ENCLOSURE (B) 3

STUDIES ON THE SYNTHESIS OF HYDROGEN PEROXIDE FROM WATER VAPOUR BY THE ELECTRIC DISCHARGE METHOD

by
ENG. COMDR. DR. H. FUJIMOTO
ENG. LT. COMDR. Y. MOMOTARI
ENG. LIEUT. T. KONOSU

Research Period: 1945

Prepared for and Reviewed with Authors
by U. S. Naval Technical Mission to Japan

December 1945

ENCLOSURE (B)3

LIST OF TABLES AND ILLUSTRATIONS

ENCLOSURE (B)3

SUMMARY

Using superheated steam at about 125°C, H_2O_2 was not synthesized by the 50 cycle A.C. Tesla discharge. Using superheated steam at about 125°C and 500 kilocycles, H_2O_2 could be synthesized. The power consumption was about 300 kwh/kg of H_2O_2 and its concentration was about 0.08%. When two reaction tubes were used in series, there was no improvement in the yield of H_2O_2.

I. INTRODUCTION

The synthesis of H_2O_2 from water vapour has been carried out with the high frequency silent discharge under reduced pressure. However, by this method, the operation of the apparatus is difficult owing to the reduced pressures and the extremely small volume treated per unit. To improve this point, this experiment was begun under such conditions that gaseous superheated steam was used and the high frequency discharge took place at atmospheric pressure followed by rapid cooling. Commercial frequency discharge was also tried but results were unsatisfactory. This research was carried out from January to July 1945 by Eng. Lt. T. KONOSU

II. DESCRIPTION

A. Apparatus

The apparatus is shown in Figure 1(B)3.

B. Procedure

As shown in Figure 1(B)3, the water is boiled in the water boiler (B). The steam formed is superheated by the heating coil (H) and flows into reaction tube (R). At this point discharge occurs. The products then flow into cooling tube (C) and are condensed. The condensed water containing the synthesized H_2O_2 is collected in receiver (D). When the experiment is over, the product is titrated with $\frac{1}{10}$ N $KMnO_4$ to determine the concentration of synthesized H_2O_2. The discharge voltage is generated by the Tesla coil shown in Figure 1(B)3.

C. Results

Results are shown in Table I(B)3.

III. CONCLUSIONS

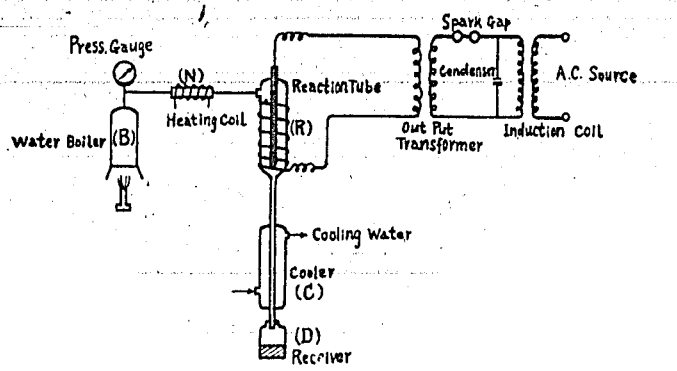
When commercial frequency discharge was used, the formation of H_2O_2 was negligible. When high frequency discharge was used, the quantity of H_2O_2 increased with increasing steam volumes, but its concentration was decreased.

The synthesis of H_2O_2 by this method offers many difficulties, since the power consumed per quantity of H_2O_2 is high and the concentration of product is low.

Table I(B)3
RESULTS OF TESLA DISCHARGE ON STEAM

Discharge	Condensed Water (cc/10 min)	Super-heated temp (°C)	Prim Voltage (volts)	Prim Current (amps)	Powerr (watts)	H_2O_2		Power Consumption (kwh/kg H_2O_2)
						Total (gm/hr)	Concen-tration (%)	
Commercial frequency	10	125	15	5	75	Trace	---	---
	30	130	20	5	100	Trace	---	---
	50	125	30	5	150	Trace	---	---
	100	125	40	5	200	Trace	---	---
High frequency	10	130	15	4	60	0.02	0.03	3.000
	15	125	17	5	85	0.04	0.05	2.000
	20	125	17	5	85	0.05	0.04	1,500
	30	125	22	5	110	0.11	0.05	1,500
	60	125	35	5	165	0.17	0.05	1,000
	100	125	40	5	200	0.40	0.06	500
	150	125	42	5	210	0.70	0.08	300
	200	125	45	5	225	0.45	0.04	500

ENCLOSURE (B)3



Reaction Tube Detail

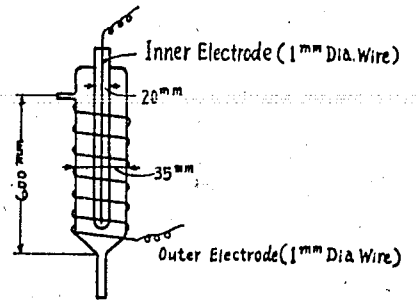


Figure 1 (B)3
APPARATUS FOR H_2O_2 SYNTHESIS
BY TELSA DISCHARGE