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U. S. NAVAL TECHNICAL MISSION TO JAPAN
C/O FLEET POST OFFICE
SAN FRANCISCO, CALIFORNIA

15 January 1946

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From: Chief, Naval Technical Mission to Japan.
To: Chief of Naval Operations.

Subject: Target Report - Japanese Suicide Craft.

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

1. Subject report, covering Target S-12 of Fascicle S-1 of reference (a), is submitted herewith.

2. The investigation of the target and target report were accomplished by Comdr. R.H. Hedgecock, USN.

C. G. GRIMES
Captain, USN

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JAPANESE SUICIDE CRAFT

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

[illegible] SCHEDULE S-1, TARGET S-02

JANUARY 1946

U.S. NAVAL TECHNICAL MISSION TO JAPAN

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SUMMARY

SHIP AND RELATED TARGETS

JAPANESE SUICIDE CRAFT

Part I - SHINYO - "Special Attack Boats"

Only Type 1, Mod. 1, and Type 5 SHINYO boats were actually used as suicide special attack boats. Types 2, 3, 6, 7, and 8 were in design and experimental stages in an endeavor to attain better performance. Type 4 was never designated because of the superstition attached to "Shi", its Japanese pronunciation, which can also mean "death".

Type 1, Mod. 1, a 5.1 meter, single-man, single engine, 23 knot, inboard motor boat, carrying a 270kg explosive charge in the bow, was later supplemented with the Type 5, designed as a "division leader". Type 5 was a 6.5 meter, two-man, two-engine, 25 knot, inboard motor boat carrying a 270kg explosive charge in the bow, and equipped with radio.

The conclusion of the war ended the production of the successfully tested Type 8, which was an 8.0 meter, three-man, three-engine, 23 knot, inboard motor boat, designed as a squadron leader". This non-suicide SHINYO boat was built to lead several divisions of Type 1, Mod. 1 SHINYO, each division in turn to be led by a Type 5 SHINYO. The Type 8 was not equipped with a bow charge, but instead carried two special 28cm launchable torpedoes. The Type 8, like the Type 5, was equipped with radio.

Part II - KAITEN - "Human Torpedo" or "One Man Submarine"

A KAITEN was substantially an altered torpedo, having human control and additional fuel capacity inserted between the torpedo warhead and the torpedo engine.

Only KAITEN Types 1, 2, 4, 5, 6, and 10 were projected or built; the other numbered types were never designated.

KAITEN Type 1 was an altered Mark 93, Mod. 3 torpedo. Type 6 was distinguished by a modification of the forward air flask of Type 1. Type 2 was an unsuccessful version of a KAITEN built as such, and not altered from a torpedo. It was propelled by gases of combustion formed by hydrogen peroxide, hydrogen hydrate, fuel, and cooling water. Type 4 was an unsuccessful attempt to operate the Type 2 KAITEN on conventional Japanese torpedo fuel, namely, kerosene and oxygen. Unsuccessful Type 5 merely contained a modification of the forward air flask of Type 4. Type 10 was a successful adaptation of the Mark 92 electric torpedo, but was perfected too late for mass production.

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ENCLOSURE (D)

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REFERENCES

Location of Target:

SHINYO - Fourth Section (Ship Construction) of the Navy Technical Department, TOKYO.
KAITEN - Second Section (Torpedo) of the Navy Technical Department, TOKYO.

Japanese Personnel Who Assisted in Gathering Documents and Who Were Interviewed:

For SHINYO and KAITEN:

A. KATAYAMA, Constructor Admiral, IJN.
K. YADA, Constructor Captain, IJN.

For SHINYO Only:

S. MAKINO, Constructor Captain, IJN, directed of SHINYO Boat Design from its beginning.
T. KOYAMA, Civilian Engineer in the Fourth Section, Navy Technical Department, who had worked on design of small boats since 1934. He supervised drafting work for the SHINYO Boat hulls designed by the Navy Ministry.
K. MATSUSHITA, Ordnance Lt. Comdr., IJN, designed the Power Rocket "4FH1".

For KAITEN Only:

K. MIMIZUKA, Ordnance Captain, IJN, directed KAITEN design from its beginning.
R. NAGANO, Engineering Lt. Comdr., IJN, designed the No. 6 Engine from the Type 2 and 4 KAITEN. In 1938 he studied internal combustion engines for one year at the Technical College in Dresden, Germany.

Related Report:

NavTechJap Report, "Japanese Torpedoes and Tubes, Article 1 - Ship and KAITEN Types", Index No. O-01-1. (Contains complete data on KAITEN).

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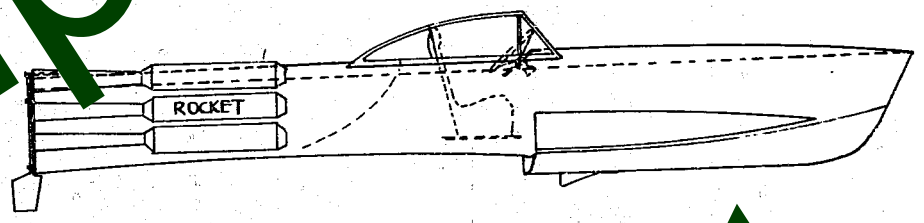

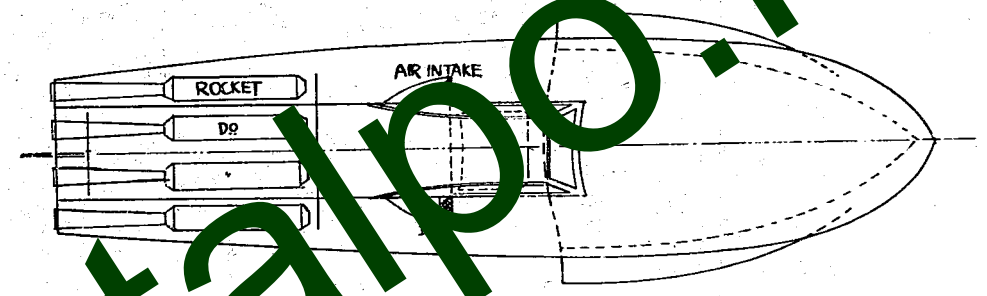

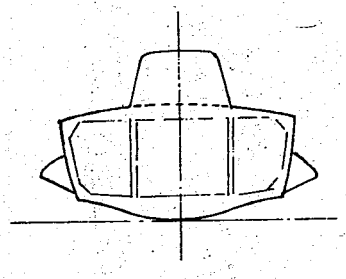

LENGTH 7 metre
DISPLACEMENT [illegible] ton
POWER [illegible]-ROCKET
SPEED [illegible] Knots
RADIUS OF ACTION [illegible] nm
CREW 1

[illegible]e 7
SHINYO [illegible]PE 7

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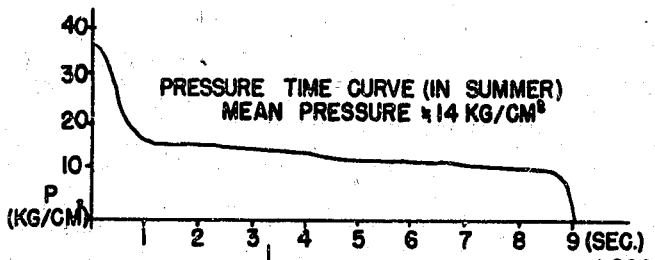

