(158) Horizontal shaft bevel drive gear
(159) Horizontal shaft thrust bearing
(160) Bearing spacer
(161) Horizontal shaft outer ball bearing
(162) Left horizontal traversing shaft
(163) Horizontal shaft inner ball bearing
(164) Left traversing worm drive spur gear
(165) Spur gear lock washer
(166) Spur gear lock nut

ENCLOSURE (B), continued

(167) Traversing worm drive assembly
(168) Traversing shaft worm coupling
(169) Left azimuth spiral drive gear
(170) Left azimuth spiral driven gear
(171) Left azimuth shaft ball bearing
(172) Azimuth shaft lower bearing retaining washer
(173) Azimuth shaft bearing washer lock screw
(174) Left azimuth shaft coupling
(175) Coupling retaining washer
(176) Azimuth gear assembly cover

d. Elevating Mechanism (Figures 2(B) and 13(B))

(177) Elevating gear train housing cover
(178) Elevating bell crank
(179) Elevating crank section
(180) Elevating crank bearing retaining nut
(181) Elevating crank shaft bearing
(182) Bearing spacer
(183) Elevating crank shaft lock washer
(184) Elevating crank shaft lock nut
(185) Elevating drive spur gear
(186) Screw (inside)
(187) Retaining washer (inside)
(188) Ball bearing (inside)
(189) Spur idler gear
(190) Outside ball bearing
(191) Outside lock nut
(192) Idler spur gear cover plate
(193) Worm drive spur gear
(194) Worm drive spur gear lock nut
(195) Floating spur gear manual operation
(196) Clutch yoke
(197) Clutch yoke bolt
(198) Clutch handle
(199) Worm drive shaft ball bearing
(200) Bearing retaining washer
(201) Bearing retaining washer lock screw
(202) Worm drive shaft outside cover
(203) Inside lock screw
(204) Inside bearing retaining washer
(205) Inside ball bearings
(206) Motive idler spur gear
(207) Motive idler gear outside bearing
(208) Idler gear lock nut
(209) Idler gear outside cover
(210) Motive drive shaft connector collar
(211) Motive drive shaft connector
(212) Motive drive shaft coupling
(213) Motive drive inside coupling and shaft
(214) Drive shaft ball bearing
(215) Motive drive shaft gear lock nut
(216) Motive power driving spur gear
(217) Motive power driving spur gear idler
(218) Motive drive spur idler lock nut
(219) Bevel drive gear ball bearing
(220) Drive bevel gear and shaft
(221) Floating bevel gear
(222) Horizontal elevating drive shaft
(223) Floating bevel gear thrust bearing
(224) Motive gear box cover
(225) Retaining washer
(226) Lock screw
(227) Horizontal shaft outside cover plate
(228) Sliding internal gear clutch
(229) Horizontal shaft inside bearing
(230) Horizontal shaft driven spur gear
(231) Horizontal shaft driven gear washer
(232) Horizontal shaft driven spur gear nut
(233) Motive gear box cover
(234) End bearing on drive bevel gear and shaft
(235) Motive drive shaft outside bearing

(236) Motive drive shaft outside thrust bearing
(237) Horizontal shaft brake assembly
(238) Brake handle
(239) Clutch handle and shaft
(240) Clutch shaft spacers
(241) Clutch yoke
(242) Left vertical azimuth shaft cover

e. Cradle (Figures 16(B) and 17(B))

(243) Brass gear arc
(244) Gear arc counter sunk studs
(245) Gear dowel pins
(246) Gear arc bracket
(247) Gear arc bracket bolts
(248) Left firing linkage arm
(249) Right firing linkage arm
(250) Trunnion
(251) Depression limit bracket
(252) Sight mounting arm
(253) Back plate holding pin recess
(254) Slide bearing bolts
(255) Handle attachment
(256) Front slide bearings
(257) Rear slide bearings
(258) Recoil mechanism mount
(259) Recoil mechanism locking latch
(260) Recoil mechanism
(261) Gun counter recoil limit
(262) Tapered locking pin hole
(263) Left firing linkage spring
(264) Right firing linkage spring
(265) Left firing linkage
(266) Right firing linkage
(267) Cradle

f. Carriage Front View and Traverse Disassembly (Figure 15(B))

(268) Fire control mount
(269) Equilibrator cam lock nut
(270) Trunnion collar
(271) Trunnion bearing seat
(272) Right carriage cheek
(273) Left carriage cheek
(274) Elevating worm drive shaft housing
(275) Self aligning slipper bearing
(276) Elevation indicator shaft housing
(277) Shaft indicator bevel gear
(278) Elevating gear box
(279) Elevating worm bracket
(280) Remote control gear box bolts
(281) Damper cover
(282) Damper plunger
(283) Damper spring
(284) Damper guide and adjusting nut
(285) Damper recess
(286) Firing pedal mount shaft
(287) Firing pedal mount shaft bearings
(288) Traversing worm wheel
(289) Carriage stand plate
(290) Bearing retaining nut lock screw
(291) Left and right bearing retaining nut
(292) Left and right thrust bearing bushing
(293) Left and right thrust bearing
(294) Left and right inner bearing spacers
(295) Left and right inner ball bearings
(296) Left traversing worm bearing housing
(297) Traversing worm drive spur gear
(298) Traversing worm drive shaft bearings
(299) Traversing worm drive shaft bearings spacer
(300) Traversing worm drive coupling
(301) Traversing worm washer
(302) Traversing worm lock nu.
(303) Traversing worm lock nut pin

g. Carriage Stand Plate (Figure 9(B))

(304) Mounting hole
(305) Worm wheel locking dowels
(306) Worm wheel flange
(307) Ball bearings
(308) Ball bearing cage
(309) Bottom bearing race
(310) Drain holes
(311) Lower radial bearing seat

ENCLOSURE (B), continued

(312) Axis pintle
(313) Lower radial thrust bearing
(314) Upper radial thrust bearing
(315) Thrust bearing assembly
(316) Bearing spacer
(317) Base ribs
(318) Carriage bearing race
(319) Carriage ribs
(320) Carriage race flange
(321) Lower radial bearing recess
(322) Ring cover
(323) Vent hole
(324) Vent hole cover

h. Carriage Left Side View (Figures 10(B) and 13(B))

(325) Trunnion collar bolt
(326) Trunnion tube plug
(327) Trunnion bearing
(328) Elevating gear train housing
(329) Rear cheek flange
(330) Tube line
(331) Carriage worm wheel guide bracket
(332) Traversing gear mechanism housing
(333) Traversing worm drive washer
(334) Traversing worm drive nut
(335) Left firing tube shaft
(336) Left firing arm
(337) Firing assembly mounting bracket
(338) Motive drive inside shaft cover
(339) Driven shaft cover
(350) Left traversing crank
(351) Equilibrator
(352) Remote control firing linkage
(353) Firing linkage spring
(354) Left sea mount
(355) Motive elevating gear box
(356) Right firing pedal
(357) Left firing pedal
(358) Left operator's foot rest

i. Carriage (Right Side View)(Figures 3(B) and 12(B))

(340) Housing bracket bolts
(341) Conduit outlet cover
(342) Traversing gear box housing
(343) Worm drive assembly outlet
(344) Right firing control cover
(345) Traversing worm drive shaft washer
(346) Traversing worm drive shaft lock nut
(347) Equilibrator cam
(348) Right side seat
(349) Right operator's foot rest

j. Carriage Front and Rear View (Figures 11(B) and 14(B))

(359) Left operator's seat
(360) Right and left equilibrator mounts
(361) Right and left lower equilibrator mounts
(362) Elevating worm
(363) Elevation limit
(364) Elevating worm mount bracket screws
(365) Duct bracket
(366) Elevating worm needle bearing
(367) Needle bearing retaining cap
(368) Duct gasket
(369) Duct cover cap

4. CONSTRUCTION

a. Elevating Mechanism (Figures 5(B) and 13(B))

The elevating crank section (130) reclines in the top of the left traversing column housing (133) and rides in ball bearings (181) which are separated by spacer (182), and the assembly fixes the elevating crank bearing retaining nut (180). This crank section (130) is fixed to the elevating bell crank (179) with a screw. Elevating handle (178) fits loosely over the coupling and forms the hand grip for the elevating bell crank. The

bell crank extends through the elevating gear train housing (177), where it rides on a ball bearing (190) and is fixed with a retainer nut. Elevating driving spur gear (185) is attached to the shaft and locked by nut (184) and washer (183). Meshing with the driving spur gear is a driven spur idler gear (189) which rides on bearing (188) that is fixed by washer (187) and set screw (186) on the inside. On the outside of its trunnions mount the bearing (190), which is fixed by nut (191) cover plate (192), prevents dust etc. from entering this assembly.

Elevating drive shaft spur gear (193) receives its movement from idler (189) and in turn transfers the movement to the shaft which carries it to the elevating worm. Worm drive spur gear lock nut (194) fixes the spur gear (193) to shaft. Floating spur gear (195) also rides on the shaft, and has fixed to collar on the outside a yoke (196) that is held by the yoke bolt (197) and receives movement from the clutch handle (198). The assembly rides on bearing (199) which is fixed in place by washer (200), lock screw (201), and enclosed with cover (202). The floating spur gear engages or disengages the manual operating gear train from the elevating mechanism.

The motive idler spur gear (206) is supported on the inside by bearing (205) which in turn is locked by retainer washer (204) and screw (203). On the outside it rides on bearing (207) which is locked by lock nut (208) and the assembly enclosed by cover (209).

Motive power when used attaches to the outside half of the coupling (211), which in turn is connected to the inside half of the coupling (213) through the self-aligning washer (212). These couplings are fixed to the housing by the collar (210). The inner half of the coupling rides in ball bearing (214), and has keyed onto the coupling shaft the motive power driving pinion gear (216), which is locked by nut (215). The driving pinion (216) meshes with the motive power idler (217), which is in turn keyed to the drive bevel gear shaft (220) and locked with nuts (218). The bevel gear rides on bearing (219) and the bevel gear (220) drives the floating bevel gear (221) that rides on the horizontal elevating shaft (222). Mounted on the horizontal shaft (222) and between the floating bevel gear (221) and the motive gear box cover (224) is thrust bearing (223). This assembly is fixed by retaining washer (225) and lock screw (226). Cover plate (227) encloses the end of the shaft. On the inside of the floating bevel gear (221) is the sliding internal gear clutch (228), the ball bearing (229), and the horizontal shaft spur gear (230), which is fixed by washer (231) and nut (232). Horizontal shaft spur gear (230) meshes with idler spur gear (206).

The horizontal shaft brake assembly (237) and brake handle (238) may control the rate or lock the entire elevating mechanism. Clutch handle and shaft (239), clutch shaft spacers (240) and clutch yoke and shoes (241) forms the assembly that gives movement to the sliding internal gear clutch which in turn engages the elevating control to the remote drive.

b. Azimuth Gear (Figures 6(B) and 15(B))

The complete traversing mechanism of the Japanese 25mm dual mount may be seen in Figure 6(B). Mounted on the vertical traversing shaft (48), which is housed in the right traversing shaft housing (39), is the hand wheel (38) fixed by handwheel retaining nut (37). The shaft and handwheel being supported near the top of the housing by thrust bearing (44), bearing spacer (43), upper ball bearing (42) and locked by bearing retaining nut (41) and retaining nut locking screw (40). Two keys (49) seat in key ways near the lower end of the vertical traversing shaft (48). Over these keys

rides the floating jaw, which engages in jaws of the right drive bevel gear (52). The engaging for manual operation by handwheel (38) is accomplished by movement of the manual traversing clutch assembly (45) and (46), which mounts near the lower end of the right traversing shaft housing. The shaft and vertical bevel drive gears ride in bearings (50) and (51). Below the right drive bevel gear (52) and on shaft (48) is mounted a bearing (53) and the assembly fixed by washer (54) and nut (55).

The right traversing shaft housing and its assembly is mounted on the horizontal shaft housing (56) by four studs. The horizontal shaft housing contains the traversing brake assembly, comprised of brake handle (57), brake bolt (58), brake shoes (59), and the brake spring (60). In addition, the housing contains the horizontal shaft (64) and its assembly. This assembly entails the horizontal driven bevel gear (63) fixed to the shaft by washer (62) and nut (61). The shaft is supported by bearings and spacers (65), (66), and (67).

The horizontal shaft housing (56) bolts to the remote control gear box (82) by six bolts and the horizontal shaft assembly extends into it. The assembly at the inner end of the horizontal shaft engages with the internal gear clutch (68) which is controlled by the clutch assembly comprised of the clutch control and shaft (72) spacers (71) and clutch yoke (70). Bevel gear (69) idles on the shaft when not engaged. Bearings (73) and (77) support the shaft. Horizontal spur gear (74) is locked to the shaft by washer (75) and nut (76). This spur gear meshes with the spur gear on the worm drive assembly (78) and transfers movement through the right self-aligning coupling (79) to the traversing worm (80). Traversing worm (80) meshes with the worm wheel on the stand plate giving movement in traverse to the mount.

The right side of the mount sustains a remote control gear box (82) which houses the remote gearing. This gear mechanism is similar to the elevating remote control gearing described in the elevating construction paragraph. The counterpart of this assembly is the remote coupling assembly consisting of the connector housing (84), outer coupling half (85), self aligning washer (86), inner coupling and shaft (87), shaft coupling bearings (88), remote spur gear (89), locked with washer (90) and nut (91). The driven spur gear (89) drives idler (92) which is mounted on the clutch bevel gear drive (93). The clutch bevel gear drive (93) drives the clutch bevel gear (69). The integral shaft of the clutch bevel gear drive rides in bearings (94, 95, and 96), and the assembly is fixed by washer (97) and nut (98).

Attached to the traversing gear train is the traversing indicator assembly which makes one complete turn per 360 degree travel of the mount. This traversing indicator is comprised of the Azimuth drive spur gear (99) mounted on shaft (100) which rides on bearings (102) separated by spacer (101). This shaft assembly is locked by washer (103) and nut (104), and inclosed by end plate (105). Azimuth drive spur gear (99) meshes with Azimuth idler gear (106) and its integral shaft. This idler shaft (106) rides in bearings (107) separated by spacer (108) and the assembly is locked by nut (109). This assembly is protected from the weather by cover (110). Driven by idler gear (106) is the worm drive spur gear (114) which is fixed on worm shaft (111). This shaft rides on bearing (112) which is fixed by retaining nut (113) and the assembly fixed by nut (115).

Azimuth indicator housing (117) mounts on top of the azimuth worm shaft housing (139) with eight studs. Contained in this housing is the azimuth shaft (120) which is supported on the upper end by bearing (119) and retaining nut (118). Connector coupling (116) is screwed and pinned to the top of the azimuth indicator shaft. The lower end of the azimuth

shaft (120) rides on bearings (121 and 122) and has fixed to it worm wheel (123) and spacer (124). This assembly is fixed by washer (125) and nut (126). Cover plates (127, 128, and 129) enclose their respective assemblies.

When traversing operations are effected from the left hand side of the mount, a crank handle is mounted upon the square end of left traversing drive (145) which protrudes vertically from the top of the left traversing column housing (133). The integral shaft on the left traversing drive (145) rides in bearing (146) with spacer (147) and the assembly is fixed with washer (148) and nut (149) and the assembly covered by cover plate (140). The left traversing drive spur gear (145) meshes with vertical shaft spur gear (141) giving movement to the vertical traversing drive shaft (150). This assembly is encased in the left column housing (133) and is supported at the top by bearing (143) and retainer nut (144). The lower end of the vertical rides in bearings (151) and (152) and has bevel gear (153) attached and fixed with washer (154) and lock screw (155). Vertical shaft bevel gear (153) meshes with bevel gear (158) on horizontal shaft. The horizontal traversing shaft outer end rides on bearings (159 and 161) with spacer (160). This assembly is fixed by washer (157) and lock screw (156). The inner end of the horizontal traversing shaft (162) supports the spiral drive gear (169), the left worm drive spur gear (164), bearing (163); the assembly is locked by washer (165) and lock nut (166). Traversing worm drive spur gear (164) drives the spur gear on the traversing worm drive assembly (167) which transfers movement through the couplings and the self-aligning washer (168) to the worm (80) which gives movement to the mount.

