

GHQ/SCAP Records (RG 331, National Archives and Records Service)

Description of contents

- (1) Box no. 3050
- (2) Folder title/number: (14)
Explosives: Rifles, Guns etc.

(3) Date: Apr. 1946 - Dec. 1950

(4) Subject:

Classification	Type of record
9615, 9621	c, e, k

(5) Item description and comment:

Shikoku

(6) Reproduction: Yes No

(7) Film no. _____ Sheet no. _____

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Mr. Martinek Henry
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GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
Economic and Scientific Section
APO 500

MWH/HSC/EAD/sm
28 December 1950

420(28 Dec 50)ESS/IND

MEMORANDUM FOR: Ministry of International Trade and Industry
ATTN: Chemical Bureau

SUBJECT: Manufacture and Use of Industrial Explosives
and Accessories in CY 1951

SHIKOKU
O.D. //
INFORMATION
DEC 29 1950
AP

1. References are:

a. Letter FOM 2541(MITI) to General Headquarters, Supreme Commander for the Allied Powers, 21 December 1950, subject: Application for Approval of Manufacture and Use of Industrial Explosives in 1951.

b. Paragraph 4a of SCAP Directive No. 3 (SCAP IN 47), 22 September 1945.

2. Permission is hereby granted to manufacture industrial explosives and accessories for the period 1 January 1951 to 31 December 1951 as shown in attached chart. The exceptions shown in the chart have been agreed upon by the Ministry of International Trade and Industry and are indicated by handwritten figures.

FOR THE CHIEF, ECONOMIC AND SCIENTIFIC SECTION:

1 Incl
MITI Schedule for
Manufacture & Use
of Ind. Expls. &
Accessories in 1951

MAURICE M. CLASS
Chief, Industry Division



1951 Authorization for Explosives & Accessories Production

<u>Type</u>	<u>Quantity</u>
Blasting Explosives.....	22,606 metric tons
Black Powder.....	793 metric tons
For Blasting & Whaling.....	247 metric tons
For Pest Extermination & Sea-beasts.....	13 metric tons
For Fuse.....	483 metric tons
For Fireworks.....	50 metric tons
Smokeless Powder.....	84 metric tons
Total.....	23,483 metric tons
Fuse.....	66,000,000 meters tons
Blasting Cap.....	110,000,000 pieces tons
Electric Detonator.....	50,000,000 pieces
Percussion Cap.....	21,000,000 pieces
Detonating Fuse.....	400,000 meters
Electric Fuse.....	5,000,000 pieces
Powder Tube.....	3,000 pieces
Friction Tube.....	5,000 pieces
Signal Detonator.....	170,000 pieces
Cartridge for Pest Extermination.....	200,000 pieces
Volley Firer Fuses.....	100,000 pieces
Liquid Oxygen Explosives.....	185 metric tons

Summary of Production Project of Industrial Explosives and Accessories

Blasting Explosives	Black Powder	Smokeless Powder	Total	Fuse	Blasting Cap	Electric Detonator
metric ton	"	"	metric ton	meter	piece	piece
7,519			7,519			
	793		793	12,360,000		
				19,300,000		
					32,000,000	
					33,010,000	
						12,000,000
						11,950,000
						10,000,000
						11,860,000
						3,210,000
						3,900,000
4,627			4,627		29,110,000	
				12,441,000		1,520,000
						5,760,000
6,281		84	6,365			
3,629			3,629	1,756,000		
550			550			
					15,880,000	120,000
				10,237,000		4,360,000
				5,141,000		
				4,765,000		
						5,870,000
						5,160,000
22,606	793	84	23,483	66,000,000	110,000,000	50,000,000

sives and

Accessories for the period from 1st January through 31st December 1951

Blasting Cap	Electric Detonator	Percussion Cap	Detonating Fuse	Electric Fuse	Powder Tube	Friction Tube
piece	piece	piece	meter	piece	piece	piece
				150,000		
32,000,000				700,000		
33,010,000		7,000,000				
	12,000,000					
	11,950,000					
	10,000,000					
	11,360,000					
	3,210,000					
	3,900,000					
29,110,000				420,000		
	1,520,000			420,000		
	5,760,000			*		
			400,000			
15,880,000	120,000	14,000,000			3,000	5,000
	4,360,000			600,000		
				1,960,000		
				600,000		
	5,870,000					
	5,160,000					
110,000,000	50,000,000	21,000,000	400,000	5,000,000	3,000	5,000

h 31st December 1951

Price	Powder Tube	Friction Tube	Signal Detonator	Cartridge for Pest Extermination	Volley Firer Fuses	Liquid Oxygen Explosives
per piece	piece	piece	piece	piece	piece	metric ton
					30,000	
000					30,000	
000			50,000		40,000	
000						
000						
000						
			120,000			
	3,000	5,000		100,000		
000						
000						
000						
				100,000		
						48
						133
						4
0,000	3,000	5,000	170,000	200,000	100,000	185