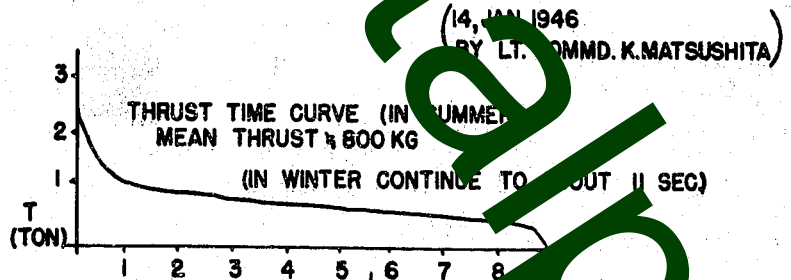

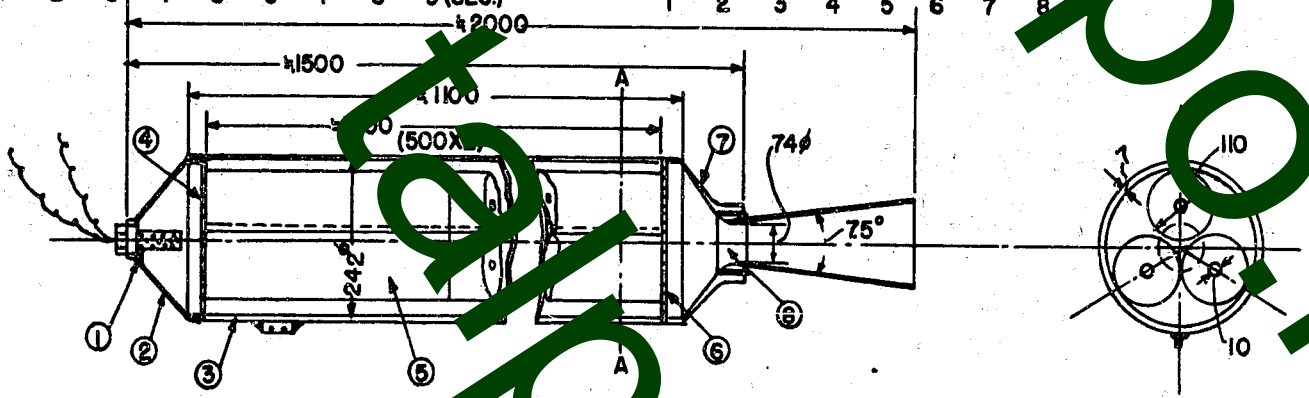

(1) Initiator, electric ignition: black powder 120 gr
(2) Front cover of the combustion chamber
(3) Cylinder, forming the combustion chamber
(4) Front plate for fixing explosives, with many holes
(5) Propellant, (explosive "Toku FDT$_6$", No. 500)
(6) End plate for fixing explosives, with many holes
(7) End cover of the combustion chamber
(8) Convergent and divergent nozzle, area ratio: about [illegible] (this design is bad) (best value = 2.2 for this pressure)
(9) About 40 g of explosive
(10) Total weight about 70 kg

Figure 8

GENERAL VIEW OF THE POWDER ROCKET "4FH120"

Composition of the propellant "Toku FDT$_6$"

(approx. value) MC 59% MNN 7%
NG 27% KS 3%
CL 4%

$$W = 1.55 + 0.082P$$

W: combustion velocity mm/sec (experimental data)
P: combustion pressure kg/cm2

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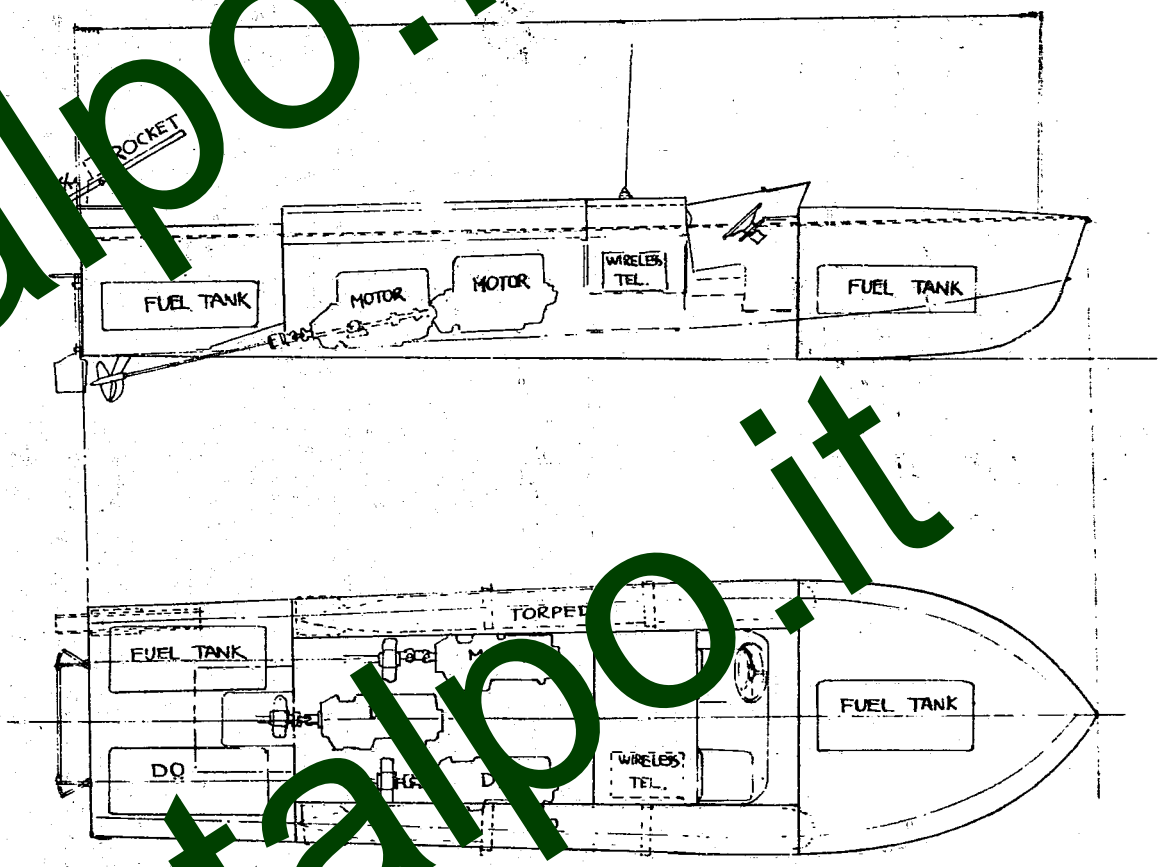

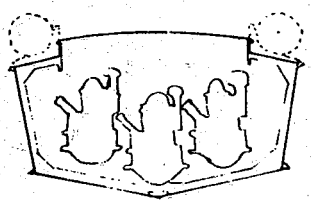

LENGTH	8.0 metre
DISPLACEMENT	4.0 tons
B.H.P	201
SPEED	22 knots
FUEL	60
RADIUS OF ACTION	50 s.m
TORPEDO	2
ROCKET	12¾
CREW	

ure 9
SHINYO TYPE S

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NavTechJap Report, "Japanese Infra-Red Devices, Article 3 - Research, Development, and Manufacture of Infra-Red Equipment", Index No. X-02-3, gives information on night direction of the SHINYO boats "on a beam" from a hilltop control station. This method, similar to airlines flying on a beam, made use of dash-board signal lights instead of the audible "dash-dot" signals used by air-lines, to indicate when the SHINYO was on the course. It was hoped that this might compensate for the poor visibility caused by the pilot position so close to the water. The project presented many "bugs" which were never completely ironed out.

PART II
KAITEN - "HUMAN TORPEDO" OR "ONE-MAN SUBMARINE"

A. General. KAITEN, applied to Japanese naval craft, signified a long range torpedo which hits the enemy ship without fail due to the steering by the pilot who gets into the torpedo".

KAITEN were manned by 18 to 20 year old youths who, after about three months training became ensigns. As in the case of the SHINYO boats, "volunteers" were reported to be plentiful because of fast promotion, special privileges, and the promise that their family would receive about ¥ 10,000 as a posthumous award. No doubt, many of the pilots were in no position not to volunteer.

In the initial phases of training, the volunteers were required to pilot SHINYO boats entirely by periscope and magnetic compass.

Six KAITEN were carried on top of I-class submarines. Tubes from the mother-sub to the lower hatch of the KAITEN and remote release equipment from the mother-sub allowed the KAITEN pilots to man their craft and start on their journey without the mother-sub having to surface. KAITEN were also transported on various "landing transporting craft". Bomb-proof KAITEN caves were being constructed along the invasion coasts of KYUSHU and HONSHU, wherever possible facing into a harbor or bay away from the sea. Only two KAITEN were located in each cave, resting on launching dollies which, in turn, were supported by rails extending to the water's edge.

Standard KAITEN attack approach procedure was to run about one meter below the surface of the water, make occasional look with a retractable periscope, and dive to about five meters prior to striking.