Spiral gear (169) meshes with spiral gear (170) whose integral shaft rides on bearings (171). The bottom assembly is fixed by washer (172) and lock screw (173). Cover (176) encloses this assembly from the elements. The top shaft extension rides in bearing (171), and has a fire control washer (175) and coupling (174) attached. The left foot rest is held to the left traversing column housing (133) by the foot rest bracket bolt (134).

c. Recoil System (Figure 8(B))

The recoil system used on the 25mm dual mount is of the hydro-spring type. The recoil cylinder (1) is shaped to lock into the cradle. A brass jacketed piston (2) is fixed to steel piston rod (3) by six set screws in the end of the piston. Four throttling ports (4) are drilled through the base of the piston. Recoil valve rod (7), which is screwed into recoil cylinder head (3) and fixed by recoil cylinder head locking cotter pin (9), functions by movement in recoil valve (6), which is screwed into the end of the piston rod. Recoil spring (5) fits over the piston rod (3) and is fixed in place by recoil cylinder packing gland nut (11). Leather packing ring (12) and leather packing ring cage (13) fits into the inside of the recoil cylinder packing gland nut. Brass packing gland (15) and cotton rope packing (14) seal the recoil cylinder packing gland nut and piston rod from leaking when in operation. The recoil connector attachment (16) screws onto the end of the piston rod and is fixed by the recoil connector attachment taper pin (17). The recoil system is filled with its fluid medium through the two recoil cylinder fill plugs (10).

d. Equilibrator (Figure 7(B))

The dual mount is equipped with two equilibrators of the coil spring type to facilitate the elevation and depression of the gun mount. The equilibrators are mounted on the rear frame and attached to the cradle trunnions by means of a silent chain (30) and attachment lug (31). The silent chain

ENCLOSURE (B), continued

connects to the equilibrator rod (26), which maintains the equilibrator spring (23) between the head bushing (24) and the base bushing (25). Four small holes drilled through the base bushing provide equalization of pressure on either side of the base bushing, and also for drainage of condensation, surplus oil, etc. Washer (27), nut (28), and cotter pin (29) fix the assembly. The equilibrator tube (18) retains the assembly between the equilibrator tube base (19) and the equilibrator cover (32). Drain plug (20) screws into the equilibrator tube base. The equilibrator is attached to the mount by equilibrator tube mounting bracket (21), four equilibrator tube mounting studs (22), the mounting plate fixed to the equilibrator cover, and its studs (33) and washers (34). When mounted, silent chain cover (35) is fixed to the head bushing by the three silent chain cover mounting screws (36).

e. Stand Plate (Figure 9(B))

The stand plate is a circular casting upon which the mount functions and which supports the entire mount assembly. Six mounting holes (304) located near the periphery of the casting afford means for anchoring. Also near the edge is a machined flange (306) to which is fixed the brass traversing worm wheel (288) by eight dowel pins (305). Immediately inside the machined flange is the bottom ball bearing race (309) which supports the 36 ball bearings (307) and cage (308). Also inside the stand plate are eight equally spaced 0.75 inch drain holes (310) and eight base ribs (317) which taper from a height of two inches at hub to the base at the race. The hollow hub (312) is integral with the stand plate, providing an inlet for any electrical leads as well as an air circulating vent. It is 7.062 inches high and machined with two diameters to afford bearing surfaces for the lower radial thrust bearing (313). The upper part of the hub (312) supports the thrust bearing (315), spacer (316), and the upper radial ball bearing (314) in this sequence. These latter bearings are mounted after the mount proper is installed, and are locked by two spanner head nuts.

The base of the mount proper accomodates the top ball bearing race (318), vent (323), vent cover (324), and ring cover (322). The lower radial bearing recess (321) is machined to receive the lower radial bearing (314). Damper plunger (282) insures a smooth even operation of the mount in traverse. The base of the mount proper is reinforced with eight carriage ribs (319).

f. Left Side View (Figures 10(B) and 13(B))

The left assembly shows the left equilibrator (351), equilibrator silent chain cover (35), and the cam (347) which causes the equilibrator to function properly. The fire control mount (268) and the open sight mounting arm (252) are located above the equilibrator mechanism as is shown the recoil systems (26). The brass gear arc (243) is shown in the elevated position. In the position shown, the bell crank (350) can drive the carriage in traverse. It may also be installed on the square exposed shaft at the end of the housing, at which point it may be used to assist in elevation of the cradle. The left seat mount (354) supports a seat for the No. 1 Man who operates the elevation handwheel and who may operate the traversing hand wheel. His feet rest in the foot rests, (358) and when firing, the left foot depresses the left firing pedal (357), which acts through the left side firing mechanism (248) to fire the left gun. Depressing of the right pedal (356) will travel through the right firing linkage and cause the right gun to fire. The motive elevating gear assembly is assembled in gear box (355).

The left side elevation (Figure 13(B)) shows rear flange (329), left lubricating line (339), left equilibrator idler (369), trunnion bearing (327), bearing cap mounting bolt (325), trunnion tube plug (326), left firing

linkage (248), and the elevating gear train disassembly housed in the elevating gear train housing (328), and the traversing gear train mechanism housed in the traversing gear train housing (332).

The elevating gear train consisting of the elevating crank section (179), elevating drive spur gear (185), spur idler gear (189), worm drive spur gear (193), floating spur gear (manual operation) (195), motive operated idler spur gear (206), and the motive gear box shown inside the housing which indicates motive gear box cover (233). The elevating gear train housing cover (177) encloses this gear train. Clutch handle (198) selects the drive, i.e., motive or manual. Motive drive inside shaft cover (338), and driven shaft cover (339), seal their respective assemblies and must be removed before disassembly can be effected.

Enclosed in the left traversing gear housing (332) is the traversing worm drive spur gear (297) fixed to shaft by washer (333) and nut (334). Contained in its cover and attached housing (136) is the left firing tube shaft (335), left firing arm (336), and the firing assembly mounting bracket (337).

g. Front View (Figures 11(B) and 15(B))

In the front elevation (Figure 11(B)) may be seen the four recoil cylinders (260), two being used with each gun. The right and left silent chains (30) are fixed to the cam and the cams locked in place by the equilibrator cam lock nut (269). The elevating bell crank (178) and traversing hand wheel (38) provide movement of the mount. A bell crank on left traversing drive shaft (145) permits the carriage to be traversed from the left side of the mount. Seat (348) and foot rest (349) are provided for the No. 2 operator who keeps the mount lined up in azimuth. Seat (359) and foot rest (358) are provided for the No. 1 operator and gunner who keeps the mount lined up in elevation with bell crank (178) and fires both guns with foot pedals (356) and (357). Clutch handle (72) provides change from manual to external drive of the mount in azimuth. Brake handle (57) fixed the mount in any desired position. Gear box (83) contains the gears for remote control of the mount in azimuth. Gear box (233) houses the gears for remote control of the mount in elevation. Worm housing (81) houses the worm mechanism which traverses the mount.

The front elevation (Figure 15(B)) and partial disassembly shows the recesses (268) for the fire control mount, the right equilibrator idler (269), trunnion collar (270), trunnion bearing seat (271), right (272) and left (271) carriage cheeks, self-aligning slipper bearings (275), elevating indicator shaft housing (276), and indicator bevel gear (277). The floating spur gear manual drive (195) drives through a shaft in elevating worm drive shaft housing (274) to the bevel gears, which in turn drive the elevating worm. The carriage has two dampers; one in assembly under (281), the other parts shown are the damper plunger (282), damper spring (283), and damper guide and adjusting nut (284). This assembly fits in the damper recess (285), and is covered to prevent dust and rain from entering. The firing pedal mount shaft (286) and its bearings (287) are shown on the outside of the lower left cheek.

The worm wheel drive housing and its disassembly is shown below the carriage. The left and right traversing worm drive spur gear (297) is fixed to the worm drive assembly (78), carrying with it two shaft bearings (298), the shaft bearing spacer (299) and the traversing worm drive coupling (300). This assembly mounts in their recesses in the lower portion of the right and left cheeks on the carriage.

The traversing worm drive (80) contacts and drives the traversing worm wheel (288). It is held in the housing by the left traversing worm bearing housing (296), left and right inner ball bearings (295), spacers (294), thrust bearings (293), thrust bearing bushings (292), and the bearing retaining nuts (291). Also fixed to the worm gear shaft are the left and right traversing worm shaft couplings (79), which are fixed in place by washers (301), nuts (302), and taper pins (303). Self aligning coupling washers (79) connect the worm drive assembly (78) to the worm gear and shaft (80).

h Right Side View (Figures 3(B) and 12(B))

The right elevation view (Figure 12(B)) shows the right cheek of the mount, mounted on the stand plate (289). Attached to this right cheek is the lubrication tubing (330) which feeds the ball bearings (307). Seven carriage worm wheel brackets (331) are mounted about the worm wheel and fix the mount in place. The firing linkage (49) controls the firing of the right gun. The additional mechanism noted at the center of this linkage is used when firing from a remote control. Cover plate (341) covers the conduit entry when electrically connected. The shaft indicator bevel gear (277) connects through a housing which is fastened by tuds (340) to an indicator which indicates the elevation of the cradle. The traversing gear box housing (342) retains the traversing gear train and the traversing worm drive coupling (300), assembly comprised bearings (298), traversing worm drive shaft spacer (299), traversing worm drive spur gear (297), washer (345) and lock nut (346). The right firing control cover (344) seals the bearing against external contaminants.

The right assembly view (Figure 3(B)) shows the cradle in the depressed position. The fill plugs (10) are used in charging the recoil cylinders. The open sights are mounted in the recesses (252) and the fire control is mounted on the segment (268). The left firing linkage (265) is mounted on the cradle (267). The equilibrator rod (26) is shown in the extended position with the silent chain riding over the idler (269) and cam (347). The firing linkage (349) operates the right gun. The azimuth indicator shaft operates inside the azimuth indicator shaft housing (117), completing one revolution to each revolution of the mount. No. 2 operator sits in seat (348) and uses the foot rests (349). He operates only the traversing hand wheel (38), and keeps the guns on the target in azimuth. When the mount is operated in azimuth from external source, it operates through the gear train housing (82), at which time the clutch (72) disconnects the manual by operating gears.

i. Rear View (Figure 14(B))

The rear elevation shows the mount on the stand plate (289) with the right and left cheeks and the shaped supports of the elevating mechanism. The shaped cheeks have reinforcing flanges about their edges. On the flanges, rear side, are located upper (360) and lower (361) equilibrator mounts. At the top of the cheeks are arms with shaped projections. Through the recesses (268) in these arms and shaped projections is mounted the open sight arms or fire control, depending on which is equipped to mount. Two trunnion bearings (327) fit on top of the cheeks and support the cradle.

Between the cheeks, the casting is shaped to support the upper thrust bearings and stand base hub, the elevating mechanism mount, and the worm drive mount.

The elevating mechanism assembly shows the following in place: elevation limit (363), elevating worm (362), self-aligning slipper bearings (275),

elevating worm mount screws (364), duct bracket (365), elevating worm needle bearing (366) and cap (367), elevating worm drive shaft housing (274), and elevation indicator shaft housing. The duct cover (369) and gasket (368) are bolted to the housing over the hub case. The idlers (269) carry the equilibrator silent link chain (30).

j. Cradle (Figures 16(B) and 17(B))

The cradle (267) is a shaped casting approximately 39.5 inches long by 21.875 inches wide by 10 inches high, and is box shaped. It has two openings in the bottom which coincide with the bottom of the gun receivers. Through these openings, the empty shell cases are expelled from the gun.

The forward end of the cradle has two sight mounting arms (252), approximately 10 inches long, for the mounting of the sighting attachments. A taper pin through hole (262) fixes the sighting attachment in place. At the rear of the cradle is the back plate holding pin recesses (253) drilled through either side, and through which the gun back plate locking pin is either inserted or removed. Also fixed to the rear of the cradle are two handle attachments (225). A cross bar handle pinned to the attachments assists in operations.

The trunnions (250) are an integral part of the cradle and are shaped to ride in brass and babbitt lined bearings (327). The ends of the trunnions are square to receive the equilibrator cam (347), which is held in place by a lock nut (269). The elevating segment gear (243) is constructed of brass; and peripherally, with the axis of the trunnion as a center, measures 108 degrees. This elevating segment gear is fixed to the elevating segment gear bracket (246) by nine dowel pins (245) and ten counter sunk studs (244).

The elevating segment gear bracket (246) mounts to the bottom of the cradle by twelve bolts (247), and is locked with nuts and cotter pins. This bracket is constructed with five girts for strength and light weight purposes. The rim of the bracket is machined on either side with the trunnion axis as a center. Two slipper bearings ride on each rim and assist in the support of the cradle.

Each gun is mounted in four dovetailed brass bearings (256 and 257) which are fixed to the cradle by four and three countersunk bolts (254), respectively. The front bearings are larger than the rear bearings, and consequently have the additional holding bolt. The bearings surfaces of these slide bearings are provided with cross lubrication grooves.

Integral with, and located at the forward end of the cradle, are four recoil mounts (258). Each recoil mount is machined to fit the recoil cylinders. When the recoil cylinders are installed, a spring loaded latch (259) locks them in place.

Just to the rear of the recoil mounts are the forward gun limit lugs (261). These also are integral with the cradle casting.

Bolted to the front end of the cradle is the depression limit bracket (251).

Parts of the firing linkage (265, 266, 248 and 249) are shown attached to the right and left side of the cradle.

ENCLOSURE (B), continued

5. DISASSEMBLY AND ASSEMBLY OF GROUPS

a. Guns

Remove the gun holding pin which connects the gun locking lugs to the recoil connector (16) by retracting the recoil piston and connector approximately one quarter inch to the rear, and pull the holding connector pin straight upward. The connector pin has a recessed center. Remove the guns by withdrawing to the rear.

b. Recoil Units

Remove the recoil connector locking pin and unscrew the recoil attachment connector (16) from the recoil piston rod (3). Depress the lock latch (259) and rotate the recoil unit (260) one eighth turn. Remove by pulling forward.

c. Equilibrators

Raise the cradle to its maximum elevation. Ease up the tension on the equilibrator chain guard (35) and the eight bolts which mount the equilibrator to the mount rear flange. Remove the equilibrator assembly unit.

d. Cradle

Adjust the cradle to a level position, and disconnect firing linkage. Remove the trunnion lock nuts (269), trunnion cams (347), trunnion collar lock bolts (325), and trunnion collars (248). Lift cradle up and forward off the mount.

e. Traversing Mechanism

(1) General: Remove the seats (348) and seat brackets (354). Disconnect firing linkage (249) from left foot rest and pedals, and remove the left (358) and right (349) foot rests.

(2) Traversing Worm: Unscrew the eight holding bolts and remove the traversing worm assembly (81). Remove the worm drive spur gears (78) and (297) then the worm drive assembly.

(3) Left Side: Remove the four bolts (135) from the base of the vertical shaft housing. Remove the crank (350) and the housing assembly slightly and pull off from the elevating crank (130). Unscrew the crank (130) to the left. Follow normal precedures for further disassembly.

Remove the traversing horizontal housing (136) from the carriage (332) and pull outward. Disassemble further in a normal manner.

(4) Right Side: Remove wheel (38), foot rest (349), and vertical housing (39) from housing (56) and remove the clutch assembly (45). Proceed normally with further disassembly.