Item of Explosives

Company	Factory	Gelatine Dynamite & "Hegi" Type Dynamite	Ammonie Dynamite & Ammonium Nitrate Explosives	Carlit	Black Powder	Smokeless Powder	Total
		(Unit) metric ton	"				
Nippon Kayaku	Asa	3,823	3,696				7,519
"	Iwahana				793		793
Asahi Kasei	Nobeoka	2,257	2,370				4,627
Nihon Yushi	Taketoyo	3,696	2,585			84	6,365
Kento Denki	Hodogaya			3,629			3,629
Hokuyo Kayaku	Sunagawa		550				550
Total		9,776	9,201	3,629	793	84	23,483

The Quantities of

Item (Unit)	Blasting Explosives metric ton	Black Powder			Smokeless Powder
		For Blasting & Whaling metric ton	For Pest Extermination & Whaling metric ton	For Fuse "	
Railway	72.14	3.155			
Maritime Transportation	94.275				
Electric Power	744.025				
Coal	13,109.				
Lignite	267.194				
Steel	11.25				
Mineal Mine	3,927.				
Ceramics	1,160.				
Ship	371.52.				
Agriculture	1,298.794	21.782			
Forestry	592.001	60.	172.38		79.56
Fishery	150.8	7.898	1.123		4.36
Quarry	104.625	104.625			
Ministry of Construction	692.985	50.			
Petroleum Investigation	10.				
Manufacturer				483.	
Total	22,605.609	247.46.	173.503	483.	83.92
Adjustment MITI	22,606	247	13 Fireworks	483 50	84

The Quantities of Industrial Explosives & Accessories demanded for

Black Powder			Smokeless Powder	Total	Fuse	Blasting Cap
Explosive	For Pest Extermination & Whaling	For Fuse				
metric ton	metric ton	"	"	metric ton	meter	piece
3.155				75.295	275,500	420,470
				94.275	348,800	543,335
				744.025	3,819,970	4,641,075
				13,109.	38,002,000	32,760,000
				267.194	1,249,000	1,628,000
				11.25		
				3,927.	17,403,750	11,217,000
				1,160.	5,155,500	3,608,850
				371.52		
1.782				1,320.576	3,495,778	3,797,597
0.	172.38		79.56	903.941	6,752,552	12,095,343
7.898	1.123		4.363	164.184	754,000	601,700
4.625				209.25	1,395,000	465,000
0.				742.985	2,131,826	1,933,128
				10.		
		483.		483.		38,760,000
7.46.	173.503	483.	83.923	23,593.495	80,783,676	112,471,498
47	13 Fireworks	483 50	84	23,483	66,000,000	110,000,000

Explosives & Accessories demanded for the period from 1st January through 31st December 1951

Explosive	Blasting Cap	Electric Detonator	Percussion Cap	Detonating Fuse	Electric Fuse	Powder Tube
meter	piece	piece	piece	meter	piece	piece
275,500	420,470					
348,800	543,335	497,870		5,370		
819,970	4,641,075					
002,000	32,760,000	35,690,000		300,000		
249,000	1,628,000					
		8,160				
403,750	11,217,000	300,000		60,000	4,878,662	
155,500	3,608,850	1,546,650		25,350		
		165,120				
495,778	3,797,597	191,997		8,980	121,338	
752,552	12,095,343		66,300,000			
754,000	601,700		150,000			21,432
395,000	465,000	46,500				
131,826	1,933,128					
		1,600		300		
	38,760,000					
783,676	112,471,498	38,447,897	66,450,000	400,000	5,000,000	21,432
000,000	110,000,000	50,000,000	21,000,000	400,000	5,000,000	3,000

December 1951

Electric Fuse	Powder Tube	Friction Tube	Signal Detonator	Cartridge for Pest Extermination	Volley Firer Fuses	Liquid Oxygen Explosives
piece	piece	piece	piece	piece	piece	metric ton
			170,000			
						48.
					30,000	
4,878,662					70,000	
						137.103
121,338						
				19,890,000		
	21,432	21,432				
5,000,000	21,432	21,432	170,000	19,890,000	100,000	185.103
5,000,000	3,000	5,000	170,000	200,000	100,000	185