B. Type 1 KAITEN (Figure 1). The KAITEN program had its inception in March 1944 and by August 1944 the successful Type 1 KAITEN was in production. The Type 1 utilized the Type 93, Mod. 3 torpedo (Figure 10). The warhead was enlarged to carry 1550kg of explosive, which could be detonated by the Type 2 inertia-type pistol (Figure 24), or by an electric mine fuse controlled from the pilot chamber (Figure 25). Inserted between the warhead and the torpedo engine compartment were the forward compartment, the control compartment, and the after main body. The forward body contained the air flask (A), the steering air chambers (D), and the forward trimming tank (E). The Type 93 torpedo was inserted into the after main body over the rear trimming tank (F). The center control chamber contained: a hand operated retractable periscope with a vertical movement of 70cm; an upper hatch (G); a lower hatch (H), used for a KAITEN pilot to enter his craft from an I-class mother-sub through a short tube while the mother-sub was submerged; batteries under the pilot's seat to run the electric gyro through a small A.C. motor generator set; manual directional steering; depth control; controls for starting, speed and direction; safety release for the impulse firing pistol; and the firing key for the electric fuze. The engine section was similar to the Type 93, Mod. torpedo, having enlarged vertical and horizontal fins (K_1) and (K_2) and enlarged vertical and horizontal automatic control rudders (M_1) and (M_2). The hand vertical rudder (L), was in the vertical fin (I).

Oxygen emitting sodium peroxide was carried for purifying the air in the pilot's chamber.

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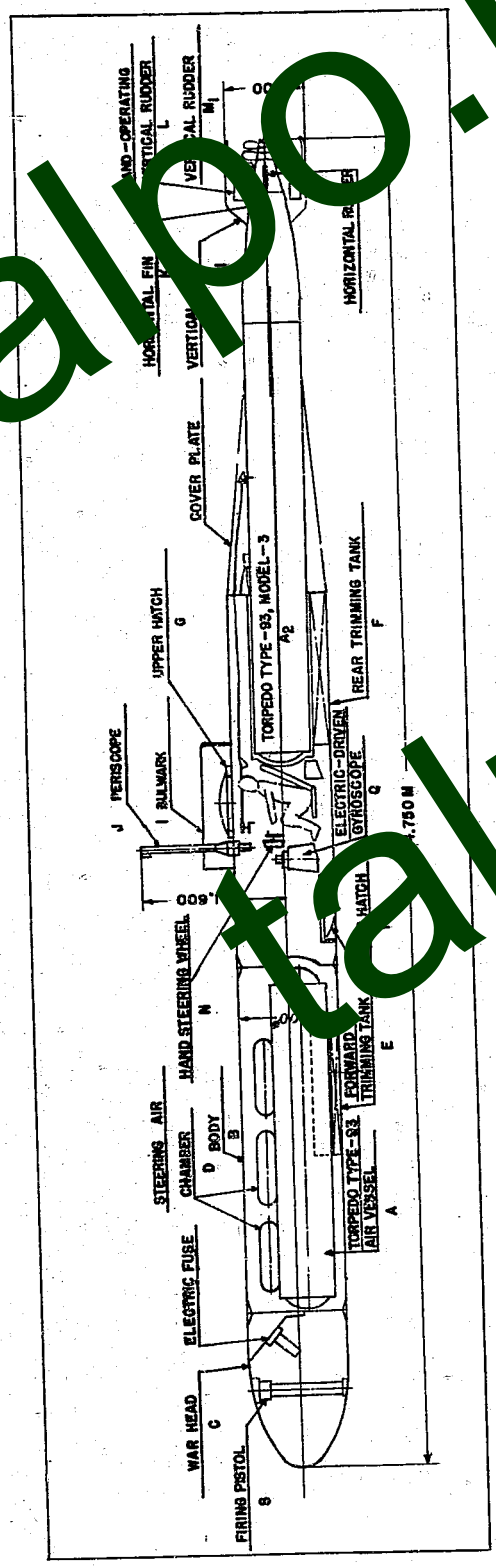

Figure 1

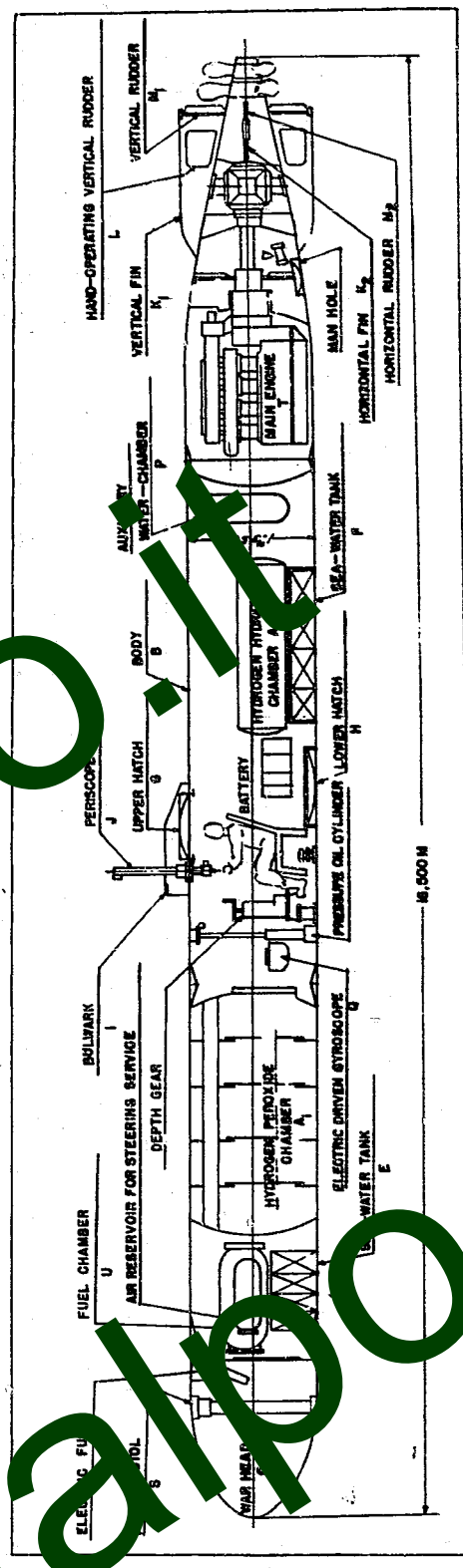

Figure 11
KAITEN TYPE 2

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Speed, range, and other important characteristics are listed in Table II.

Since the KAITEN was designed to have a much longer range than the Type 93 torpedo, the air-driven Type 93 torpedo gyro was replaced by an electrically driven gyro (Figure 20 and Table III) located in front of the pilot. The current for the gyro was supplied by a 3-phase A.C. motor generator set, which, in turn, was driven by storage batteries. The pilot could steer by hand or set his course on the gyro pilot. Steering air from chambers (D) operated the vertical rudder to put the KAITEN on the course set on the gyro pilot. Depth was maintained by the balance of a spring setting against seawater pressure. Steering air from chamber (C) operated the horizontal rudders to keep the KAITEN at the determined depth of zero to 35 meters. Sensitivity of the depth mechanism was reported to be 50cm. During the last part of the run, the pilot increased the depth of run to about five meters. The trimming tanks were adjusted prior to loading the KAITEN on the mother-sub and were not adjusted during the run.

Though designed for a 100-meter test depth, the Type 1 leaked at this depth, but successfully withstood a 60-meter test depth.

The KAITEN was of variable speed, controlled by the pilot, and could achieve a maximum of 30 knots.

C. Type 2 KAITEN (Figure 11). By December 1944, two type 2 KAITEN (Figure 11) were ready for test. Having been built from the keel up as KAITEN and not adapted from a torpedo, much better characteristics were expected (Table II). They were tested on land, but were never sufficiently perfected to give them a water running test.

The Type 2 KAITEN was designed to use hydrogen peroxide, hydrogen hydrate, fuel, and cooling water to form the gases of combustion.

The main engine, designated Engine No. 6, was designed especially for this installation. A board composed of torpedo and marine engineering personnel met and laid down the general specifications for this engine. These specifications, being "3rd degree secret", were burned at the end of the war. However, R. NAGANO, the chief designer of Engine No. 6, recalled from memory the specifications as follows: two rows of four cylinders, each with its own crank; cylinder diameter, 185mm; stroke, 200mm; engine RPM, 1500; propeller RPM, 750; weight, 1500kg; engine to withstand 30 atmospheres of external pressure; diameter of enclosing circular shell for external water cooling of the engine, about 1500mm; combustion gas supplied the engine was to be at 25 atmospheres pressure and 400°C.

The diesel engine design section at KURE, under supervision of R. NAGANO, worked 18 hours a day for two weeks, during August 1944, and turned out the manufacturer's plans. By November 1944 the first models were set up for testing by steam. Some models used cast iron cylinders and some used bronze. The crank case was cast steel and the pan was welded steel. Slide piston valves supplied and exhausted the cylinders. Construction of the engine was light. The entire engine was immersed in cooling water. The combustion chamber (Figure 14) and the hydrogen peroxide spraying nozzle (Figure 15) are explained in Enclosure (A).