Remove the azimuth bracket housing (139) and the remote control gear box (82). Proceed with further disassembly of gear assemblies (56 and 82).

f. Elevating Mechanism

Remove all of the cover plates from the various assemblies on elevating

gear box cover (177). Remove mounting studs from the elevating gear box cover and lift off the elevating gear assembly. Remove the bolts from motive elevating gear box cover (233) and remove gear box cover. Proceed further with normal disassembly. Remove elevating worm drive housing (274) and indicator housing (276). Proceed normally with further disassembly.

g. Stand Plate

Remove duct (369), gasket (368), and bracket (365). Remove the carriage worm wheel guide brackets (331). Remove the two pintle bearing retaining nuts (316). Lift the mount off from the stand plate hub (312) and proceed normally with further disassembly.

h. Equilibrator (Figure 7(B))

(1) Remove equilibrator from mount by unscrewing the screw that fixes the attachment lug (31) and the equilibrator mounting studs (22 and 33).

(2) Remove silent chain cover by unscrewing three silent chain cover mounting screws (36).

(3) Unscrew equilibrator tube base drain plug (20).

(4) Unscrew equilibrator tube base (19).

(5) Withdraw the equilibrator spring assembly and chain from the equilibrator tube.

(6) Unscrew equilibrator cover (32) from tube.

(7) Withdraw cotter pin (29) and unscrew nut (28). (Care should be used in removing nut as there is tension on the spring.)

(8) Separate the base bushing (25), equilibrator spring (23), and head bushing (24) from the assembly.

(9) To separate the silent chain (30) from the equilibrator rod (26), drift out the pin.

i. Recoil System (Figure 8(B))

(1) Remove the recoil connector attachment taper pin (17) and unscrew the recoil connector attachment (16).

(2) Remove the recoil assembly from the mount.

(3) Unscrew the two recoil cylinder fill plugs (10) and drain the fluid.

(4) Unscrew the recoil cylinder packing gland nut (11) assembly.

(5) Unscrew brasspacking gland (15) and remove the cotten rope packing (14).

(6) Remove leather packing cage (13) and leather packing ring (12).

(7) Remove the recoil spring (5).

ENCLOSURE (B), continued

(8) Unscrew and remove recoil cylinder head (8) and recoil valve rod (7).

(9) Remove the brass jacketed piston (2) and piston rod (3) from the recoil cylinder.

(10) Unscrew the recoil valve (6) from end of the piston rod.

Assembly: To assemble, proceed in a reverse procedure.

6. OPERATION

The Japanese "naval" 25mm dual mount may be traversed 360 degrees with a maximum elevation of 80 degrees and a maximum depression of minus 10 degrees. It was designed to operate either manually or electrically, and while the electrical drives and controls were not available, several statements may be made concerning them.

a. Electric Operation in Elevation

The left operator's seat bracket is shaped to receive a motor, and the elevation motive coupling results in a change of elevation of 5.22 mils of the mount.

Secondly, a clutch arrangement is provided so that either the manual operating mechanism or the electric motive operating mechanism may be alienated from the elevating mechanisms.

Thirdly, cover plates in the sides of the mount casting opening to the hollow hub of the stand plate make electrical wiring connections very feasible.

b. Electric Operation in Traverse

The right operator's seat bracket is shaped to receive a motor, and the traversing coupling and motive drive gearing are positioned for direct connection through a coupling, the gear half being in place. The motive gearing itself is designed so that one complete revolution of the traversing motive gear drive shaft will change the mount 0.278 degrees in azimuth.

Secondly, clutch arrangements provided will permit either the manual or the motive drive mechanisms to be disengaged from operation.

Thirdly, cover plates in the sides of the mount casting opening to the hollow hub of the stand plate makes electric wiring connections very feasible.

c. Manual Operation in Traverse and Elevation

The right operator, or No. 2 Man, sits on the right side of the mount, and upon receipt of the proper target, holds the mount in azimuth only on that target. This is accomplished by sighting across the open sights which are mounted on an arm protruding from the cradle, and turning the handwheel clockwise or counterclockwise, depending upon the direction of the target. The traversing engaging clutches are on the right side of the mount; consequently, the right operator must also govern their position. One complete revolution of the traversing handwheel moves the mount 5 degrees in azimuth.

The left operator, No. 1 Man, sits on the left side of the mount and maintains the cradle in elevation. One complete turn of his crank changes the elevation 61.334 mils. He also is provided with open sights which mount on an arm protruding from the cradle. The left and right sights are collimated to the same target. In addition to the elevating crank, the left operator, No. 1 Man, may install a crank on the square hub protruding from the top of the left traversing column housing and operate the mount in azimuth. It is likely that he does this when selecting the target, after which the left operator, No. 2 Man, takes over the azimuth controls.

In addition to selecting the targets and maintaining the mount in elevation, the left operator is provided with foot-pedals which when depressed will act through the firing linkage and fire the guns. The pedal provided for the right foot fires the right gun and left pedal fires the left gun. These guns may be fired individually or together, as they operate independently.

7. COMMENTS

This Japanese 25mm dual mount is exceptionally well designed and machined. Anti-friction bearings were freely used in its design and construction. Except where bearing surfaces are in contact, all the machined parts, including shafts and gears, are very heavily parkerized. The casting proper was heavily painted with red lead throughout, and the exposed surfaces had numerous coats of navy gray paint.

Upon disassembly, care must be exercised, as set screws fix all retainer nuts etc. The above construction indicates this mount to be designed for naval use.

The only possible objectionable feature to this mount is the elimination of shell cases when the mount fires near the maximum elevation position.

8. PHOTOGRAPHS

Figure 1(B) - Front Elevation of Assembly
Figure 2(B) - Rear Elevation of Assembly
Figure 3(B) - Right Elevation of Mount Less Guns
Figure 4(B) - Left Elevation of Mount with Guns
Figure 5(B) - Disassembly of Elevating Mechanisms
Figure 6(B) - Disassembly of Traversing Mechanisms
Figure 7(B) - Disassembly of Equilibrator
Figure 8(B) - Disassembly of Recoil
Figure 9(B) - Stand Plate and Base of Mount
Figure 10(B) - Left Elevation of Mount Less Guns
Figure 11(B) - Front Elevation of Mount Less Guns
Figure 12(B) - Right Elevation of Mount Stripped
Figure 13(B) - Left Elevation of Mount Showing Elevating Gearing
Figure 14(B) - Rear Elevation of Mount Showing Elevating Worm Gears
Figure 15(B) - Front Elevation of Mount Showing Traversing Mechanism and Elevating Gearing Bracket
Figure 16(B) - Bottom View of Cradle
Figure 17(B) - Top View of Cradle.

ENCLOSURE (B), continued

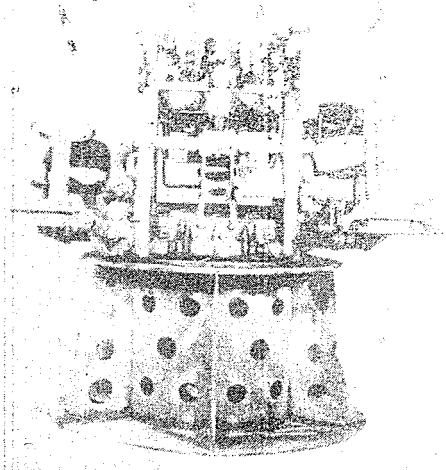

Figure 1(B)
FRONT ELEVATION OF ASSEMBLY

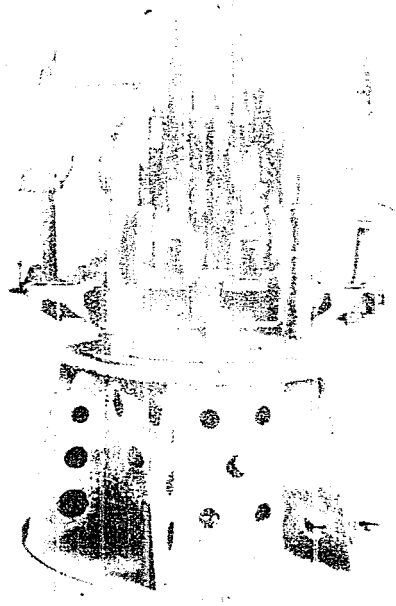

Figure 2(B)
REAR ELEVATION OF ASSEMBLY

Figure 3(B)
RIGHT ELEVATION OF MOUNT LESS GUNS

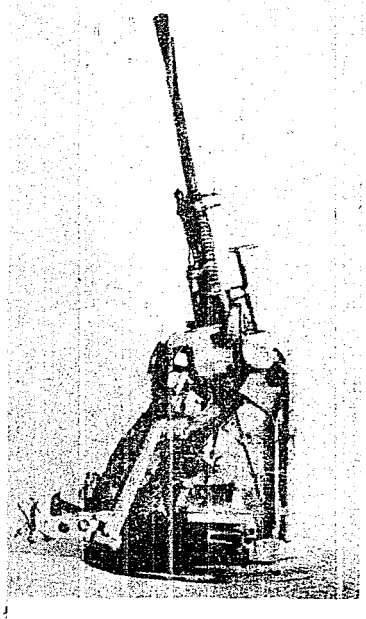

Figure 4(B)
LEFT ELEVATION OF MOUNTS WITH GUNS

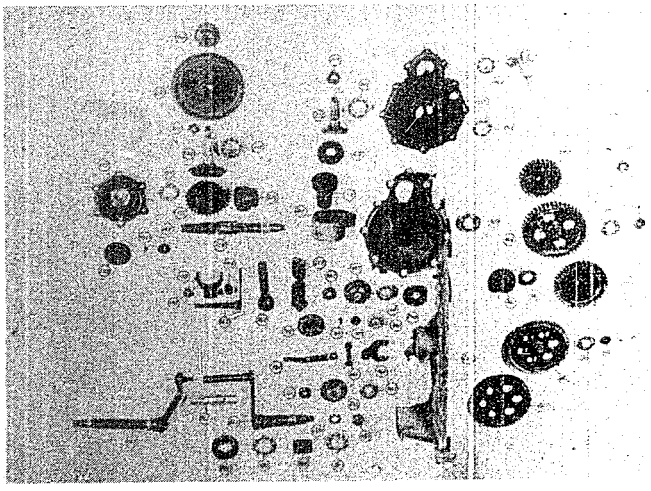

Figure 5(B)
DISASSEMBLY OF ELEVATING MECHANISMS

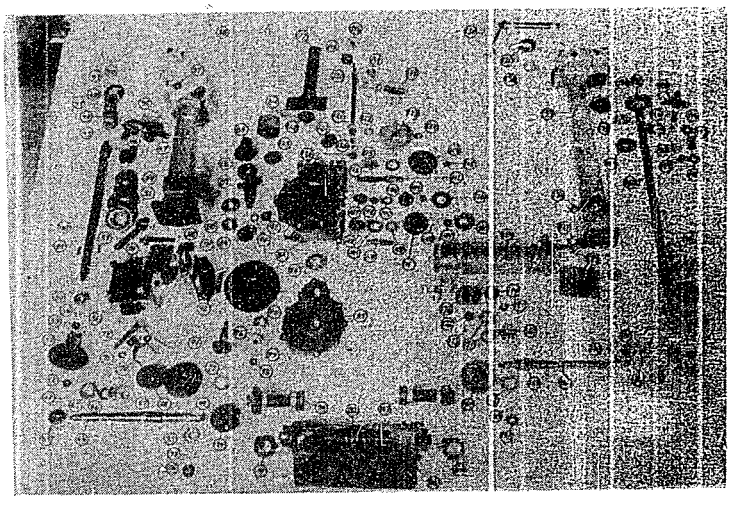

Figure 6(B)
DISASSEMBLY OF TRAVERSING MECHANISMS

ENCLOSURE (B), continued

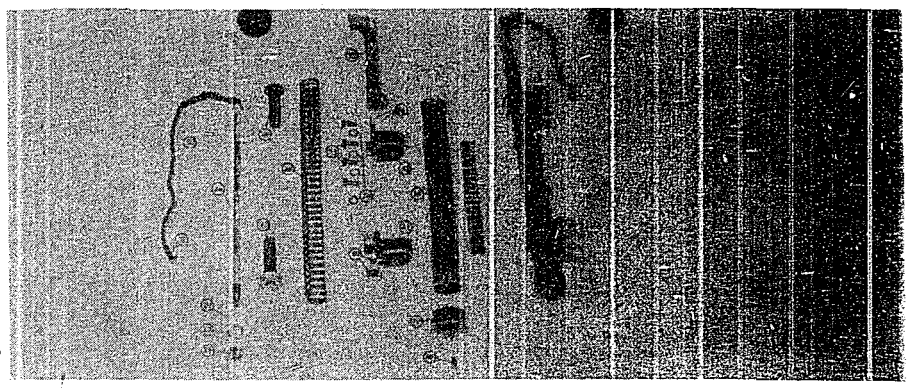

Figure 7(B)

DISASSEMBLY OF EQUILIBRATOR

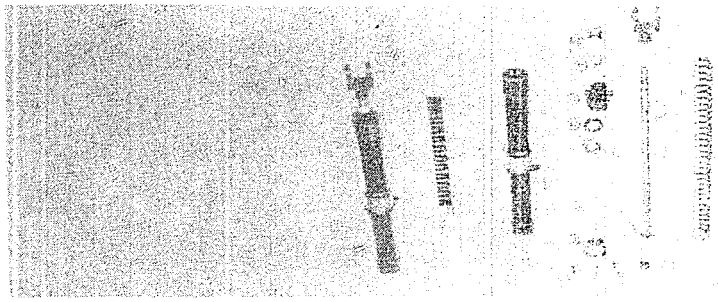

Figure 8(B)

DISASSEMBLY OF RECOIL

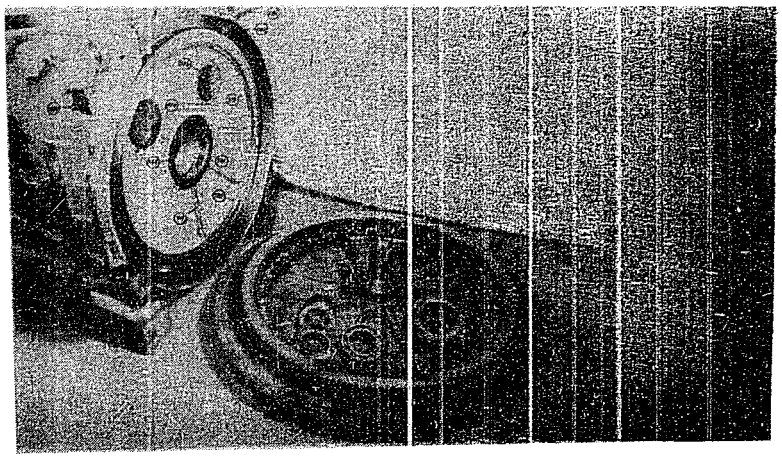

Figure 9(B)