<u>Manufacturer</u>	<u>Factory Designation</u>	<u>Factory Location</u>	<u>Products</u>	<u>Quantities Authorized</u>
Nippon Kayaku K.K.	Asa	Asa-machi, Asa-gun, Yamaguchi Pref.	Blasting Explosives	7,519 metric tons
"	Iwahana	Iwahana-mura, Gunma-gun, Gunma Pref.	Black Powder	793 metric tons
"	"	"	Fuse	12,360,000 meters
"	"	"	Volley Firer Fuses	30,000 pieces
"	Kokura	Shimoitozu, Itabitsu-cho, Kokura City, Fukuoka Pref.	Fuse	19,300,000 meters
"	"	"	Volley Firer Fuses	30,000 pieces
"	"	"	Electric Fuse	150,000 pieces
"	Nibuno	Toyotomi-mura, Kanazaki-gun, Hyogo Pref.	Blasting Cap	32,000,000 pieces
"	"	"	Electric Fuse	700,000 pieces
"	"	"	Signal Detonator	50,000 pieces
"	"	"	Volley Firer Fuses	40,000 pieces
"	Orio	659, Asekawa, Wakamatsu City, Fukuoka Pref.	Blasting Cap	33,010,000 pieces
"	"	"	Percussion Cap	7,000,000 pieces
"	Iwamizawa	1792, Higashitonebetsu, Iwamizawa City, Hokkaido	Electric Detonator	12,000,000 11,950,000 pieces
"	"	"	Electric Fuse	150,000 pieces
"	Iizuka	196, Wakana, Honami-mura, Kaho-gun, Fukuoka Pref.	Electric Detonator	10,000,000 11,360,000 pieces
"	Kiyama	Kokura, Kiyama-machi, Miyoki-gun, Saga Pref.	Electric Detonator	5,210,000 3,900,000 pieces

<u>Manufacturer</u>	<u>Factory Designation</u>	<u>Factory Location</u>	<u>Products</u>	<u>Quantities Authorized</u>
Asahi Kasei Kogyo K.K.	Nobeoka	304, Kawashima, Nobeoka City, Miyazaki Pref.	Blasting Explosives	4,627 metric tons
"	Nobeoka	5003, Tsunetomi, Nobeoka City, Miyazaki Pref.	Electric Fuse	420,000 pieces
"	Kokura	1623, Saienba, Kokura City, Fukuoka Pref.	Blasting Cap	29,110,000 pieces
"	Kiyama	883, Kokura, Kiyama-machi, Miyoki-gun, Saga Pref.	Fuse	12,441,000 meters
			Electric Detonator	1,520,000 pieces
			Electric Fuse	420,000 pieces
			Electric Detonator	5,760,000 pieces
Nihon Yushi K.K.	Taketoyo	8, Seimon, Taketoyo-machi, Chita-gun, Aichi Pref.	Blasting Explosives	6,281 metric tons
			Smokeless Powder	84 metric tons
Kanto Denki Kogyo K.K.	Hodogaya	1625, Bukko-cho, Hodogaya-ku, Yokohama City.	Blasting Explosives	3,629 metric tons
			Fuse	1,756,000 meters
			Detonating Fuse	400,000 meters
			Signal Detonator	120,000 pieces
Hokuyo Keyaku K.K.	Sunagawa	Toyonuma, Sunagawa-machi, Sorachi-gun, Hokkaido.	Blasting Explosives	550 metric tons
Teikoku Kakohin Kawagoe Seizo K.K.		2036, Matoba, Kasumigaseki-mura, Irume-gun, Saitama Pref.	Blasting Cap	15,880,000 pieces
			Electric Detonator	120,000 pieces
			Percussion Cap	14,000,000 pieces
			Powder Tube	3,000 pieces
			Friction Tube	5,000 pieces
			Cartridge for Pest Extermination	100,000 pieces