The first external pressure test of 13 atmospheres deformed the crank case and pan, necessitating reinforcement.

The first load test was made at 20 atmospheres steam pressure, 300°C, with no back pressure because the hollow propeller shaft exhaust was not fitted. The engine developed 1500hp. The cast iron cylinders showed wear, but the bronze cylinders deformed and seized. Later the actual gas test was made with the exhaust connected to the hollow propeller shaft. It was never possible to get the back pressure down to 2 to 3 atmospheres. The lowest value of back pressure of 7 to 8 atmospheres, combined with 25 atmospheres pressure, the highest combustion chamber pressure found feasible, produced an acceptable compromise of 1000hp. But the combustion gas flow was never steady and leaks developed in the tin-lined hydrogen peroxide tank and lines.

The engine was so designed that a single handle controlled its complete operation.

Upon successful completion of the steam test in November 1944, orders were let at five different places for mass production of this engine. When the contracts were cancelled in April 1945, after the discontinuance of the Type 4 KAITEN, about 200 units had been constructed.

The after propeller was driven by a single hollow propeller shaft, and a mitre gear attached to this shaft through a mitre gear box drove the counter rotating forward propeller.

The Type 2 KAITEN embodied several new design features not found in the Type 1. The electric gyro was not changed, but the "off course signal" from the gyro directional pilot was designed to actuate an air slide valve which transmitted the signal to an oil hydraulic system, which in turn actuated the vertical rudder. The steering air chamber was used only to actuate the slide valve, since it was feared that oil would get sluggish at low temperatures and be unsuitable for the pilot signal. The constantly running hydraulic oil pump was attached to the main engine shaft of the KAITEN.
The spring-actuated depth gear moved the horizontal rudder by means of a hydraulic system to which oil under pressure was supplied by the oil pump mentioned above. Oil pressure was used to raise and lower the periscope through a range of about 80cm.

The same Type 97 pistol inertia exploder (Figure 24) and electric fuse (Figure 25) that had been used on the Type 1 KAITEN were also used on the Type 2 model.

The Type 2 KAITEN was designed for a depth of 100 meters and actually withstood 60 meters when tested, after being converted to the Type 4 KAITEN. Reference to Table II will show that the Type 2 KAITEN was larger and more powerful than the Type 1 and was designed for much greater range and distance. Finally, after repeated unsuccessful attempts to eliminate "bugs", the Type 2 KAITEN was abandoned.

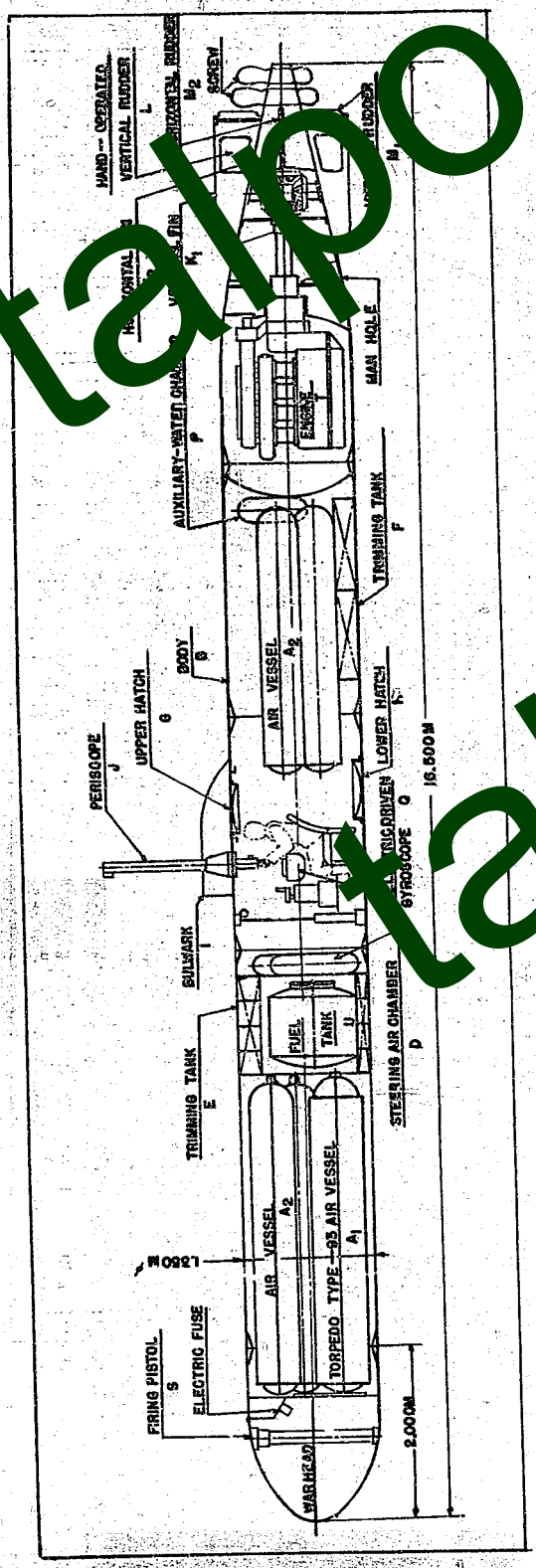

Figure 13
KAITEN TYPE 10

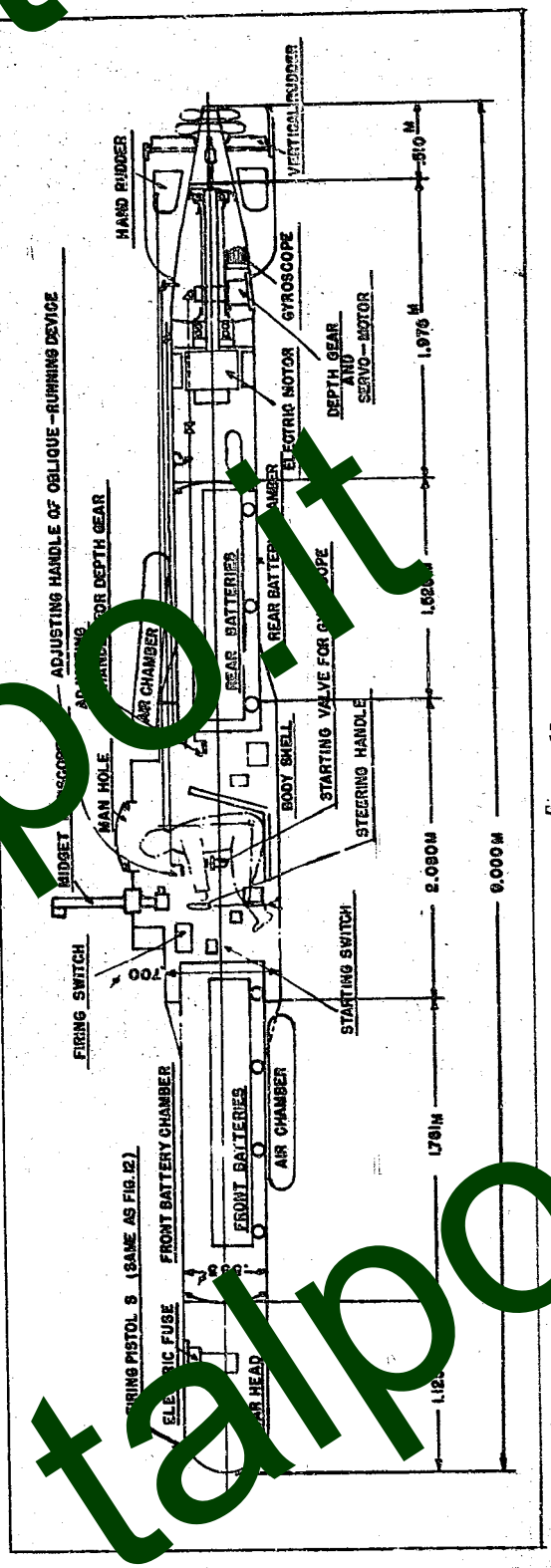

Figure 13
KAITEN TYPE 10

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D. Type 4 KAITEN. Between January and March 1945 five Type 4 KAITEN (Figure 12) were tested and finally abandoned. The Type 4 design was developed in an effort to operate the Type 2 KAITEN on the kerosene and oxygen fuel successfully used in the Type 93, Model 3 torpedo. The main outer dimensions were retained, the same Model 6 engine and control equipment were used, but the fuel system was redesigned to utilize kerosene and oxygen in place of the hydrogen-peroxide formerly used.