STAND PLATE AND BASE OF MOUNT

ENCLOSURE (B), continued

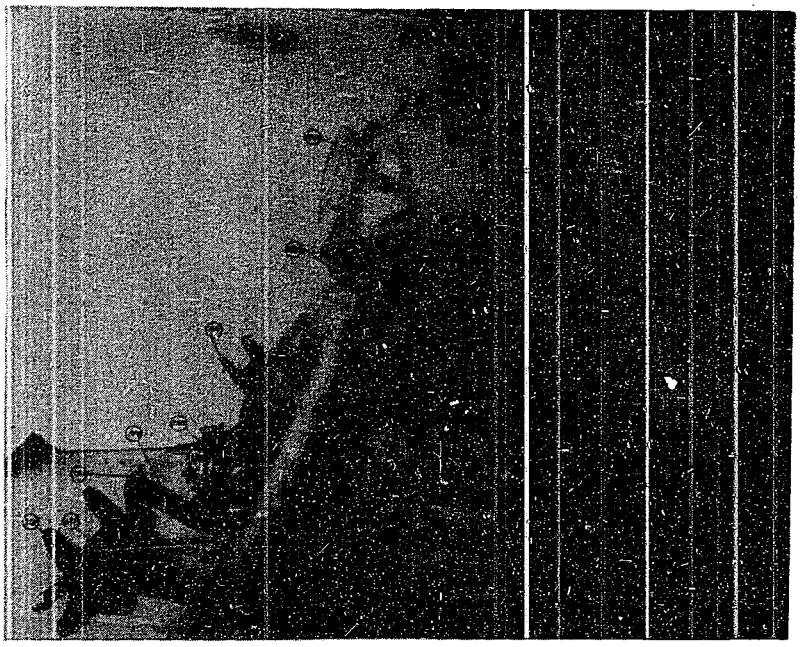

Figure 10(B)

LEFT ELEVATION OF MOUNT LESS GUNS

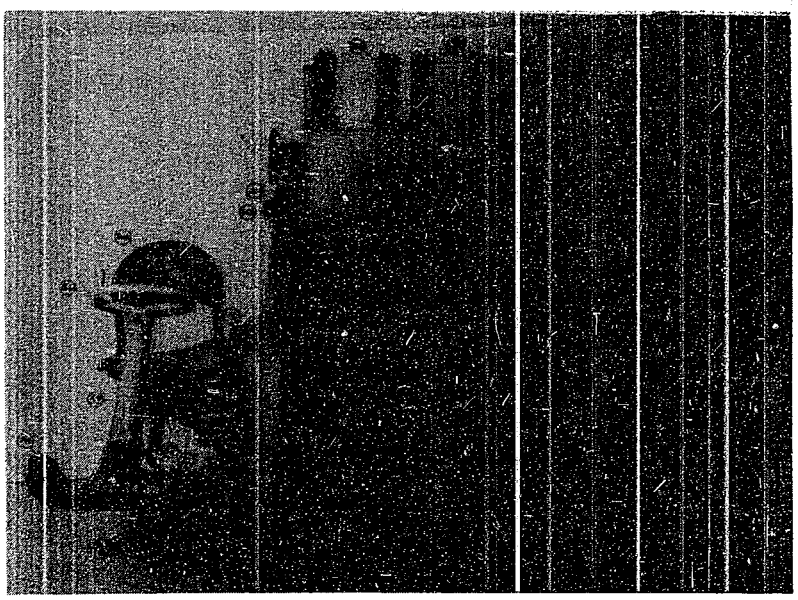

Figure 11(B)

FRONT ELEVATION OF MOUNT LESS GUNS

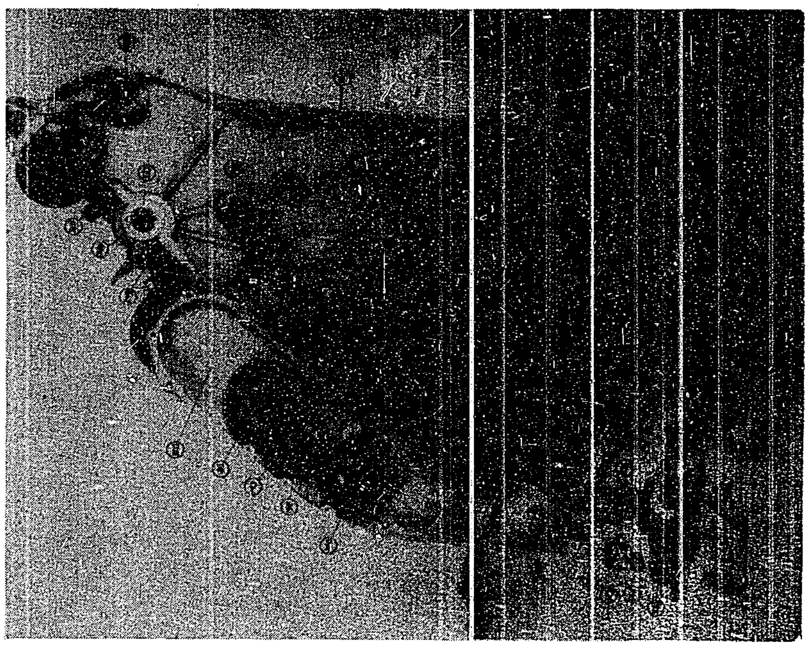

Figure 13(B)
LEFT ELEVATION OF MOUNT SHOWING ELEVATING GEARING

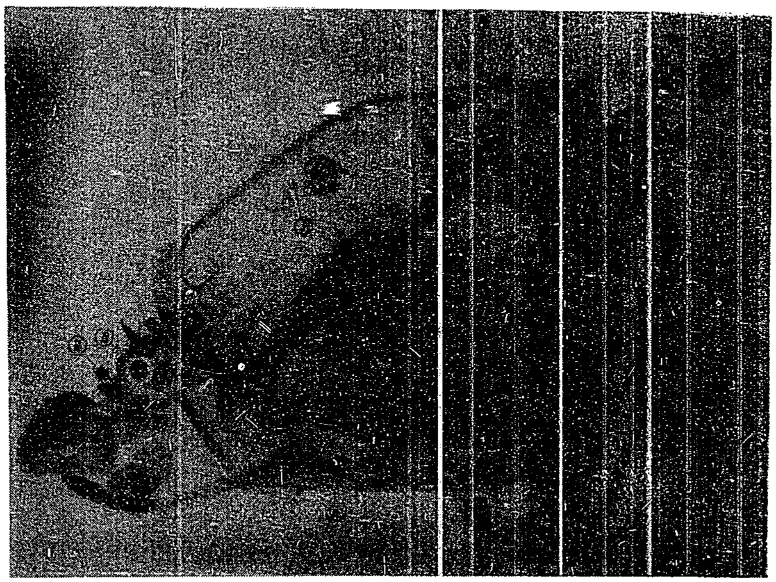

Figure 12(B)
RIGHT ELEVATION OF MOUNT SIMPLIFIED

ENCLOSURE (B), continued

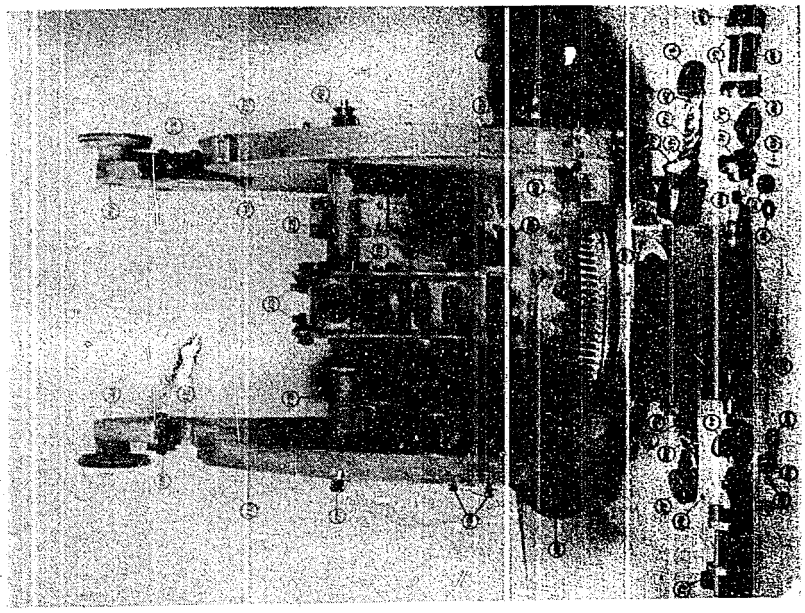

Figure 15(B)

FRONT ELEVATION OF MOUNT SHOWING TRAVERSING MECHANISM AND ELEVATING GEARING BRACKET

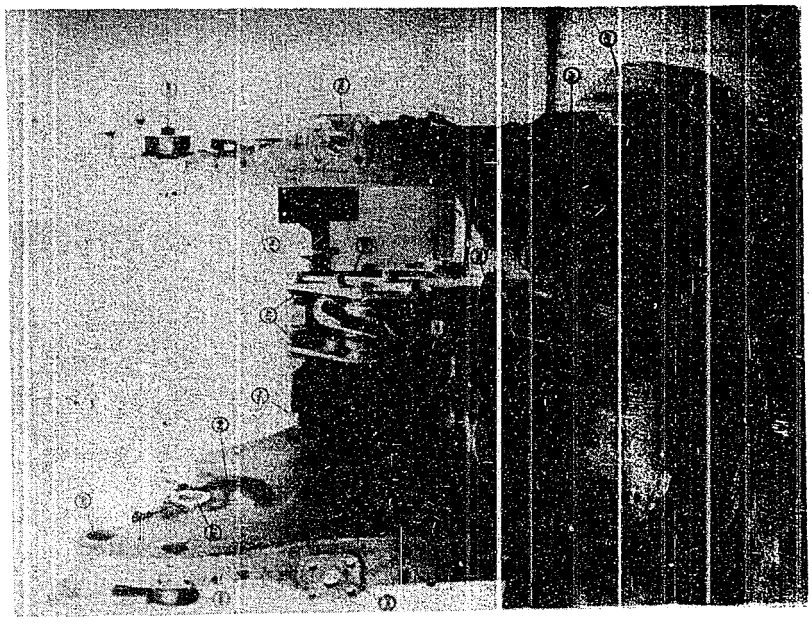

Figure 14(B)

REAR ELEVATION OF MOUNT SHOWING ELEVATING WORM GEARS

ENCLOSURE (B), continued

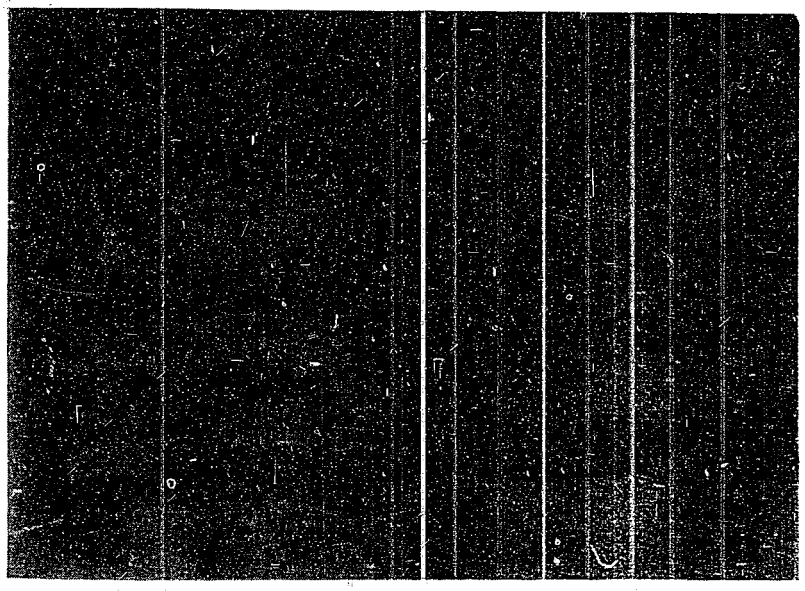

Figure 17(U)
TOP VIEW OF CRADLE

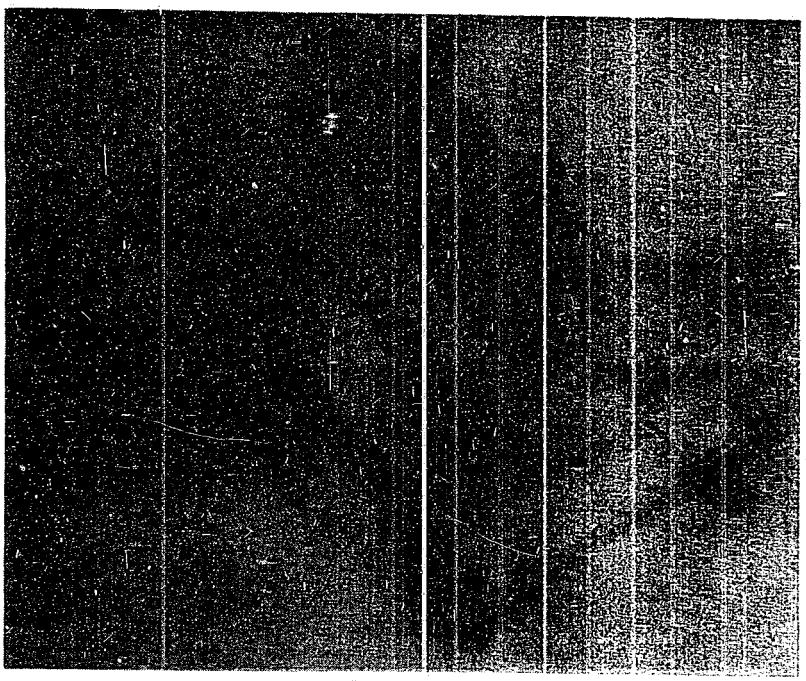

Figure 16(U)
BOTTOM VIEW OF CRADLE

ENCLOSURE (C)

JAPANESE 25 MM MULTI A/A-A/TK GUN

1. MOUNTING - GENERAL DESCRIPTION

The mounting, provided with a circular base plate drilled for holding down bolts, would be suitable for use either as a land (fixed emplacement) or a naval mounting, and is of heavy construction designed to accomodate three 25mm machine guns.

Elevation is gear driven and operated easily and rapidly by hand crank. A finger controlled clutch and friction brake are provided.

Traverse is also gear driven but operated by handwheel and is rather slow and difficult to use, a finger controlled clutch and locking clamp being provided.

Auxiliary gear is also provided for operating both the elevating and traversing gear by some form of remote control.

Firing is accomplished by foot operated pedals, with movement of the pedals being transmitted by mechanical means to the trigger mechanism of the guns.

The outer pedal fires the two outer guns and the inner pedal the center gun. All guns may be fired together by simultaneously depressing both pedals.

Provision is made for firing by remote control.

2. MOUNTING - GENERAL CONSTRUCTION (see Figures 1(C), 2(C), 3(C), and 4(C))

The base plate is a heavy circular casting and supports the revolving turntable amd a heavy casting.

Bolted to the top face of the turntable are the two side frame castings. Cast integral with the lower front end of the left hand side frame is the traversing remote control gear box housing which carries a bracket to which is attached the lower end of the elevating column, the foot rests, and firing pedals. The elevating hand crank is supported on the top end of the column and engages at its inner end with the elevating gear box, also cast integral with the left hand side frame.

The traversing gear housing, cast integral with the right hand side frame, carries a bracket supporting the traversing column and foot rests. The traversing hand wheel is mounted directly on the top of the column.

Each side frame is provided with a bracket supporting the operators' seat, each seat being adjustable both vertically and horizontally.

The cradle casting, mounted in trunnion bearings situated on the top of each side frame, carries the three 25mm guns with their recoil cylinders and the sighting gear. The guns slide in dovetailed blocks screwed to the cradle. The recoil cylinder yokes are pinned to eye brackets (one each side of each gun body), cylinders themselves being flanged and seated against the vertical front face of the cradle.

Hinged to the rear of the cradle is a tubular recoil guard which is held by spring loaded catches.

Bolted to the underside of the cradle on the right hand side is the elevating

arc. This is a casting and has a bronze rim riveted to it in which the worm gear teeth are cut.

A sliding tray is provided underneath the cradle, the front end of which has two rollers that run in channel guides screwed to the turntable top. The rear end also has two rollers which run in grooves in the outrigger guides bolted on to the rear face of each side frame (see Figure 1(C)). The function of this tray is to catch and deflect empty shells to the front of the mount.

Three deflector plates which serve some what the same purpose are mounted on the elevation drive shaft housing (see Figure 3(C)) between the side frames.