<u>Manufacturer</u>	<u>Factory Designation</u>	<u>Factory Location</u>	<u>Products</u>	<u>Quantities Authorized</u>
Teikoku Kokohin Seizo K.K.	Ueki	1245, Ueki-machi, Kurate- gun, Fukuoka Pref.	Fuse	10,237,000 meters
			Electric Detonator	4,360,000 pieces
			Electric Fuse	600,000 pieces
Kanto Dokusen Seisekusho	Takasaki	138, Tokiwa-cho, Takasaki City, Gunma Pref.	Fuse	5,141,000 meters
			Electric Fuse	1,960,000 pieces
K.K. Mite Shoten	Morioka	6, Higeshiyama, No.8 Jiwari, Kegano, Iwate-gun, Iwate Pref.	Fuse	4,765,000 meters
			Electric Fuse	600,000 pieces
Keratsu Kokohin Seisekusho	Keratsu	11, Motoishi, Keratsu City, Saga Pref.	Electric Detonator	5,870,000 pieces
			Electric Detonator	5,160,000 pieces
Kyushu Kokohin K.K.	Shime	Befu, Shime-machi, Kasuya gun, Fukuoka Pref.	Electric Detonator	5,160,000 pieces
Koe Koko Kogyo K.K.	Tokyo	⁸⁹⁰ 1017, Shimurenokadai-machi, Itabashi-ku, Tokyo.	Cartridge for Pest Extermination	100,000 pieces
Nippon Chisso Hiryo K.K.		Itsuki-mura, Kuma-gun, Kumamoto Pref.	Liquid Oxygen Explosives	48 metric tons
			Kegemori-mura, Chichibu-gun, Saitama Pref.	Liquid Oxygen Explosives
Showa Denko K.K.		Agawa-mura, Higashikanbara- gun, Niigata Pref.	Liquid Oxygen Explosives	105 metric tons
Denki Kagaku Kogyo K.K.		Aome-cho, Nishikubiki-gun, Niigata Pref.	"	4 metric tons

<u>Total of Products</u>	<u>Quantities Authorized</u>
Blasting Explosives	22,606 metric tons
Black Powder.....	793 metric tons
Smokeless Powder.....	84 metric tons
Total.....	23,483 metric tons
Fuse.....	66,000,000 meters
Blasting Cap.....	110,000,000 pieces
Electric Detonator.....	50,000,000 pieces
Percussion Cap.....	21,000,000 pieces
Detonating Fuse.....	400,000 meters
Electric Fuse.....	5,000,000 pieces
Powder Tube.....	3,000 pieces
Friction Tube.....	5,000 pieces
Signal Detonator.....	170,000 pieces
Cartridge for Pest Extermination.....	200,000 pieces
Volley Firer Fuses.....	100,000 pieces
Liquid Oxygen Explosives.....	185 metric tons

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GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
Civil Affairs Section
APO 500

471.86 (14 APR 1950) CAS-EM

14 APR 1950

SUBJECT: Manufacture of Air Rifles

- TO:
- Chief, Hokkaido Civil Affairs Region, APO 7-5
 - Chief, Tohoku Civil Affairs Region, APO 7
 - Chief, Kanto Civil Affairs Region, APO 500
 - Chief, Tokai-Hokuriku Civil Affairs Region, APO 710
 - Chief, Kinki Civil Affairs Region, APO 25
 - Chief, Chugoku Civil Affairs Region, APO 248
 - ✓ Chief, Shikoku Civil Affairs Region, APO 1050
 - Chief, Kyushu Civil Affairs Region, APO 24-5

B-380

1. Reference is memorandum for Ministry of International Trade and Industry from Industry Division, Economic and Scientific Section, General Headquarters, Supreme Commander for the Allied Powers dated 4 April 1950.

2. Forwarded for your information.

FOR THE CHIEF, CIVIL AFFAIRS SECTION:

1 Incl:
Memo, ESS, GHQ, SCAP
(cy)

J. A. O'Brien
J. A. O'BRIEN
CIVIL AFFAIRS SECTION
APO 500

- COPY -

GENERAL HEADQUARTERS
SUPREME COMMANDER FOR THE ALLIED POWERS
Economic and Scientific Section
APO 500

MMC/WT/ABO/MWH/RAS/jtt
4 April 1950

471.86 (4 Apr 50)ESS/IND

MEMORANDUM FOR: Ministry of International Trade and Industry

SUBJECT: Manufacture of Air Rifles.

1. References are:

- a. Memorandum from Ministry of International Trade and Industry to Chief, Economic and Scientific Section, GHQ, SCAP, L)-81, 31 Jan 1950, subject: Interpretation of Arms Mentioned in the Directive, Number 3.
- b. Directive Number 3, SCAPIN 47, 22 Sep 1945.
- c. Economic Stabilization Board, Instruction Number 23, 15 Dec 47, subject: Regulation on Restriction of Use of Essential Materials.
- d. Ministry of International Trade and Industry Ordinance Number 13, 1 Mar 1950, subject: Ministerial Ordinance Amending a Part of the Regulation of Restriction on Use of Essential Materials.