The reduction in the weight of fuel carried permitted the installation of an 1500kg warhead in place of the 1500kg one previously used, while still keeping the total weight of the Type 4 KAITEN 200kg less than that of the Type 2.

On land tests the Type 4 developed 1200 hp, but in the water test made only 20 knots, whereas its specifications called for a maximum speed of 40 knots. Maintaining a steady flow of gases of combustion to engine No. 6, as well as reducing the back pressure, seemed to present difficulty.

The Japanese concluded that there were too many difficulties to be overcome in the Type 4 KAITEN to make further work upon this model worthwhile, in view of the fact that the Type 1 KAITEN was already in successful mass production.

E. Type 10 KAITEN. After abandoning the Type 2 and Type 4 KAITEN, the designers next turned to an electrically propelled KAITEN, the Type 10 (Figure 13). They may have been influenced by the consideration that sufficient storage batteries were available.

Table II shows the Type 10 KAITEN to be about one-third the size of the Type 1 and to have only 300kg of explosive. The design embodied a minimum amount of change from the Type 92 torpedo. The charge could be fired by an electric fuse installed in the cockpit or by the Type 2 inertia pistol which fired on impact. (Figure 24). A front battery compartment and a steering air chamber were installed aft of the warhead. The control room for the pilot was located aft of the forward battery chamber. It contained a firing switch; engine starting switch for the constant-speed motor to drive the KAITEN at one speed of 7 knots; hand directional steering; a small periscope which was fixed vertically but which could rotate; and an air starting valve for the air-driven gyro (Figure 18) located in the after end of the KAITEN. The remainder of the after part of the KAITEN was similar to that of the Type 92 torpedo except for the addition of a steering air chamber, a hand rudder and the enlarging of the horizontal and vertical fins.

This KAITEN had an upper hatch but no lower hatch; hence, it was not possible for the pilot to enter the KAITEN from a mother-sub while the mother-sub was submerged.

When underway the Type 10 KAITEN ran at the depth set on the depth gear. The spring versus water pressure depth gear actuated the horizontal rudder by means of air pressure.

To use the periscope, the pilot would stop the engine, and the 50kg positive buoyancy would bring the KAITEN to the surface. The free floating waterline was approximately in the middle of the small conning tower.

The pilot could not read course degrees from his station after the Type 10 KAITEN was started and headed in the right direction by eye observation through the periscope, the air gyro for automatic course control was started by a control handle in the pilot control room. This operation was quite similar to the course gyro being started when a torpedo is fired from a torpedo tube. If the pilot wanted to change the course on which the gyro had been started, his hand-operated vertical rudder was sufficient to overcome the small vertical rudder operated by the gyro.

TABLE II

SUMMARY OF KAITEN DATA, ALL TYPES

															Air Chamber				Steering Air Chamber					Type of Main Engine		
Type	Diameter (cm)	Total Length (mm)	Weight of Explosive Charge (kg)	Speed/Range (kt-m)	Total Weight (kg)	Reserve Buoyancy (kg)	Center of Gravity (mm)	Total Length of Warhead (mm)	Total Weight of Warhead (kg)	Volume of A-Liquid Chamber (lit)	Weight of A-Liquid (kg)	Weight of A-Liquid Chamber (kg)	Volume of B-Liquid Chamber (lit)	Weight of B-Liquid Chamber (kg)	Maximum Charging Pressure (kg/cm²)	Volume (lit)	Weight of Charging Air (kg)	Weight of Air Chamber (kg)	Maximum Charging Pressure (kg/cm²)	Volume (lit)	Volume of Fuel Chamber (lit)	Volume of Lubricating Oil (lit)	Volume of Water Chamber (lit)	Cylinder Bore x Stroke (mm)	Revolutions of Main Shaft (RPM)	Shaft Horsepower (HP)
1	100	14,750	1,550	12/78,000 20/43,000 30/23,000	8,300	100	8,800	2,250	2,250					.	215	1,550	435	1,076	200	160	196	107	5.5	142 x 180	685	[illegible]
[illegible]	[illegible]	16,500	1,500	20/83,000 30/50,000 40/25,000	18,370	530	9,300	2,000	2,100	2,630	[illegible]	[illegible]	256	210					215	430	550	270	100	185 x 200	750	1,500
4	[illegible]	[illegible]	1,800	30/38,000 20/62,000 40/27,000	18,170	730	9,300	2,000	2,600						280	3,343	1,204	3,804	215	80	550	270	45	185 x 200	750	1,500
10*	[illegible]	[illegible]	300	7/3,500	3,000	50	5,014	1,125	375										200	91						7

*Number of cells: 112 (28x4); Voltage: 56V; Amperage: 120A; Motor RPM: 216; Propeller RPM: 136.

ENCLOSURE (A)

THE NEW ENERGY SOURCE OF THE TORPEDO

(Prepared by Lt. Comdr. R. NAGANO, IJN)

A new energy source of the torpedo, hydrogen peroxide, producing oxygen gas was investigated:

When a concentrated solution of hydrogen peroxide (H_2O_2 about 80%) is mixed with the concentrated hydrogen hydrate ($(NH_2)_2H_2O$ about 80%) about one-tenth in quantity, the temperature rises to nearly 1,000°C, and a great quantity of oxygen gas is produced. We intended to use this reaction in driving the engine. When we mixed these elements in the following ratio:

H_2O_2	:	$(NH_2)_2H_2O$	:	fuel	:	cooling water
10	:	1.0	:	1.5	:	1

we obtained a combustion gas which contained over 70% superheated steam. The rest was CO_2, CO, H_2, N_2, etc. at a temperature of about 500~700°C. Hence, we could apply this reaction and drive the engine of the torpedo.

At first we applied it to Type 93 torpedo and obtained, as a result of the low-speed braking test on land, the following results:

Pressure in combustion chamber	20kg/cm²
Shaft horsepower	220 hp
Liquid efficiency	shaft hp x running time / consumption of H_2O_2

At the time, the investigation of KAITEN Type 2 was very urgent. We continued our experiment with the main engine (designated Engine No. 6) for the Type 2 KAITEN. By the end of 1944 we obtained the following results:

Pressure in combustion chamber	20kg/cm²
Shaft horsepower	1600 hp
Liquid efficiency	900 hp sec/kg

The final tests, i.e. running tests, were about to be made, but they were never carried out.

The type of combustion device which is shown in the appending figures (Figures 14 and 15) had good characteristics.

Independently, the investigation to use concentrated nitric acid and alcohol had commenced and the experiment on combustion was going on, but satisfactory results had not yet been obtained.

ENCLOSURE (A), continued

Figure 15
HYDROGEN PEROXIDE SPRAYING NOZZLE

Figure 14
HYDROGEN PEROXIDE COMBUSTION CHAMBER

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ENCLOSURE (B)

STEERING APPARATUS FOR TORPEDOES

(Applicable to KAITEN as Noted)

(Prepared under the supervision of Capt. K. MIMIZUKA, IJN)

[Note: KAITEN data only was not removed from this data because the remainder would be incomplete.]

The types of steering apparatus used in Japanese torpedoes were of the Whitehead torpedo type. The most typical one is the Type 4, Mod. 2 used for the Type 6 or 8 torpedo. As shown in Figure 16, the flywheel was driven by an air turbine and the air passage to the steering cylinder was controlled through a small slide valve which was regulated by an eccentric pin set on a vertical axis. The revolutional speed of the flywheel was about 15,000 RPM and it was maintained by means of an air jet.

With the advent of the oxygen torpedo, which had a very long range, a more powerful gyroscope was required and the Type 98 was developed. For this type, the flywheel was enlarged, the speed of revolution of the rotor raised to about 18,000 RPM, the accuracy of bearings was improved, and the direction maintaining capacity was greatly increased. Moreover, the adoption of a new type controlling valve which utilized the combination of a diaphragm slide valve and air-slit intercepting ring brought a satisfactory result. The details of this system are illustrated in Figure 18. The separation of the reducing valve and the steering cylinder from the gyroscope body, and the use of the rubber spring minimized the disadvantageous influence of engine vibration upon the gyroscope. This type was effective for a period of one-half hour.