Attached near the rear of each side frame are two spring loaded vertical equilibrator plungers, which pass over a pulley, and are connected to a block on the end of the trunnion which rotates with the cradle.

3. MOUNTING - GENERAL CHARACTERISTICS (Figures 1(C), 2(C), 3(C), and 4(C))

a.	Total weight (including guns)	4850 lbs
b.	Number of guns per mounting	3
c.	Elevation	0° - 80°
d.	Traverse	360°
e.	Estimated range	14,000 feet
f.	Types of fire	automatic and single shot
g.	Overall height - fully elevated	approx 9'
	fully depressed	approx 4' 6"
	length - fully elevated	approx 8' 6"
	fully depressed	approx 8' 6"
	width	approx 7' 4"

4. GUNS - GENERAL CHARACTERISTCS (Figure 5(C))

a.	Caliber	25mm
b.	Rifling	
	No. of grooves	12
	Width of grooves	approx 1/8"
	Depth of grooves	approx 0.0085
	Hand	Right
c.	Rate of fire per barrel	250 to 300 RPM
d.	Type of operation	Gas
e.	Type of breech	Locked
f.	Type of cooling	Air
g.	Type of cocking gear	Hand lever, pinion & rack
h.	Overall length (including flash eliminator)	approx 8'
i.	Total weight (less magazine)	244 lbs
j.	Recoil	4 3/4" to 5"
k.	Hand of gun	May be right or left[¢]
l.	Japanese gun	replica of Hotchkiss 25mm

[¢]Difference being location of cocking and firing mechanisms, safety catch, and magazine opening cover.

MAGAZINE - GENERAL CHARACTERISTICS (Figure 7(C))

a.	Type	Single row curved box
b.	Capacity	15 rounds
c.	Construction	Pressed steel

ENCLOSURE (C), continued

d. Spring ..... "W" type
e. Weight (empty) ..... approx 14 3/4 lbs
(full) ..... approx 36 lbs

6. AMMUNITION (Figure 7(C))(Explanation of color markings)

a. Plain yellow ..... H.E. Tracer in picric base
b. Plain chocolate ..... H.E. in picric base
c. Plain yellow with green band.....H.E. tracer (type of explosive unknown)
d. Plain choclolate with green band.....H.E. (same type of explosive as c.)

7. OTHER DETAILS

a. Percussion fuse ..... 6.5 secs
b. Weight ..... approx 1 lb 7 ozs each round
c. Type ..... Rimless

8. GUN ACTION

a. Forward - When the trigger mechanism is operated, the sear disengages from the bent on the underside of the gas piston yoke, thus allowing the yoke and breech block assembly to be propelled forward by return spring pressure.

The face of the breech block carries a round from the mouth of the magazine forward into the the chamber, and the breech block comes to a halt. The piston yoke is free to continue forward approximately 1 5/8" and in doing so locks the breech block in the body by forcing the two hinged locking lugs on the block upwards into recesses in the body.

This movement of the piston yoke relative to the breech block also drives the point of the firing pin through the front face of the breech block and fires the round. Thus at the instant of firing the breech is locked.

b. Backward - After the round is fired, the breech is locked during period of maximum chamber pressure, until the shell passes the gas vent. Some of the propellant gas passes through the vent and strikes the head of the piston forcing the piston yoke to the rear.

This movement of the yoke relative to the breech block allows the hinged locking lugs to drop down, thus unlocking the breech block. The complete piston and breech block assembly are then forced backwards by the residual propellant gases in the chamber, compressing the return springs, and extracting the empty shell case. The case is then ejected through an opening in the bottom of the gun body on striking the ejector.

Any excess recoil is taken by the two spring loaded buffers in the retainer back plate assembly.

c. Interlock Mechanism (Refer Figure 11(C))

When the magazine is pressed into the magazine housing, its bottom rear edge (A) rides over ramp (B) on sliding block (C), thus causing the block to compress the spring (D).

The end of the magazine is provided with a slot (E) which, when the magazine is pressed right home, engages with the sliding block and locks the

magazine in the gun. At the same time its bottom rear edge (A) presses down the end of the lever (F), thus lifting lug (G) clear of the slotted hole in the top of the breech block and allowing the gun to function.

As the magazine empties, the platform comes down until finally the bottom end of lever (H), which pivots on the end of the platform, fouls the front end of the breech block as it comes forward under the pressure of the return springs after the last round has been fired. This fouling action causes the top end of the lever (H) to force the sliding block to the rear, releasing the magazine, and at the same time allowing the lever (F) to reset so that the lug (G) engages in the slotted hole in the top face of the breech block.

The breech block is, therefore, prevented from travelling forward, and the gun stops in the cocked position.

CHANGE LEVER (Location for types of fire)

a. Safe: Engage spring loaded plunger in hole nearest rear end of gun. (see Figure 10(C))

b. Automatic: Engage plunger in the center hole in body. (see Figure 9(C))

c. Single Shot: Engage plunger in hole nearest muzzle end of gun.

10. AUXILIARY TRIGGER MECHANISM (Figures 9(C) & 10(C) with cover removed)

The auxiliary trigger mechanism is screwed to the cradle adjacent to the trigger mechanism on the gun, and consists of a hinged plunger (A), sliding block with ramp (B), crank and roller (C), and return spring (D).

The mechanism is made either right or left hand to suit hand of gun.

a. When change lever (E) is placed on safety (Figure 10(C), the lower arm (F) pushes over the hinged plunger (A) so that its end (G) does not engage with the sliding block (B) when firing pedal is depressed.

At the same time a lug (J) on the lower arm (F) on the safety lever locks against the hinged firing lever (H) on the gun itself. Therefore, the firing pedal can be depressed without operating the gun firing mechanism.

b. When the change lever is placed on automatic (Figure 9(C), the end of its lower arm (F) clears the hinged plunger (A), presses against the end of the sliding block (B), causing the roller to ride up the ramp and push the hinged lever (H) on the gun over to the right, taking the end of the crank (K) with it. The other end of the crank (K) depresses the trigger, releasing the sear. Firing continues until the foot pedal is released.

c. When the change lever (E) is placed on single shot, the top arm of the lever pushes the hinged striker arm (L) out to the side of the gun.

When the trigger mechanism functions as already described above, the gun fires.

However, upon recoil, the end of the striker arm (L) trips the hinged plunger (A) out of engagement with the sliding block (B), allowing the sliding block to return under pressure of return spring (D) to its normal position. The hinged lever (H) and crank (K) then move out of engagement with the trigger and so the gun ceases firing.

ENCLOSURE (C), continued

11. RECOIL CYLINDER (Figure 8(C))

The recoil system is of the liquid buffer and spring recuperator type. When the gun recoils, the piston moves towards the rear of the recoil cylinder, this movement being resisted both by the recoil spring and the liquid pressure.

Runout is obtained by the spring reasserting itself, and is controlled by the liquid pressure and finally by the tapered control plunger which engages with the throttling bush inside the head of the piston. Filling plugs are located on the front cap.

12. GAS REGULATOR

The muzzle end of the gas vent block has ten shallow grooves cut around its outer periphery and is screwed inside to receive the gas regulator.

This has a conical gas control valve at its rear end and is also provided with a spring clip. The clip engages in one of the grooves, thereby locking the regulator in any desired position.

13. BARREL CONSTRUCTION

The barrel casing, machined on its outer surface to form cooling fins, is in five sections; each section is secured to the barrel by two tapered pins passing horizontally through the casing and barrel and riveted in place.

The breech end of the barrel is shouldered down and screwed single start acme thread right hand for a length of approximately 3 3/4", while the muzzle end is shouldered down and screwed single start "V" thread Left Hand to receive the flash eliminator.

Gas vent block and gas cylinder form part of the second and fourth section, respectively, of the barrel casing, and are connected by a short length of tubing having flanged ends spigoted to retain a copper jointing washer.

A hole is provided near the breech end of the barrel for the hexagonal locking setscrew located in the top of the gun body.

14. RECOIL CYLINDER (to remove from mounting)

a. Lift out knurled locking pin holding yoke of recoil cylinder to eye on body of gun.

b. Pull out the spring loaded catch situated on the front vertical face of the cradle, and rotate slightly to retain in disengaged position.

c. Rotate recoil cylinder until four lugs around the perimeter of cylinder clear the four corresponding slots in the mounting hole in the front vertical face of the cradle.

d. Cylinder can then be removed by withdrawing to the front of the mount.

e. Assemble in reverse order.

15. GUNS (to remove from cradle)

a. Disengage spring loaded catches at the rear of mounting, holding tubular recoil guard.

b. Drop guard clear of guns.

c. Remove the two recoil cylinders (two per gun) as already explained.

d. Slide each gun to the rear until it clears the dove tailed guide blocks.

e. Gun can then be removed by lifting clear of the mounting.

f. Assemble in reverse order.

16. STRIPPING GUN (Figure 5(C)

a. Trigger housing block, breech block and piston group from body

(1) Withdraw pin locking trigger housing. Press in spring loaded catch to unlock at the same time; take up the pressure of the return springs by grasping the plate retaining return springs by the grip provided.
(2) Ease the trigger housing block away from the body.
(3) Pull back the cocking gear handle to remove the breech block, piston group, and return springs.

b. Barrel

(1) Remove hexagon head locking screw in the top front of gun body.
(2) Using large spanner on flats provided just to the front of locking screw hole, unscrew barrel in direction of engraved arrow. (anti-clockwise viewed from front of gun)
(3) Dust cover which fits over spigoted end of gas cylinder can then be removed by sliding to the rear.
(4) Gas regulator can be removed by unscrewing. (anti-clockwise viewed from muzzle end of barrel)
(5) Assemble in reverse order.

c. Magazine Housing

(1) Rotate locking pin until arm is vertical.
(2) Locking pin can then be withdrawn.
(3) Pull upwards on interlock lever and the complete housing will lift out.
(4) Assemble in reverse order.

d. Cocking Mechanism

(1) First remove magazine housing as already explained.
(2) Turn gun upside down and tap cocking mechanism body until it slides clear of gun body.
(3) Remove rack by sliding to rear of gun body where it will liftoff.
(4) Assemble in reverse order.

e. Trigger Mechanism and Change Lever

(1) Remove trigger housing unit as already described.
(2) Remove taper pins and nuts retaining hinged firing lever and crank unit.
(3) Lift off firing lever and crank unit.
(4) Lift out pin securing change lever to the single shot striker arm.
(5) Lift off striker arm from pivot pin.
(6) Slide change lever to end of slot in body and lift off.
(7) Assemble in reverse order.

f. Ejector

(1) Remove magazine housing as already explained.

ENCLOSURE (C), continued

(2) Ejector can then be removed by sliding forwards and lifting out.
(3) Assemble in reverse order.

Breech Block From Piston Yoke

(1) Push out pivot pin through the hinged locking lugs and end of link.
(2) Breech block can then be lifted clear of yoke.
(3) Assemble in reverse order.

h. Extractor From Breech Block

(1) Turn breech block upside down.
(2) Lift extractor spring out.
(3) Extractor can then be lifted out.
(4) Assemble in reverse order.

j. Piston Yoke

(1) Remove breech block link by pushing out pivot pin.
(2) Remove firing pin by swinging up to vertical position and sliding out to either side of yoke.
(3) Assemble in reverse order.

k. Trigger Housing Assembly

(1) Press in spring loaded locking plunger to slide off plate retaining return springs.
(2) Slide trigger guard to the rear to remove.
(3) Tap out trigger pivot pin and remove trigger.
(4) Tap out pin retaining sear block and remove sear block by sliding to the rear.
(5) Lift out sear spring from sear.
(6) Remove two buffer plungers and disc springs from sear and block. These will drop out.
(7) Assemble in reverse order.

l. Interlock Mechanism (to strip from magazine housing)

(1) Withdraw cotter pin and lift out magazine catch operating handle.
(2) Tap out bush holding interlock lever and remove lever.
(3) Remove spring loaded magazine catch by sliding forward.
(4) Remove spring and button from catch.
(5) Assemble in reverse order.

m. Cocking Mechanism Housing

(1) Remove split pin and nut from end of lever spindle.
(2) Withdraw lever from housing.
(3) Remove countersunk screws, bolts, and nuts to raise cover from housing.
(4) Gear wheel, gear segment, spacer, pivot pin, and bush for segment will then lift out.
(5) Assemble in reverse order.

RECOIL CYLINDER (to strip)

a. Remove taper pin locking yoke to piston rod.

b. Unscrew yoke and remove.

c. Press in spring loaded plunger on end of cylinder and unscrew stuffing

box. Take up the spring pressure by pressing against the box as it is finally disengaged from the cylinder; at the same time empty out the recoil fluid.

d. Remove piston assembly and spring.

e. Press in spring loaded plunger on other end of cylinder and unscrew cap assembly comprising the cap and control plunger.

f. To remove plunger from cap, tap out taper pin, remove hexagonal lock nut and unscrew plunger.

g. Remove throttling bush from inside piston head by unscrewing.

h. Unscrew gland from stuffing box.

i. Packing can then be pressed out.

j. Assemble in reverse order.

Figure 1(C)