2. The Ministry of International Trade and Industry is authorized to permit the manufacture of air rifles subject to the mechanical specifications and limitations as set forth below:

- a. Barrel - To be limited to a maximum length of eighteen (18) inches; bore to be free from rifling and not to exceed 0.186 inches in diameter. In no case shall the barrel or tube wall metal thickness exceed 0.062 inches.
- b. Propelling Force - To be spring and/or air actuated; the propelling energy to be developed by the mechanical movement of integral parts of the unit without the use of inflammable powder or a percussion fired cartridge.
- c. Penetrating Force - Sufficient to allow the pellet to enter but not pass through a pine board 0.250 inches thick at a distance of ten (10) feet.

3. The manufacture of air rifles shall be authorized consistent with the provisions of the Ministry of International Trade and Industry Ordinance Number 13, reference 1d, above.

Copies furnished:
CA Sec
CHS
G-4

W. F. MARQUAT
Major General, U. S. Army
Chief, Economic and Scientific Section

- COPY -

Feb. 23, 1950

25 Sho No. 438

To : Col. L.E. Toole,
Commanding Officer of Shikoku Civil Affairs Region.

From : Naomi Momoi, Governor of Kochi Pref.

Subject: Application for the Permission of
manufacturing 30 m/m Line Projecting Whaling Gun.

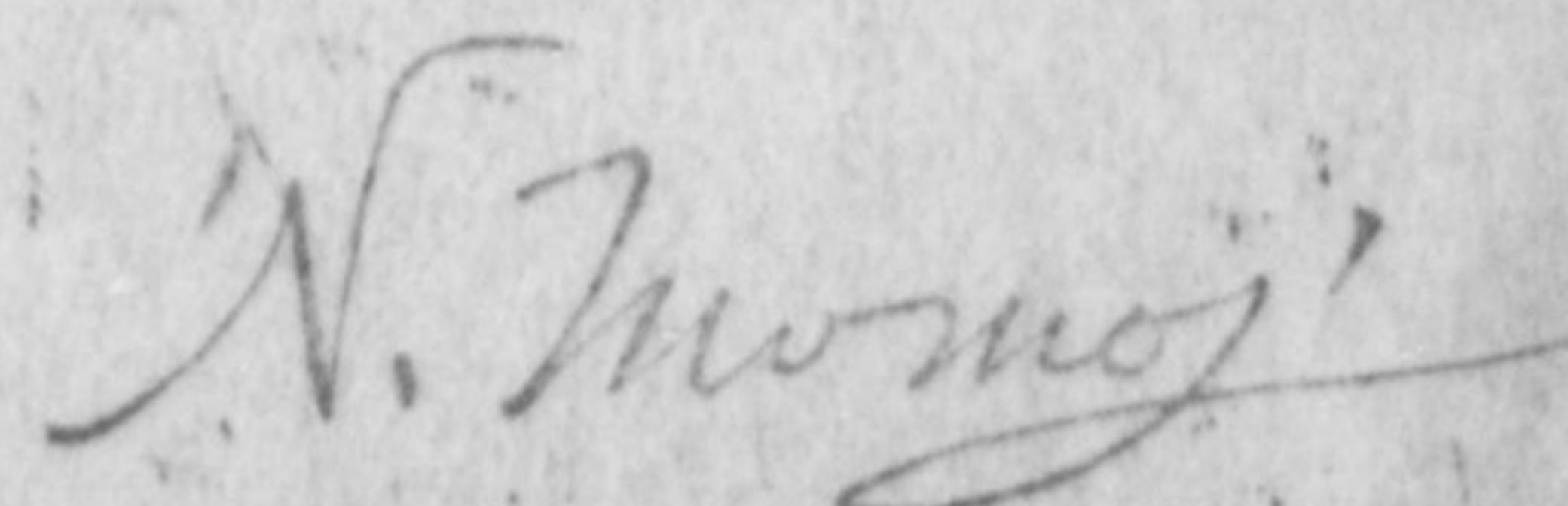
Sir,

I have received an application for the permission of the manufacturing from Takekichi Miroku, engaged in manufacturing whaling guns, No. 166, Hoen-cho, Kochi City as shown in the paper attached.

According to my investigation, the manufacturing of whaling guns has already been permitted, nothing objectionable being recognized.

You are cordially requested to grant the permission.

Yours respectfully,



Naomi Momoi
Governor of Kochi Pref.