On the contrary, the Type 2 gyroscope was the most simple one, and was suitable for the Type 2 midget torpedo. The construction of this type was almost the same as the Type 91 for aerial torpedo service, except for the possession of the oblique-running mechanism and the air jet device. The principle features are shown in Figure 19.

The greatest improvement in recent years in the capacity was made in the development of the electric drive gyroscope. The rotor was driven at a speed of about 20,000 RPM by means of a three-phase A.C. device. Five minutes were required to attain maximum speed of rotation from starting. Delicate ball bearings, which had high grade accuracy, were used in all axes, especially the horizontal ones, instead of the cone-type needles used in the Type 98. Owing to the above-mentioned improvement, these gyroscopes had sufficient ability to maintain their axes in one direction for about 10 hours with little deflection. Due to the lack of quick starting, this gyroscope was not used for torpedoes, but for small underwater weapons such as KAITEN, etc. Nevertheless it was useful as a compass. This type required a motor-generator, battery, etc., as accessories.

Further, the Type 93 torpedo was equipped with a special steering device which permitted the torpedo to take a circular course after the straight desired running. The outline of the mechanism is illustrated in Figure 21. As is clearly seen from the Figure, air was sent to the intercepting cylinder (E) by the action of a cam (C) at the end of the straight running. The plunger (H) of that cylinder intercepted the air passages at both ends of the steering cylinder. Only the air from the reducing valve passed through the cylinder, pushed the piston of the steering cylinder on one side and the vertical rudder turned the torpedo in only one direction.