MOUNTING, GENERAL CHARACTERISTICS

ENCLOSURE (C), continued

Figure 2(C)
CRUISING, GENERAL CHARACTERISTICS

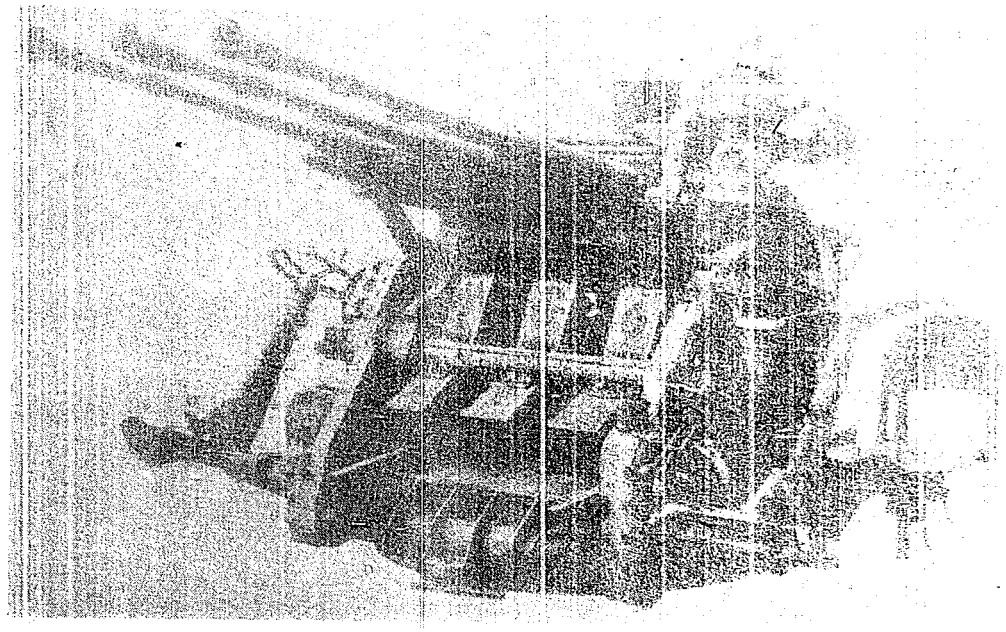

Figure 3(C)
MOORING, GENERAL CHARACTERISTICS

ENCLOSURE (C), continued

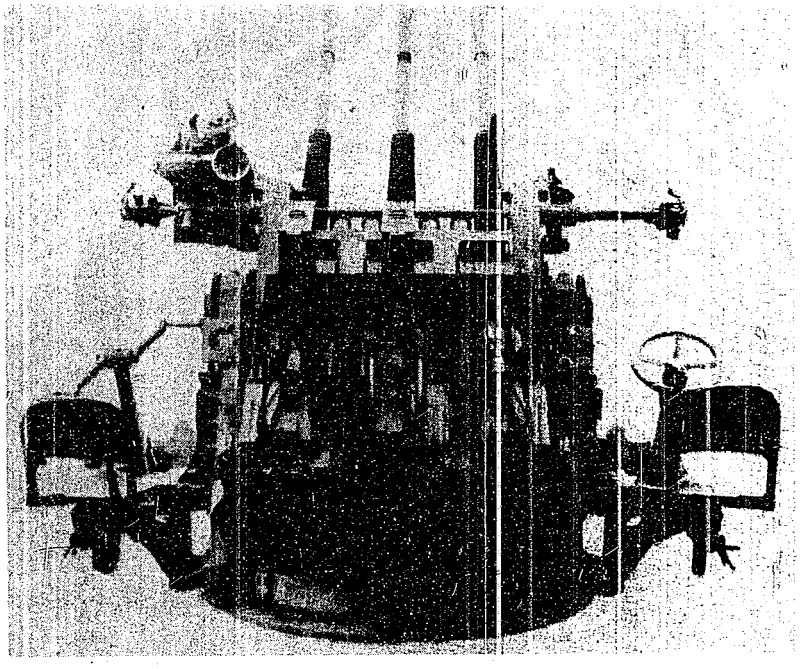

Figure 4(C)
MOUNTING, GENERAL CHARACTERISTICS

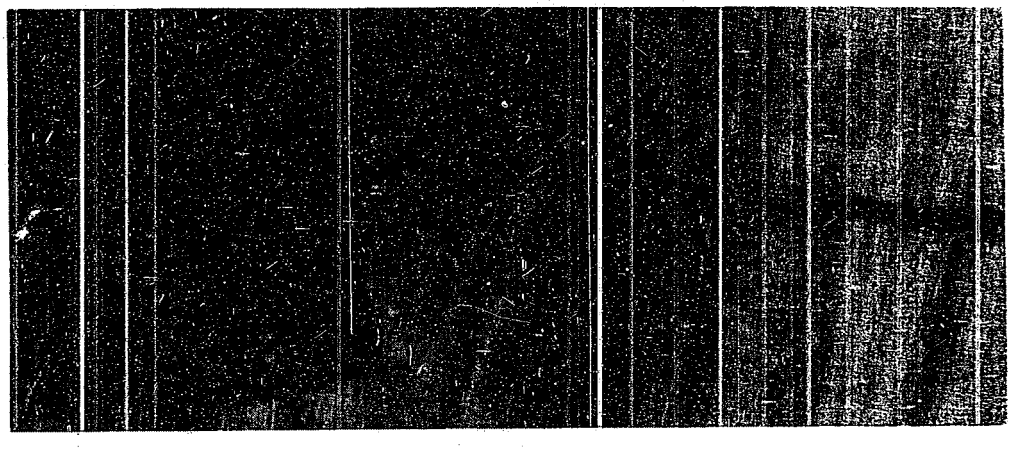

Figure 5(C)
GUNS, GENERAL CHARACTERISTICS

ENCLOSURE (C), continued

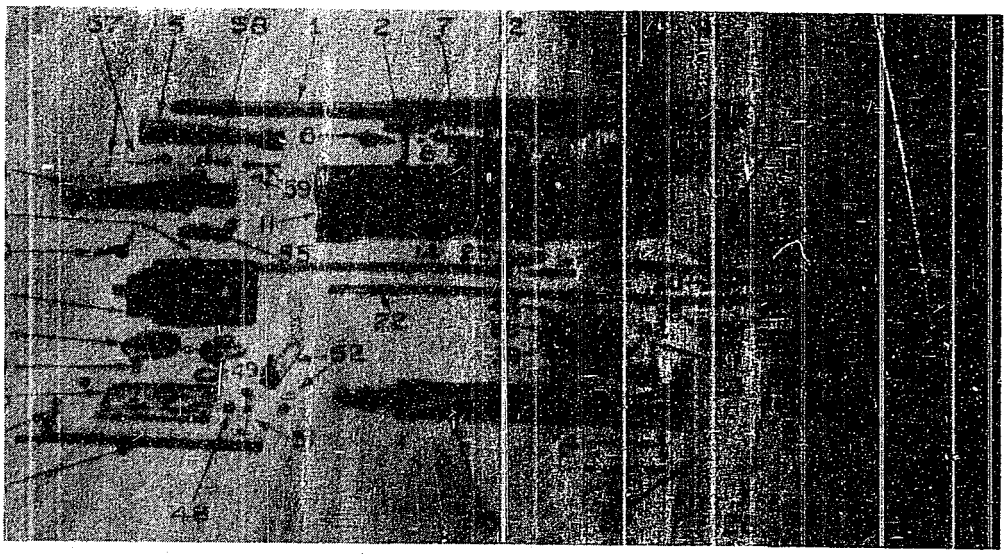

Figure 6(C)

GUNS, GENERAL CHARACTERISTICS

1. Barrel
2. Gas vent block
3. Gas cylinder
4. Barrel casing
5. Flash eliminator
6. Gas regulator
7. Connecting tube
8. Connecting tube copper washers
9. Dust cover
10. Barrel locking screw
11. Body
12. Eye block for recoil cylinder
13. Opening for magazine housing
14. Mounting block for cocking gear
15. Dove tailed slides
16. Change lever
17. Trigger mechanism
18. Trigger mechanism nuts, washer and split pins
19. Plate retaining return springs
20. Spring guides
21. Spring connecting piece
22. Return springs
23. Ejector
24. Trigger housing block
25. Trigger guard
26. Sear block
27. Sear
28. Sear pivot pin
29. Trigger
30. Trigger pivot pin
31. Pin locking, trigger housing
32. Retaining pin sear block
33. Buffer assembly
34. Buffer spring discs
35. Buffer plunger
36. Gas piston yoke
37. Firing pin
38. Breech block
39. Extractor
40. Breech block link
41. Link pivot pins
42. Hinged lock
43. Interlock lever groove
44. Ejector groove
45. Cocking gear rack
46. Cocking gear cover
47. Cocking gear wheel and segment
48. Cocking gear spacer
49. Cocking gear bush
50. Cocking gear pivot pin
51. Cocking gear bolts, nuts and washers.
52. Cocking gear lever, washer and nut
53. Cocking gear body
54. Magazine housing
55. Interlock lever
56. Interlock lever bush
57. Magazine catch operating handle cotter and pin
58. Magazine catch
59. Spring and cap
60. Locking pin; magazine housing

ENCLOSURE (C), continued

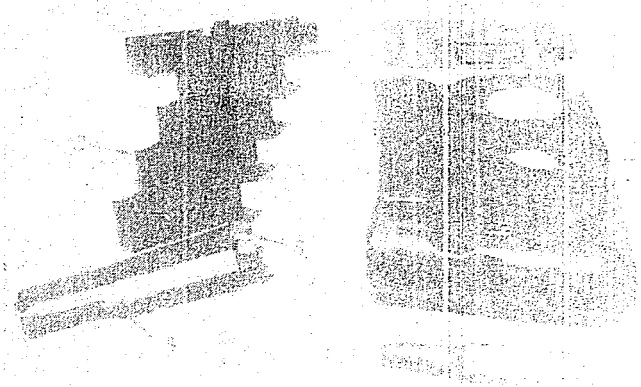

Figure 7(C)

MAGAZINE, GENERAL CHARACTERISTICS

1. Magazine body
2. Cover
3. Spring
4. Platform
5. Tip lever
6. Round

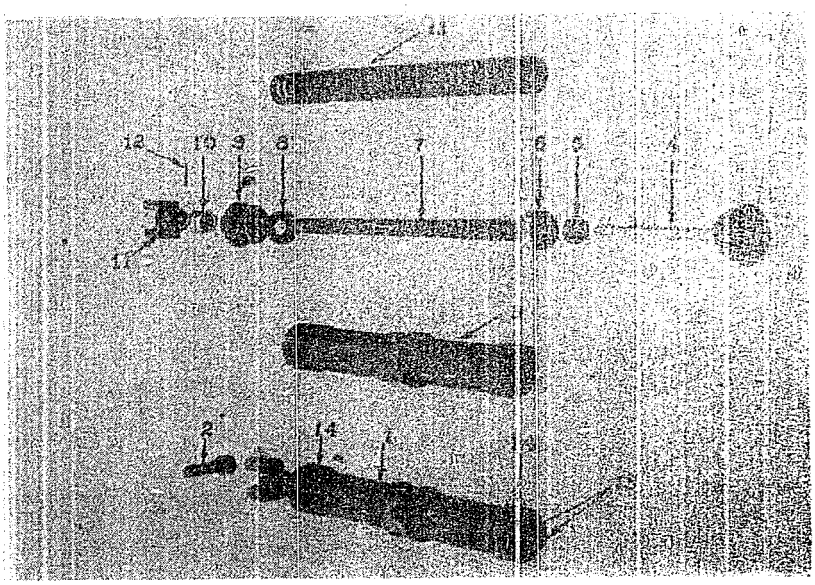

Figure 8(C)

MAGAZINE, GENERAL CHARACTERISTICS

Recoil cylinder assembled
Yoke pin
Cylinder
Screwed cap and control plunger
Throttling bush
Piston
Piston rod
Spring
9. Stuffing box
10. Gland
11. Yoke
12. Taper pin
13. Spring
14. Spring loaded locking plunger
15. Filling plugs

ENCLOSURE (C), continued

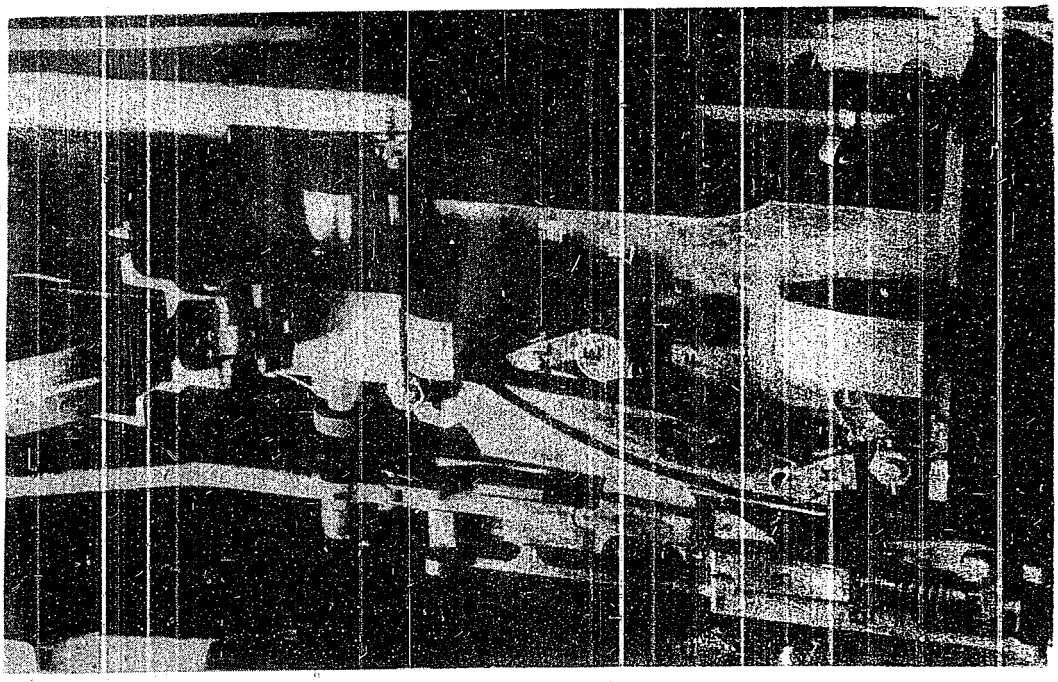

Figure 10(C)
AUXILIARY TRIGGER MECHANISM

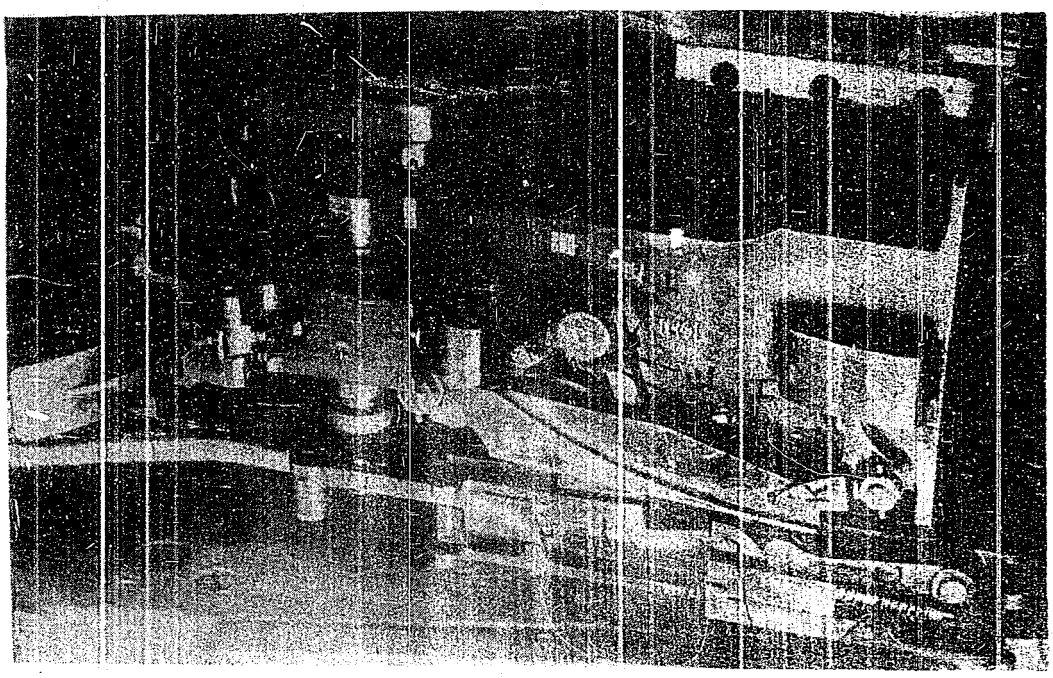

Figure 11(C)
AUXILIARY TRIGGER MECHANISM

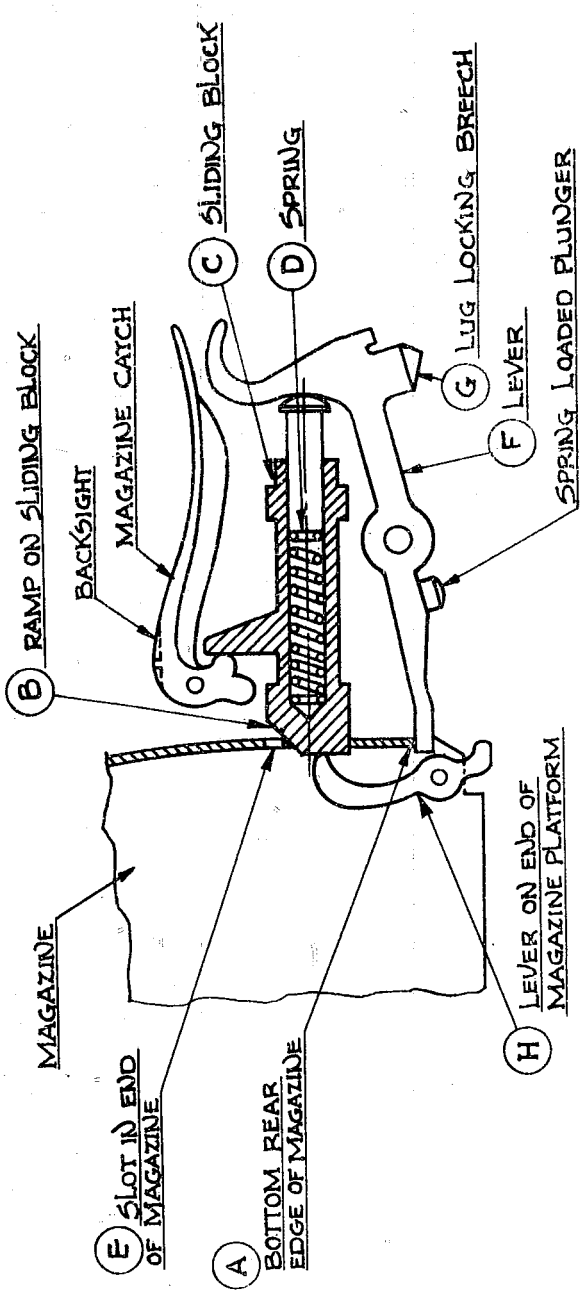

Figure 11(C)

JAPANESE 25 MM. MUZZLE AND AUTOMATIC MECHANISM (SCALE)

ENCLOSURE (D)

JAPANESE VICKERS TYPE (CAL. .303) AIRCRAFT MACHINE GUN

5 June 1943

Intelligence Report No. 11,
Ordnance Intelligence Section,
Office of the Chief Ordnance Officer, USAFFE,
A.P.O. 501

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ALAN C. JOHNSTON
Major, Ord. Dept.,
Intelligence Officer

ENCLOSURE (D), continued

1. GENERAL DESCRIPTION

The Japanese (Vickers type) cal. 0.303 machine gun is basically a copy of the British Vickers machine gun M1918, with certain modifications to adapt it for use in airplanes. It is permanently mounted in place through the crosshead bracket and the elevating bracket. However, it could be mounted on a cal. 0.30 or 0.50 tripod. It is reported that two of the guns are mounted in a plane, and that they are synchronized to fire through the propeller. The gun is precision built, with practically all parts interchangeable with the British Vickers M1918. The chamber is constructed for 7.7mm Japanese (cal. 0.303) cartridges, which are an exact copy of the British cal. 0.303 ammunition. Cal. 0.303 metal links are also used.