Kochi, 20th, Jan., 1950.

To : Col. L. E. Toole
Commander of Shikoku Civil Affairs Region.

From : Bukichi Miroku
President of Miroku Iron Factory Ltd.,
No. 166, Hoeicho, Kochi City.

Subject: Application for the permission of Manufacturing
30m/m Rope Projection Gun for undermentioned
purposes.

We beg to cordially ask you to grant us a permission for manufacturing above as follows:-

1. Type, quantity & specification of this gun.

- (1) 30m/m rope projection gun

Estimated number of production 5 guns per month.

- (2) Will attach a fore supporter and aft holder to the whale gun barrel, which we are authorized to manufacture as per drawing attached herewith.

2. Purposes and reason for manufacturing.

- (1) For the salvage of shipwreck and its crew within the range of 500 metres, it is practicable to afford wrecked people the first aid by projecting a life rope with a harpoon attached to it, which is automatically dropped into sea at its maximum distance, leaving the life rope alone near at hand of the wrecked people.

(2) For economical use in hilly districts

In setting up electric, telecommunicating wires and suspension bridge, if it is within the range of 500 metres, a great economy is realized by projecting a first rope from one hill to another and thus leading to the proper work without excavating a time serving footing spots only to connect 2 hills. It admits of no dispute that this will save the expenses, time and labor to a great extent.

3. Name of responsible maker

Bukichi Miroku

Age - 60 years (Date of Birth-Dec. 21, 1890)

No. 166 Hoyei-cho, Kochi City.

4. Name of chief engineer

Same as maker

5. Names of advisers & guidance

Nissan Kagaku Kogyo Co., Ltd.

Kochi Prefectural Offices

6. Estimated demand for this gun

Demand in Kochi-Ken not more than 21

Domestic demand not more than 151

Bukichi Miroku
Bukichi Miroku
President of Miroku Iron
Factory Ltd.

HJH/rb

Headquarters
81st Military Government Company
Kochi, Shikoku

APC 24
19 April 1946

Subject: Authorization to commence production.

To : Miroku Factory Company Limited,
166 Hoeicho, Kochi City.

As no reconversion is involved in the operation of the Miroku Factory Company Limited, 166 Hoeicho, Kochi City, they may continue the manufacturing of whale guns and repairing of hunting guns, precision machines and safes.

Fred M. Grant
Major, Inf.
Senior Mil Govt Officer

Plan reckoned 30m/m line-projecting whale gun

Calibre ----- 30m/m Total length of barrel----900m/m
 Length of combustion chamber -----155m/m
 Haspoon weight ----- 6kg
 Kind & amount powder ----- (smokeless powder
 No. 2 square) 25g

<u>Division</u>	<u>worth</u>	<u>sign</u>
1) Vivacity -----	0.2789 -----	A
2) Force of powder-----	10391 -----	f
3) section Area of barrel -----	7.066 $\frac{\text{cm}^2}{\text{cm}}$ -----	6
4) Volume of combustion chamber -----	109.5 $\frac{\text{cm}^3}{\text{cm}}$ -----	Co.
5) Total volume of barrel -----	636.0 $\frac{\text{cm}^3}{\text{cm}}$ -----	C.
6) Imaginary amount of bullet --	0.6564kg -----	U.

$$u = \frac{i (P + \lambda W)}{g}$$

P: Weight of harpoon W: Powder amount
 λ : of charburier = 0.5
 i: Inside projectory coefficient = 107
 g: Gravity

7) Charge weight of combustion camber volume -----0.2283 ----- Δ
 8) Instant combustion pressure ----- 3073 $\frac{\text{kg}}{\text{cm}^2}$ ----- P'

Due to Abel Nobel type

- 9) Parametre of charge -----0.04704----- h_1
 10) Relation between rate of combustion & volume of barrel
 which harpoon passed over

$$1 - \left(\frac{C_0 - W}{C - W}\right) \frac{\gamma - 1}{2} = \frac{Z}{Z_0} \frac{M(Z) - M(Z_0)}{Z\phi(Z)}$$

$$\int \frac{ZM(Z)}{Z_0 Z\phi(Z)} - M(Z_0) \int \frac{Z dz}{Z\phi(Z)} = N(Z) - N(Z_0) - M(Z_0)(L(Z) - L(Z_0))$$