ENCLOSURE (B) continued

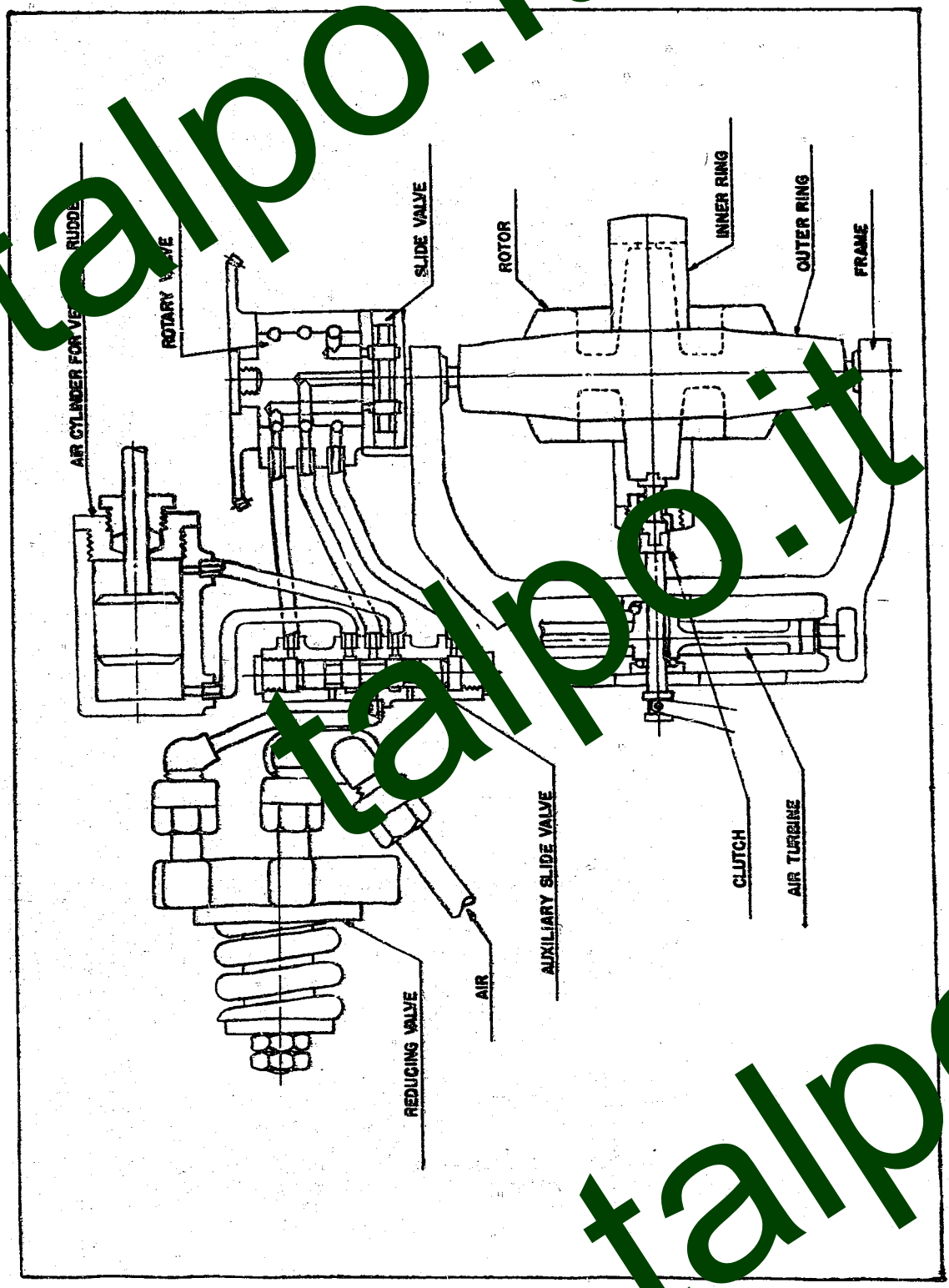

Figure 16
TORPEDO STEERING CONTROL, TYPE 4 MODEL 2

ENCLOSURE (B), continued

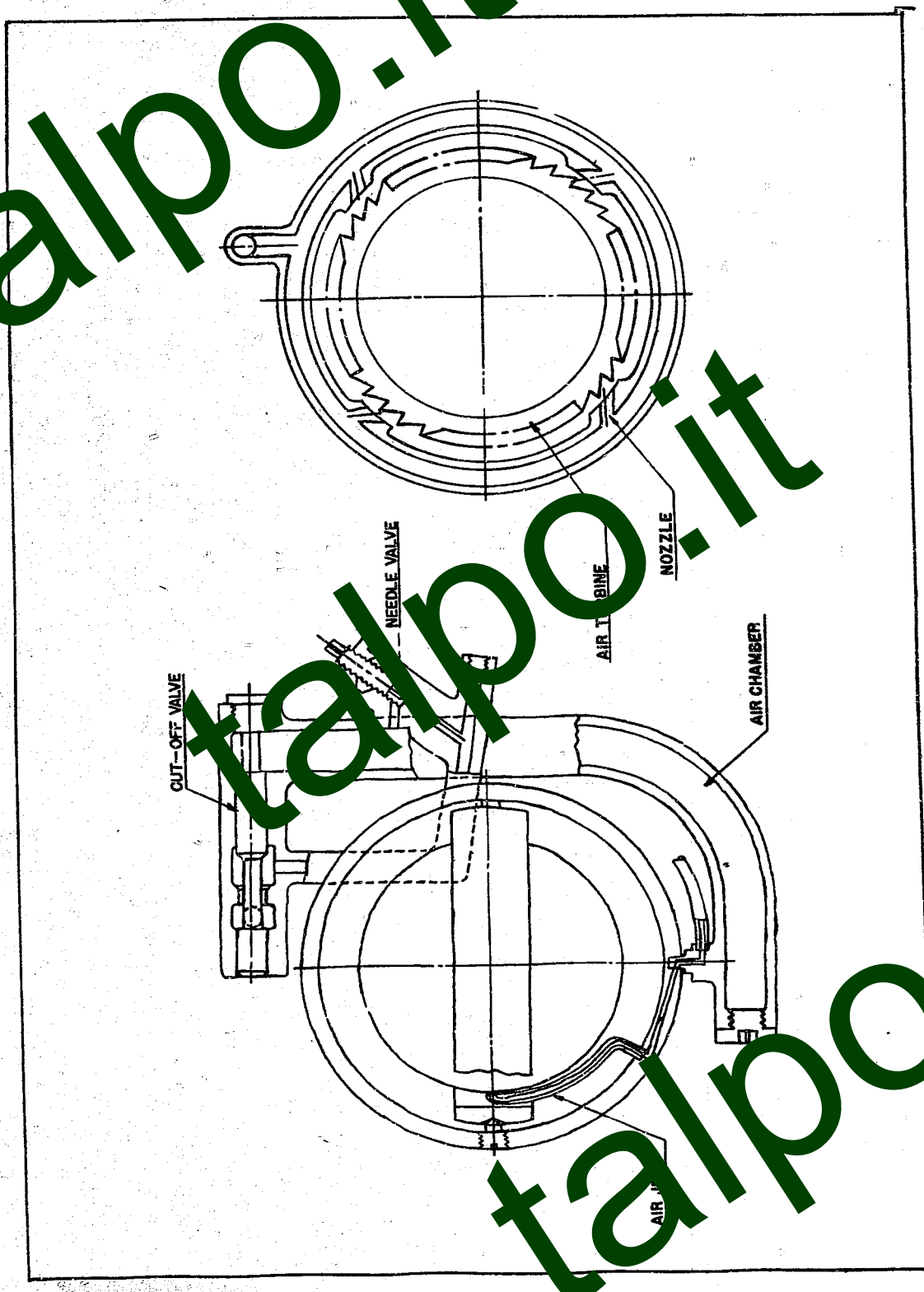

Figure 17
DETAIL OF GYROSCOPE, TYPE 4, MODEL 2

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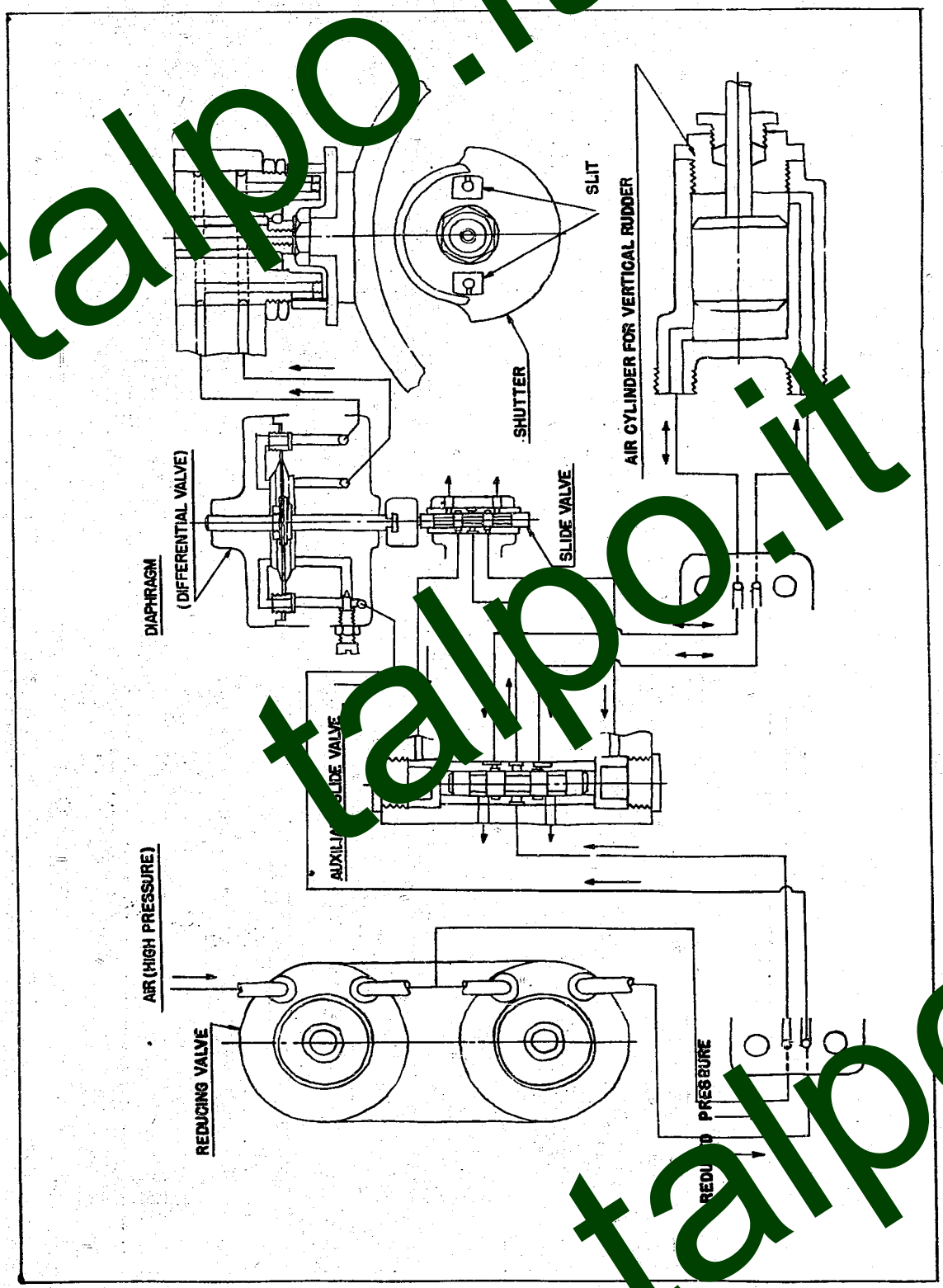
ENCLOSURE (B), Continued



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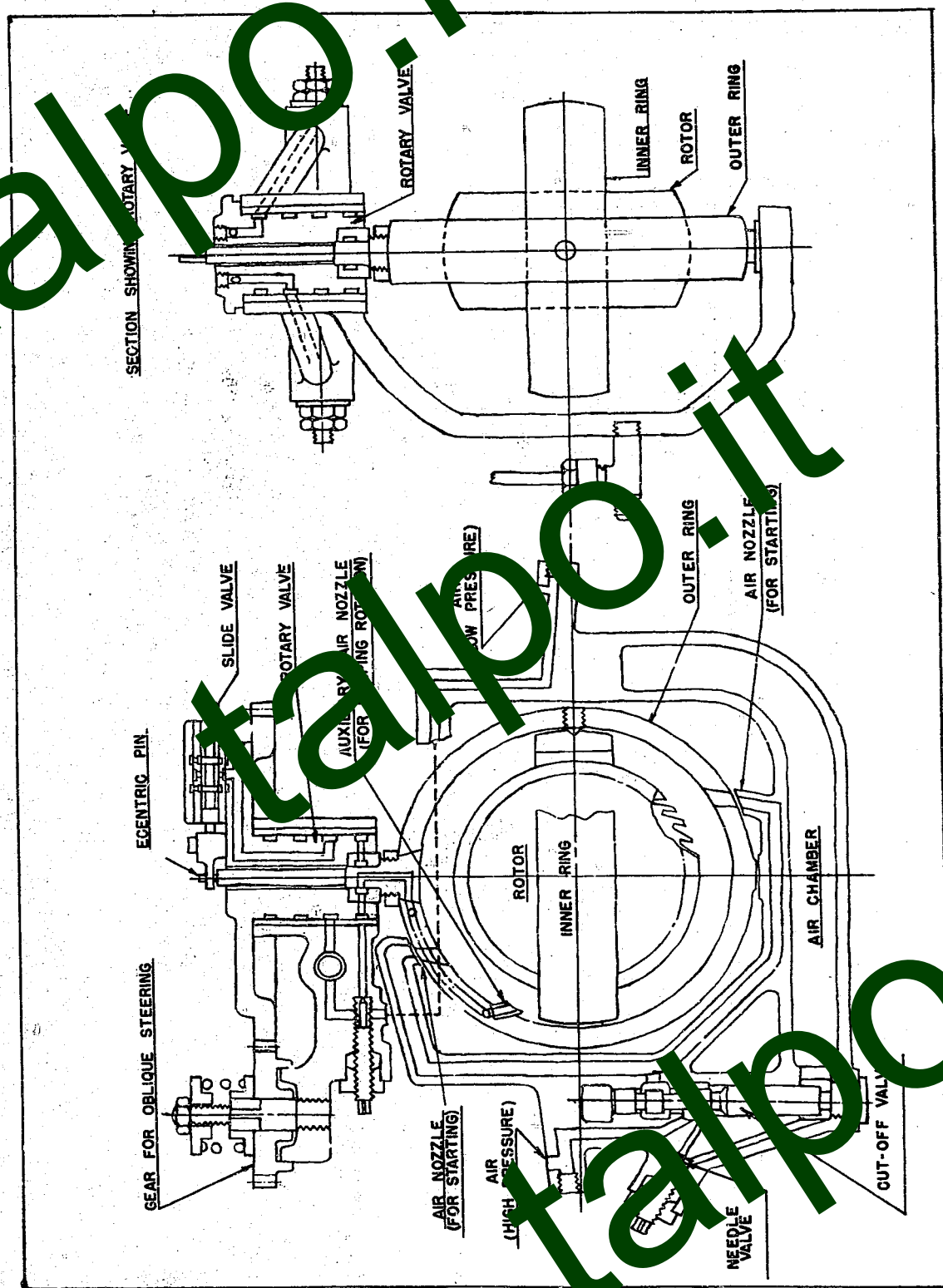
ENCLOSURE (B), continued