The Japanese Vickers had an excellent Parkerized finish throughout, except at the moving surfaces which were highly polished, and the lock, which had the appearance of an aluminum finish. The only composition material used was a hard rubber grip on the check crank handle.

Attached are two photographs, Fig 2(D), showing the top, left, and right side views of the assembled guns, and Fig 1(D), showing a detailed stripping of the Japanese "Vickers Type" machine gun with an accompanying nomenclature list.

2. DETAILED DESCRIPTION OF ASSEMBLY AND OPERATION

a. Barrel Casing

The Barrel casing (7) has 76 ½ inch holes drilled at staggered intervals to provide air circulation for cooling of the barrel (8). It is firmly attached to the breech casing (11) immediately ahead and above the crosshead bracket. At the muzzle end of the barrel casing is a casing adapter (5). This adapter has vent holes in its side through its disc to allow for the escape of gases. The hub at the barrel casing end is threaded and into this the front brass cone (6) is screwed and locked with a pin. The rear end of the adapter is threaded, and is screwed into the muzzle end of the barrel casing. When installed in place, the adapter nut is flush up against the barrel casing; the front brass cone bears against the expanded side of the barrel casing. The brass cone (6) seals the barrel casing from the expanding gases and serves as a bearing for the muzzle end of the barrel (8). The muzzle end of the adapter is fitted with interrupted threads which hold the muzzle attachment (4) in place, and which is locked by the muzzle attachment latch (3), which is spring loaded (1) and fitted into a housing on top of the muzzle attachment. Cotter pin (2) holds the assembly in place. The muzzle attachment is cone shaped inside, and has sixteen 1/4" x 7/16" oblong holes (round holes are also used) drilled about its circumference. It is believed that this attachment hides the flash and also acts as a Cutt's type Compensator.

b. Breech Receiver

The breech receiver (11) which is attached to the barrel casing is of riveted construction and rectangular in shape. To the side plates are attached the cam guides through which the familiar Vickers movement is attained. There is a shaped piece attached to the left side plate which limits the forward movement of the crank handle (52). The side plates are formed to receive the feed block (21). The top or breech cover (12) closes with a spring lock and opens to the right side, using the breech receiver bolts (13) as pins for its hinges. A slotted hole is cut in the rear of the left side plate and fitted with left barrel extension housing (47) for the movement of the crank bearing. The other side plate

is slotted and fitted with housing plate (48) to keep the mechanism clean. The back plate (14) is held in place by back plate bolt (16) and "T" fixing pin (15), which screws into the left side plate which is fixed to receive it. The right (18) and left inside plates (17) are shaped similarly with extensions at the front end. These extensions function with the feed block assembly, thus permitting a feed from either side by simply changing the feed block. The crank (20) contains two journals, one of which is extended to carry the crank handle (52), which is locked in place with a threaded pin (57). Opposite the crank handle side the crank is slotted to accept the fuzee (30) and to which the fuzee spring assembly (29) is attached by means of double hooks. The front end of the fuzee spring assembly contains a screwed stem with a vise-pin for increasing or decreasing the tension on the fuzee spring. Attached to the crank is a curved spring which holds the the connecting rod (19) in a vertical position and prevents damage to same during stripping process. The head of the connecting rod recesses into the side lever head (31) of the lock.

c. Lock

The lock assembly contains a lock casing (32), trigger (37), tumbler (39), lock spring (41), firing pin (36), sear and spring (42), trigger pin (40), and tumbler axis pin (38). The casing has guides formed at each lower side which which work in conjunction with similar guides on each inside plate. The lock casing is shaped to accept the extractor (34), which contains the gib and spring. At each side of the lock and attached to the tumbler axis pin is the left (33) and right (35) extractor levers. The side and head lever (31) is held in place by the side lever and head bushing (43), which in turn is held in place by the split fixing pin (44).

d. Crank Assembly

The crank housing (45) is bolted to the bottom of the breech casing with two bolts and nuts (46). The crank axle (49) has splined ends. On the left side is mounted the check lever (50) and check crank handle (51). The crank axle is installed in the housing with washers (56), (58), (60), splined bushing (53), bushing spring (55), crank axle nut (54), and cotter pin (59). The bushing spring is used to return the check crank and lever.

e. Barrel and Attachment

The barrel (8) is threaded at the muzzle end to accommodate the muzzle cup (9), and when installed, the front brass cone (6) provides the front bearing for the barrel. The counter recoil buffer spring (10) is installed between the muzzle cup and the barrel casing adaptor. The breech end of the barrel is grooved to accommodate the extractor ribs. Trunnions, which are shaped on either side of the barrel, fit into the forward bearings of the right and left inside plates. The chamber is shaped to form a bullet lead. Immediately ahead of the trunnions is the accurately ground rear barrel bearing surface.

f. Feed Block

The feed block contains a shaped body (21) with guides, an upper lever (24), a lower lever (25), a slide fit with pawls and spring (22), and bottom pawl and spring (23). The cartridge belt is fed into the feed block after which the feed action in controlled by the slide and pawls. The lower lever is formed with a stud which engages in the recess formed on the extension of the left inside plate, and is therefore influenced by it. The upper and lower levers fit together and are securely held by the split

fixing pin (28). The entire feed block being held by a shaped spring (26) and an axis pin (27) having a split shank.

g. Synchronizing Mechanism

The synchronizing unit is mounted immediately above the feed block, and is hinged by the plate mounting bolt and nut (64) which is locked in place by a cotter pin (62). Attached to the synchronizer mounting plate (63), and locked by means of two mounting "U" bolts (65) is the actuator housing (70) and assembly, consisting of the actuator spring (71), actuator (72), and actuator stop nut (73). Construction of the actuator assembly to the trigger control (76), which is anchored immediately ahead of the actuator by the front mounting bolts (75), is accomplished through a toggle (74) which rides in a track and receives movement from the safety trigger link (78) through the trigger safety cable (77) which, in turn, is controlled by the operator. When the safety cable is pulled, the cable link moves forward, depressing the safety lock lever (83) located at the bottom front of the trigger control housing, and controlled by a flat bent spring; and held in place by the safety lock lever pin (84). Depressing the safety lock lever allows the operator to fire the gun by pulling the trigger cable (79), which brings the trigger link (80) forward. This, in turn, depresses the impulse plunger spring (82), and forces the impulse plunger (81) forward. This forward motion is limited by the impulse plunger stop nut (85). A guide coupling (86) is bolted to the trigger control housing by two cap screws (87). The guide coupling is designed with a 7/64" orifice guide and a threaded front projection, all of which turns easily, even when bolted in place. It may be locked and pinned by a swivel link. set on top of the trigger control housing. The purpose of this design is to lock positively the impulse wire guide (88) which is a brass tube that insures rigidity to the impulse carrying wire. The wire passes through the 7/64" orifice guide and into a recess provided for it in the impulse plunger. When the assembly is completed, the locking bolt (66), locking bolt spring (67), locking nut (68), and cotter pin (69) retain same in place.

h. Ammunition and Belt

A section from an ammunition belt (89) used in this Japanese "Vickers Type" machine gun shows the ammunition in the metal link belting.

i. Synchronizer Gear Case Control

The following was taken in its entirety from the report on "The 7.7mm Machine Gun" prepared by 713th Ordnance Co. (AVN), Service Group, U.S. Army Air Services.

There are two Vickers type machine guns mounted directly in front of the pilot in the Type 0 SSF ZEKE and synchronized to fire through the propeller.

The synchronizing mechanism is entirely mechanical. A single synchronizer is provided to synchronize both guns. It is mounted on and driven from the gear case on the rear of the engine. A shaft, geared to the engine shaft, is set in bushings in the synchronizer body. Keyed to this shaft is a hub on either end of which is mounted a cam secured by a nut. The contacting faces of hub and cam are saw toothed and by loosening the nut, the cam may be rotated with respect to the hub to synchronize the guns with the propeller. The cams have three lobes. A roller follower riding on each cam is connected to an impulse tube. One of each of these impulse tubes runs direct to the trigger synchronizing mechanism of each

gun.

The manual trigger in the cockpit is connected by wire cables to the trigger mechanism of each gun. Compressing the trigger grip in the cockpit causes a link in the trigger mechanism of the gun to be moved up in contact with the plunger on the end of the impulse tube with the trigger grip. The reciprocating motion of the impulse plunger, due to the action of the cam, cam follower, and impulse tube, then forces the trigger grip to release the sear each time the roller follower is raised by a cam lobe. The gun safety, which is connected by a cable to the manual safety control in the cockpit, consists of a lock to prevent movement of the link in the trigger grip when the manual trigger is squeezed with the cockpit safety control in the "Safe" position. The action of the weapon and its parts are identical with those of the Vickers Mark V machine gun with several minor exceptions consisting of later modifications to the basic weapon copied by the Japanese.

Although the Japanese machine gun is nominally a 7.7mm and the cockpit controls are so labelled, it is chambered for ammunition of exactly the same dimensions as the British caliber 0.303 cartridge and the latter can be used in it.

j. Data from British Vickers Caliber 0.303 Aircraft Gun Mark II

Nomenclature .... Gun, Vickers, cal. 0.303 in A/c Mk 2 (1943)
Weight ..... Approximately 24 lbs
Rate of fire ..... Approximately 900 rds/min
Bore of barrel ..... 0.303"
Length of barrel ..... 28.4"
Twist of rifling ..... 1 in 10"
Type of rifling ..... Enfield left hand
No. of grooves ..... five
Working wt. of fuze spring ..... 10-12 lbs
Length of gun overall
(excluding round counter) ..... 41½"
Mark of gun:
(1) The number of the gun is shown on the body of the barrel casing.
(2) Gun testing section Mark consisting of two crossed 0.303" cartridge in miniature is stamped:
(a) At the crank handle, end of crank shaft.
(b) On the upper face of the barrel block on some guns.
(c) At the muzzle end of the barrel casing.

k. Variations from British Vickers (M1918)

The following modifications from the British Vickers machine gun M1918 were noted in the Japanese copy.

(1) Extensions to front of both right and left inside plates permits an interchange of feed blocks. Therefore, with a minor change, this machine gun may be adapted to either right or left hand feed.

(2) The Japanese do not use the recoil buffer as found on the back plate of the British Vickers M1918. It is believed that they use the flat coiled counter recoil barrel buffer spring located between the muzzle cup and barrel casing adaptor as an alternate to serve a similar purpose.

(3) The Japanese use both left and right hand cocking levers, depending upon the directional feeds. They have also incorporated a check handle and check lever which is probably used only for the removal of jams or other possible failures. It may also be used to aid the operator to cock the gun, depending upon its installation. The reason is that the check lever working in conjunction with the check crank handle will not completely cock the gun, and that the crank handle must be pulled to completely cock the piece.

(4) The British Vickers, it is believed, contains an enclosure for the fuzee spring. This has been dispensed with in the Japanese type of Vickers machine gun.

(5) The front cone is constructed of brass material to provide a better bearing surface for the movement of the muzzle end of the barrel.

References

1. The Vickers Gun Simplified - A pocket book and illustrated guide. Third Edition by Robertson & Mullens, Ltd. Melbourne.
2. The 7.7mm Machine Gun prepared by 713th Ordnance Co. (AVN), Service Group, U.S. Army Air Service's.
3. Japanese Machine Gun by 2nd Lt. M.F. Medlin, Ord. Dept.

7.7 (Vickers Type)
Japanese Machine Gun, Fixed.
The Ordnance Sergeant, Oct. 1942.

3. NOMENCLATURE OF JAPANESE (VICKERS TYPE) MACHINE GUN

(1) Spring, muzzle attachment latch.
(2) Pin, muzzle attachment latch cotter.
(3) Latch, muzzle attachment.
(4) Attachment, muzzle.
(5) Adapter, barrel casing.
(6) Cone, brass front.
(7) Casing, barrel.
(8) Barrel.
(9) Cup, muzzle.
(10) Spring, counter recoil barrel buffer.
(11) Receiver, breech.
(12) Cover, breech receiver.
(13) Bolts, breech receiver.
(14) Plate, back.
(15) Pin "T", fixing.
(16) Bolt and nut, back plate.
(17) Plate, right inside.
(18) Plate, left inside.
(19) Rod, connecting.
(20) Crank.
(21) Block feed.
(22) Slide and pawls, feed.
(23) Pawl, bottom.
(24) Lever, upper.
(25) Lever, lower.
(26) Spring, axis.
(27) Pin, axis spring.
(28) Pin, split fixing.
(29) Spring, fuzee assembly.
(30) Fuzee.
(31) Lever and head, side.
(32) Casing, lock.
(33) Lever, left extractor.
(34) Extractor - with gib and spring.
(35) Lever, right extractor.
(36) Pin, firing.
(37) Trigger.
(38) Pin, tumbler.
(39) Tumbler.
(40) Pin, trigger.
(41) Spring, lock.
(42) Sear and spring.
(43) Bushing, side lever and head.
(44) Pin, split fixing for (43).
(45) Housing, crank.
(46) Bolts and nuts for crank housing.
(47) Housing, barrel extension left.
(48) Housing, barrel extension right.
(49) Axle, crank.

ENCLOSURE (D), continued

(50) Lever, check.
(51) Check, crank handle.
(52) Crank handle.
(53) Bushing, spline.
(54) Nut, axle crank.
(55) Spring, bushing.
(56) Washer, limit lever.
(57) Pin, screwed crank handle.
(58) Washer.
(59) Pin, cotter crank axle.
(60) Washer, quill bushing.
(61) Pin, cotter.
(62) Pin, cotter.
(63) Plate, synchronizer mounting.
(64) Bolt and nut, plate mounting.
(65) "U" bolts, mounting.
(66) Bolt, locking.
(67) Spring, locking bolt.
(68) Nut, locking.
(69) Pin, cotter locking bolt.
(70) Housing, actuator.
(71) Spring, actuator.
(72) Actuator.
(73) Nut stop actuator.
(74) Toggle.
(75) Bolts, front mounting.
(76) Housing, trigger control.
(77) Cable, trigger safety.
(78) Link, safety trigger.
(79) Cable, trigger.
(80) Link, trigger.
(81) Plunger, impulse.
(82) Spring, impulse plunger.
(83) Lever, safety lock.
(84) Pin, safety lock lever.
(85) Nut, impulse plunger stop.
(86) Coupling, guide.
(87) Cap screws, guide coupling.
(88) Guide, impulse wire.
(89) Ammunition and belt.