Provided

$$M(Z) = \int_0^Z \frac{Z dz}{\phi(Z)} \quad N(Z) = \int_0^Z \frac{ZM(Z)}{Z\phi(Z)} dz$$

$$L(Z) = \int_0^Z \frac{Z dz}{Z\phi(Z)}$$

$$1 - \left(\frac{C_0 - W}{C - W}\right) \frac{\gamma - 1}{2} = \frac{Z}{Z_0} [N(Z) - N(Z_0) - M(Z_0)(L(Z) - L(Z_0))]$$

- 11) Rate of combustion when harpoon begins to move
 -----0.001692----- Z_0

$$\frac{P}{P} \quad P_0 = 52 \text{ Kg}$$

Form function of powder grain ----- $\phi(Z) (= \sqrt{1-Z})$

$$M(Z_0) = \int_0^{Z_0} \frac{Z dz}{\phi(Z)} \text{ -----0.002-----} M(Z_0)$$

$$N(Z_0) = \int_0^{Z_0} \frac{ZM(Z)}{Z\phi(Z)} dz \text{ -----0.002-----} N(Z_0)$$

$$L(Z_0) = \int_0^{Z_0} \frac{Z dz}{Z\phi(Z)} \text{ -----11.69-----} L(Z_0)$$

- 12) Volume in barrel when powder burned out
 -----285.4 $\frac{\text{cm}^3}{\text{cm}^3}$ ----- C_1

13) First Velocity ----- 133.7 ----- V

$$V = \sqrt{V_1^2 + \frac{20+w}{(\gamma-1)u} \left(\frac{C_0 - w}{C_1 - w} \right) \frac{\gamma-1}{2} \left[1 - \left(\frac{C_1 - w}{C_0 - w} \right)^{\frac{\gamma-1}{2}} \right]}$$

Provided $V_1 = \frac{6}{AB} \{ M(1) - M(Z_0) \}$

(A) V_1 - Harpoon Velocity due to the powder burned out

(B) $\frac{2efw}{(\gamma-1)u} \left(\frac{C_0 - w}{C_1 - w} \right) \frac{\gamma-1}{2} \left[1 - \left(\frac{C_1 - w}{C_0 - w} \right)^{\frac{\gamma-1}{2}} \right]$ is

Harpoon Velocity due to adiabatic expansion gas from the point of powder burnt out to the end of barrel.

14) Combustion rate of max pressure against the parametre of charge ----- 0.783 ----- η

Expression

$$\frac{\gamma-1}{\gamma+1} \frac{1}{\eta} = \frac{M(\eta) M(Z_0)}{\varphi(\eta)} + \frac{\gamma-1}{\gamma+1} \left\{ \frac{N(\eta) - N(Z_0) - M(Z_0)}{L(\eta) - L(Z_0)} \right\}$$

15) Barrel Volume at Max pressure ----- 163.2 ----- \bar{C}

Expression

$$\frac{C_0 - w}{C - w} = \left\{ 1 - \frac{2}{\gamma-1} \left[\frac{N(\eta) - N(Z_0) - M(Z_0)}{L(\eta) - L(Z_0)} \right] \right\}^{\frac{2}{\gamma-1}}$$

16) Max Pressure ----- 1716 ----- Pm

Expression

$$P_m = P_1^2 \left(\frac{C_0 - w}{C - w} \right)^{\frac{\gamma+1}{2}}$$

Remarks: As for the harpoon velocity and the highest pressure, the figure got by the above expressions was multiplied by 1.24 according to the experiment made in there past. The curve Figure of barred inside Velocity & pressure will be shown on the accompanying paper.

Thickness of barrel

The stretching power is calculated, which is made to burst pursuant to the barrel main line which has the greatest work and danger against the inside pressure of the thick cylinder.

Expression

$$\text{Stretching Power} = \frac{P_o \cdot r_1^2}{(r_1 - r_o)(r_1 + r_o)} \left(\left(\frac{r_o}{r} \right)^2 + 1 \right)$$