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ENCLOSUR[illegible] (B), Continued

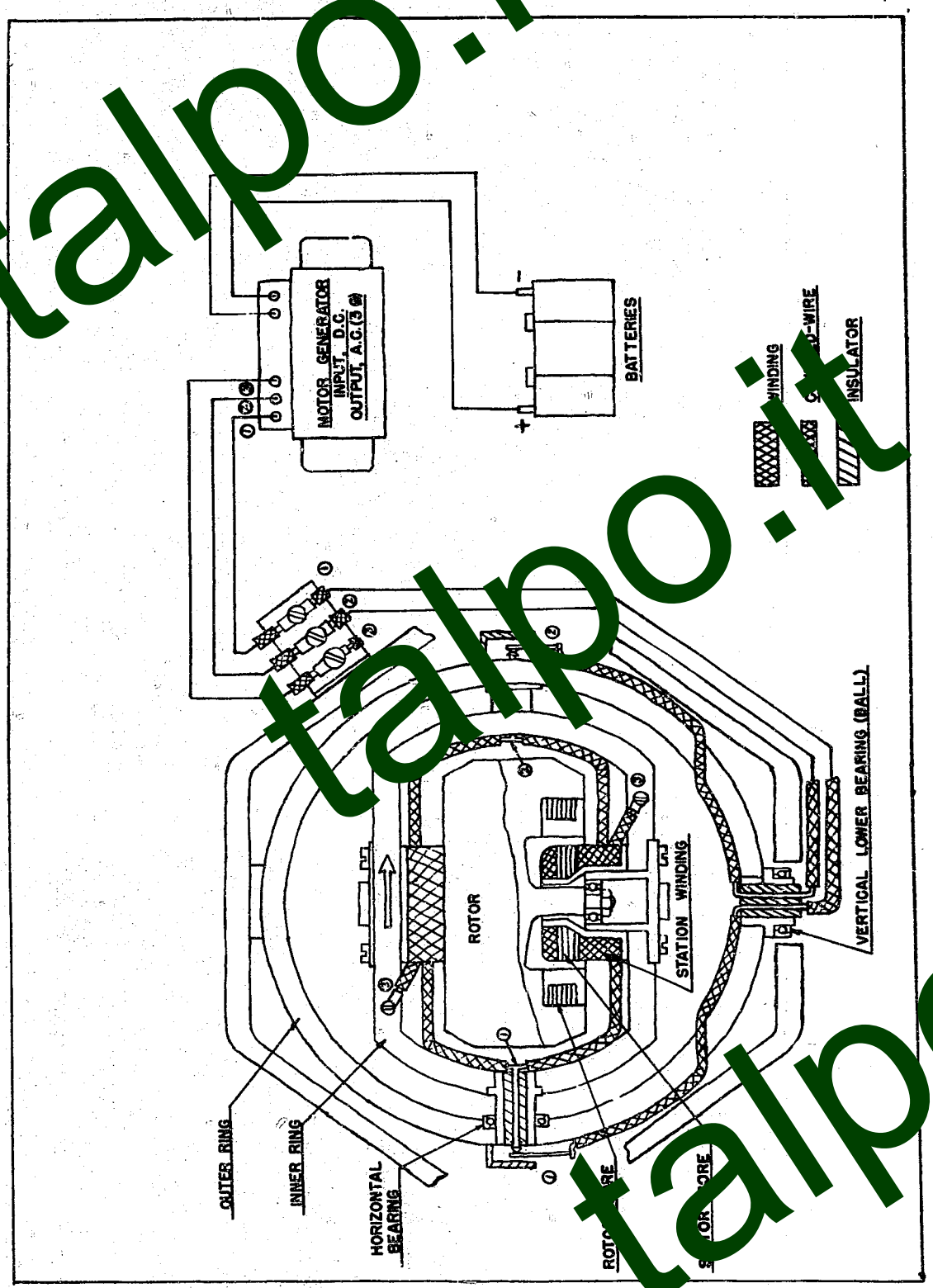

Figure #0

ELECTRICAL GYROSCOPE FOR TORPEDO STEERING CONTROL

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ENCLOSURE (B), continued

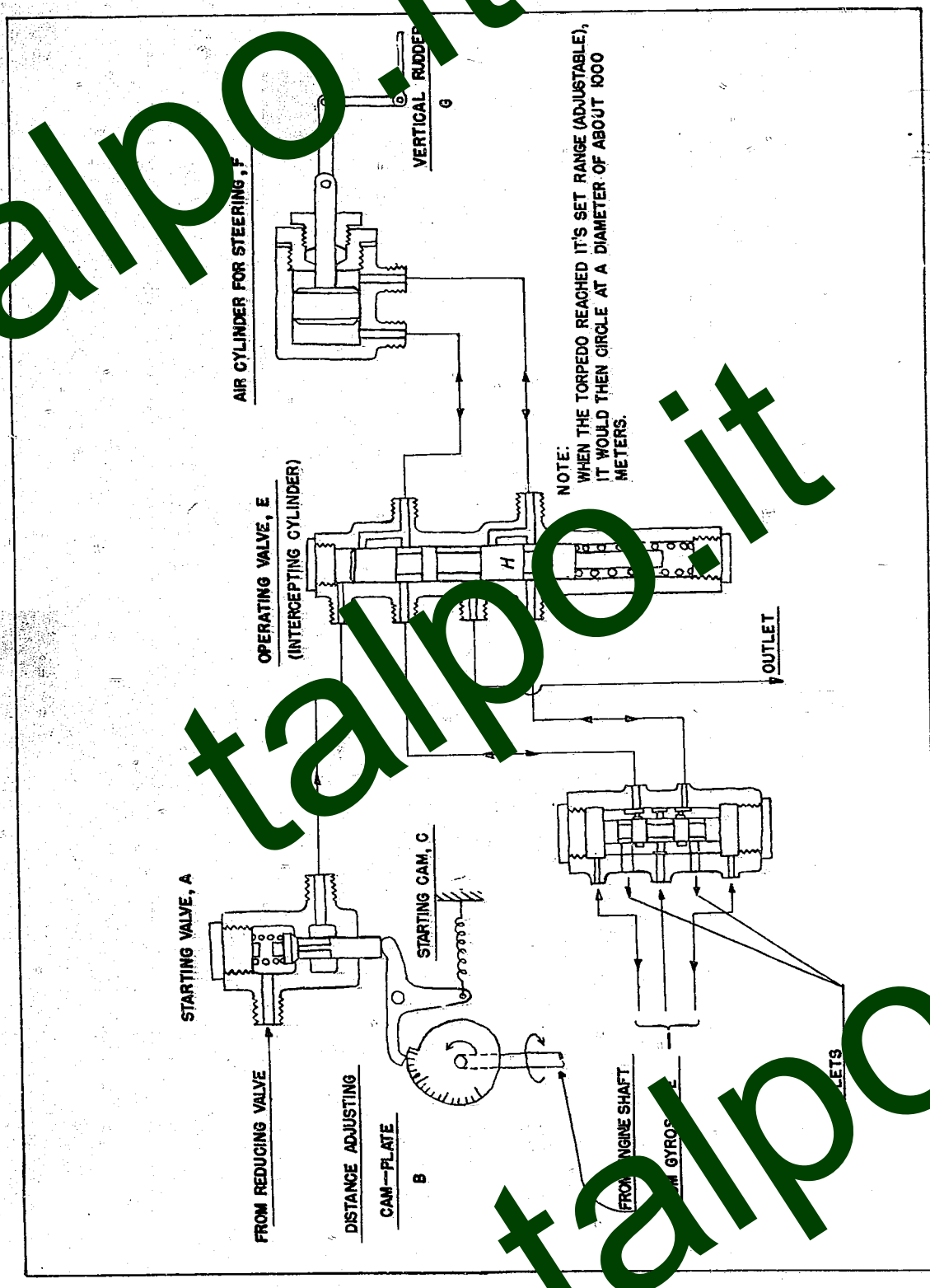

Figure 21
ARRANGEMENT OF SECONDARY STEERING DEVICE FOR CIRCLING

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