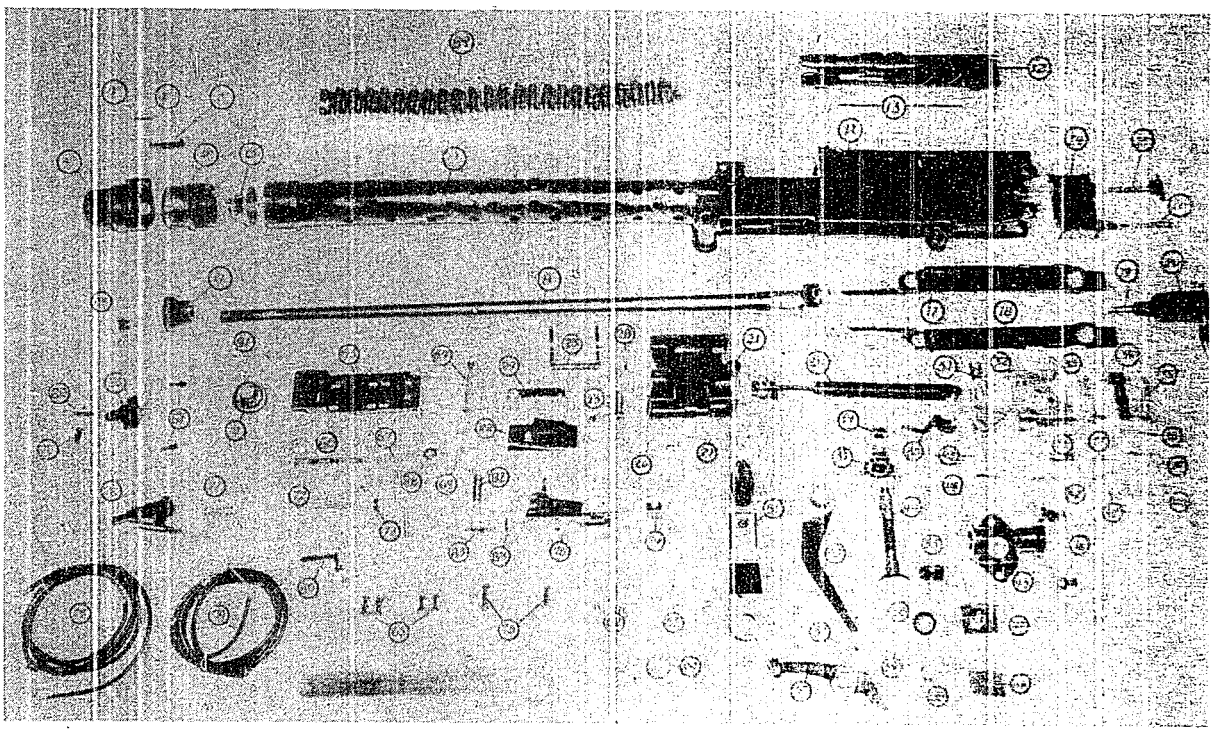

Figure 1(D)
JAPANESE VICKERS TYPE MACHINE GUN

ENCLOSURE (D), continued

(50) Lever, check.
(51) Check, crank handle.
(52) Crank handle.
(53) Bushing, spline.
(54) Nut, axle crank.
(55) Spring, bushing.
(56) Washer, limit lever.
(57) Pin, screwed crank handle.
(58) Washer.
(59) Pin, cotter crank axle.
(60) Washer, quill bushing.
(61) Pin, cotter.
(62) Pin, cotter.
(63) Plate, synchronizer mounting.
(64) Bolt and nut, plate mounting.
(65) "U" bolts, mounting.
(66) Bolt, locking.
(67) Spring, locking bolt.
(68) Nut, locking.
(69) Pin, cotter locking bolt.
(70) Housing, actuator.
(71) Spring, actuator.
(72) Actuator.
(73) Nut stop actuator.
(74) Toggle.
(75) Bolts, front mounting.
(76) Housing, trigger control.
(77) Cable, trigger safety.
(78) Link, safety trigger.
(79) Cable, trigger.
(80) Link, trigger.
(81) Plunger, impulse.
(82) Spring, impulse plunger.
(83) Lever, safety lock.
(84) Pin, safety lock lever.
(85) Nut, impulse plunger stop.
(86) Coupling, guide.
(87) Cap screws, guide coupling.
(88) Guide, impulse wire.
(89) Ammunition and belt.

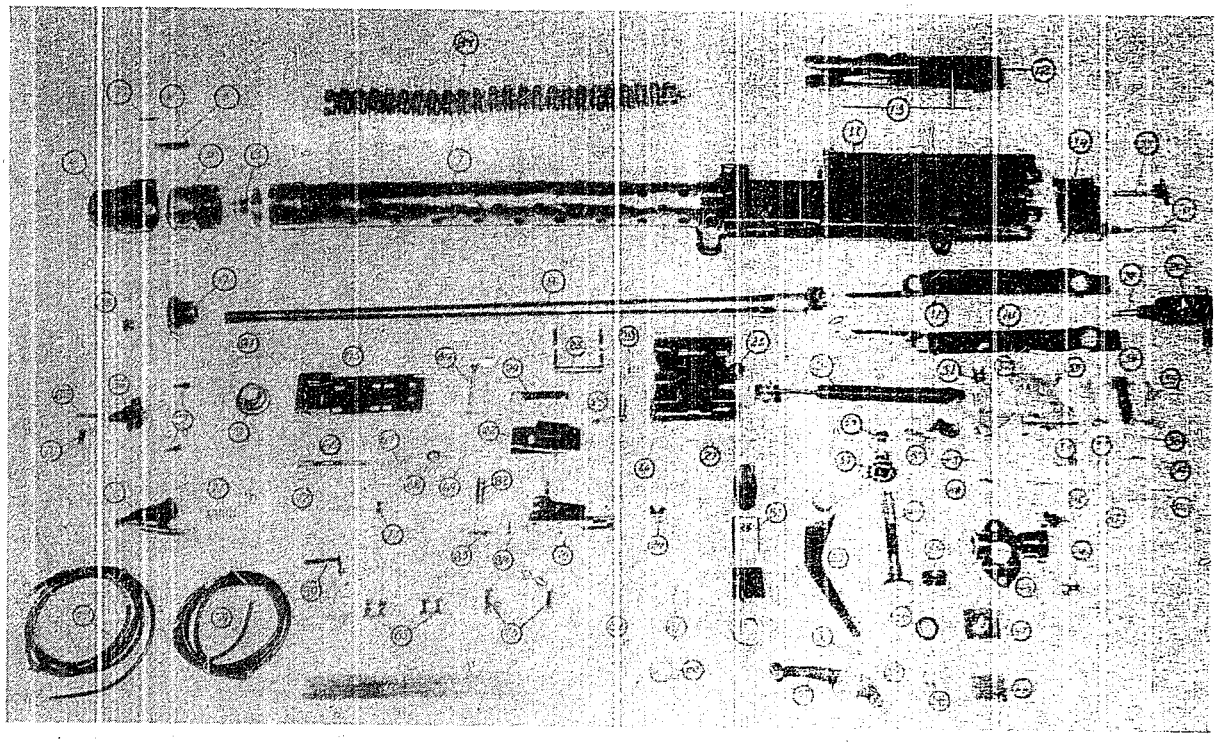

Figure 1(D)

JAPANESE TYPE 99 MACHINE GUN

ENCLOSURE (D), continued

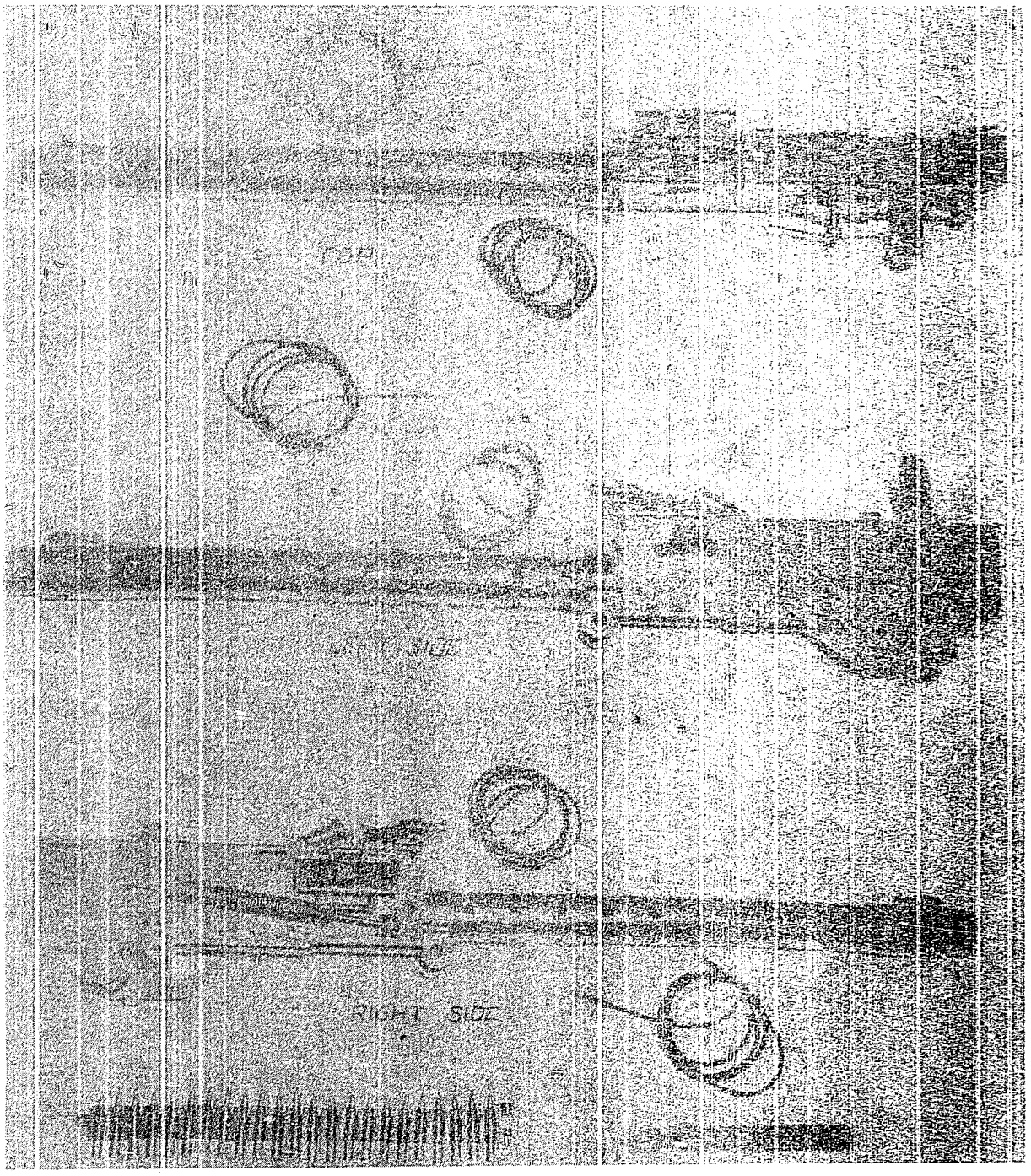

Figure 2(D)

JAPANESE VICKERS TYPE MACHINE GU

ENCLOSURE (E)

LIST OF JAPANESE DOCUMENTS FORWARDED TO WDC THROUGH ATIS

NavTechJap No.	ATIS No.	Subject
ND50-3168	4392	Progress Report in Experiments and Improvements of Vickers Type 40mm MG
ND50-3169	4393	Tests of Vickers Type 40mm Sing e Machine Gun Mount Manufactured at KURE, and Progress of Improvement
ND50-3100	4381	Reports of Experimentation of Vickers Type 40mm Model 2 Machine Gun
ND50-3101	4382	Report on Vibration of 25 Rounds Continuous Feed Vickers Type 40mm Single Machine Gun Mount
		Pamphlet Documents on Naval AA Machine Guns
		40mm Guns
ND50-3168	4392	Progress Report on Experiments and Improvements of Vickers Type 40mm MG - March 2, 1932
ND50-3169	4393	Tests of Vickers Type 40mm Single Machine Gun Mount Manufactured at KURE and Progress of Improvement. April 1932
ND50-3100	4381	Report on Experimentation of V[illegible]ype 40mm Model Machine Gun - May 1932
ND50-3101	4382	Report on Vibration of 25 Rounds [illegible]tinuous Feed Vickers Type 40mm Single Machine Gun Mount - July 1933
		25mm Guns
ND50-3523	4395	Explanation of 25mm Type 94 Twin MG Mount - May 1936
ND50-3102	4383	Assembly, Disassembly, and Handling of 25mm Type 95 Twin Mount - May 1936
ND50-3103	4384	Exp. Aiming Training Equipment used with 25mm Type 95 MG Firing Equip. - Oct. 1938
		13.2mm Guns
ND50-3104	4385	Durability Test of 13mm Type 93 MG and Test of 13mm Common Amm. - 1935
ND21-3425	4394	Standard Adjusting Procedure for the 13mm MG - May 1939
		12mm Guns
ND50-3105	4386	Test of Accuracy of Vickers 12mm MG - May 1931
ND50-3106	4387	Explanation of Vickers Type 12mm MG Model 2, Modification I D - April 1932

ENCLOSURE (E), continued

NavTechJap No.	ATIS No.	Subject
		General
ND50-3107	4388	Essentials of MG Construction Methods - May 1936
ND50-3108	4389	Exp. on Decoppering MG Barrels - July 1936
ND50-3109	4390	Test of Machine Gun Barrel Materials - Oct. 1938
ND50-3110	4391	MG Springs and Spring Materials - 1944
ND50-3445	4220	Research on Chrome Plating of Gun Barrels (7.7mm to 25mm) - May 1939
ND50-3112	4558	25mm Single Assembly, Type 96, Mod. 3 - Dec. 1942
ND50-3113	4559	25mm Single Assembly, Type 96, Mod. 8, on 2 Wheel Carriage - November 1943
ND50-3114	4560	25mm Single Assembly, Exp. Model of Ring Type Mount for Speed Boat
ND50-3115	4561	25mm Single Assembly, Exp. Model of Adjustable Trunnion Height Mount - July 1943
ND50-3116	4562	25mm Single Assembly, Type 96, Mod. 3 - August 1943
ND50-3117	4563	25mm Single Assembly, Type 96, Mod. 3, on 2 Wheel Carriage - March 1943
ND50-3118	4564	25mm Twin Assembly, Type 96, Mod. 4 (For Submarine Use) - July 1939
ND50-3119	4565	Structure of the Manual-Operated Traversing Gear for the 25mm Exp. Twin Mount, Type 96 - June 1944
ND50-3120	4566	Structure of the Wooden Dolly for 25mm Twin Mount, Type 96
ND50-3121	4567	25mm Triple Assembly, Type 96, Mod. 2 - Oct. 1937
ND50-3122	4568	25mm Triple Assembly, Type 96, Mod. 2 - May 1938
ND50-3123	4569	General Arrangement of Armament on Various Types of Vessels Ranging in Size from Heavy Cruisers to Suicide Motorboats