P_o - Inside Pressure

r₁ - Outside radius

r_o - Inside radius

r - Optional radius to get stretching power

r - Stretching power

1.5 cm ... 2,092 kg/cm²

2.0 1,262

2.5 875

3.0 667

3.5 540

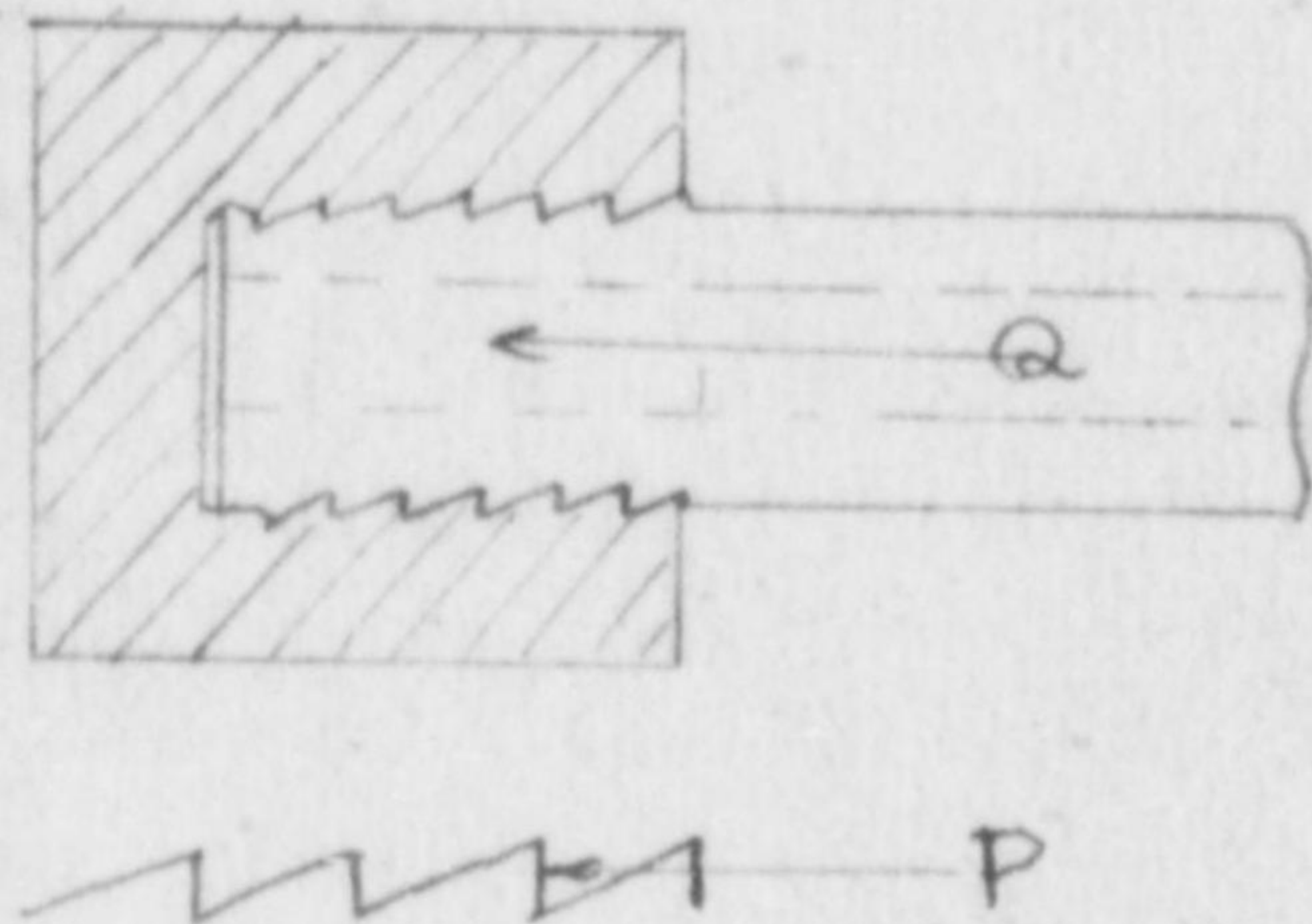
4.0 457

4.5 401

4.75 280

According to the figures shown above, the stretching power of the inside is 2092 kg/cm² and the minimum opposing power of proportional limit of steel is 2500 kg/cm². Therefore, the thickness of barrel is strong enough against inside pressure.

Intensity of breech screw



When the pressure made on the contact surface of the screw is considered, the number of screw increases more than when the cutting of the screw and its curving is considered. Therefore, the expression is,

$$p = \frac{Q}{Z \pi \text{ det}}$$

Q = Power which operates to barrel axis ----- 8,000 kg

Z = Numbers of screws

de = Average diameter of screw ----- 10 cm

t = Height of screw ----- 0.5 cm

P = Contact pressure ----- Kg/cm²

P is hard steel and under 130 kg/cm²

Therefore, $Z = \frac{8000}{130 \times \pi \times 10 \times 0.5} \approx 4$ doubled, considering the shock of gun

4 x 2 = 8 screws

Fig. of Pressure Curve & Harpoon Velocity Curve in Barrel
of 30m/m Line-projecting whale gun

