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Report on

Water Loss from Submarine Storage Cells

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ABSTRACT

This report describes measurements of the water lost from a typical submarine storage cell by evaporation to the ventilation air under a wide variety of temperature and humidity conditions. It was found that the water loss increases rapidly with increase in temperature and with decrease in humidity. It is recommended that consideration be given to ventilating the battery with outside air which would have a lower temperature and higher relative humidity than does the ventilating air under present conditions.

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AUTHORIZATION

1. This problem was authorized by Bureau of Engineering letter, reference (a). Other references pertinent to this problem are listed as references (b) to (e).

References: (a) BuEng let.SS/S62(7-30-D1) of 7 Aug.1935.
(b) NRL Confidential Report No. P-1023 of 2 Feb.1934.
(c) ONI Report on visit to H.M.S. REGULUS, 31 October 1931, X Serial No. 879.
(d) Vinal, "Storage Batteries".
(e) BuEng 1st end. SS/S38(3-13-D1) of 27 March 1936 forwarding to BuC&R NRL let.SS/19 of 13 March 1936 to BuEng.

STATEMENT OF PROBLEM

2. The problem considered in this report is that of determining the water loss from a typical submarine cell during the charging process.

KNOWN FACTS BEARING ON THE PROBLEM

3. In the operation of submarine storage batteries, the cells gradually lose water from their electrolyte. To replace this water, large quantities of distilled battery water must be carried by the submarine. The weight and space required by this battery water are a charge against the military efficiency of the ship. The process of watering the 120 or 240 cells in a submarine is time-consuming and troublesome and further reduces the military efficiency. Minimizing this loss of water by any feasible means would therefore increase the effectiveness of a military submarine.

4. Submarine batteries lose water in three distinct ways:

(1) The electrolyte may itself be lost from the cell as by leakage, by spraying during the gassing phase of the charge, or by splashing when operating in a heavy sea.

(2) When the cells are gassing, the electrolytic process consumes water which is lost as hydrogen and oxygen gas.

(3) The dry ventilation air evaporates water from the electrolyte.

The first of these is of negligible importance in a properly operated submarine. The second, the gassing process, is important only during the gassing phase of the charge. The third process is always occurring, since the cells are constantly ventilated.

5. The amount of water lost from an operating battery depends upon the type of ventilation used. There are two general types of battery ventilation systems: the open system and the closed system. In the

open system, used by the British Navy and discussed in reference (b), all the cells in a battery ventilate into the battery space, which in turn is ventilated by blowers. In the closed system, used by the United States Navy, all of the cells in a battery are connected to a ventilation duct which sucks air from the battery space through the individual cells into the duct system. Available information indicates that the water loss from batteries using the open system is less than with the closed system (for example, in ref.(c)).

6. Service experience has proved that operating conditions markedly affect the rate of water loss. Thus, submarines operating in the Panama area in summer consume far more water than those in New London; submarines operating in the temperate zones in winter consume less battery water than in summer.

THEORETICAL CONSIDERATIONS

7. The amount of water loss by gassing can readily be calculated from Faraday's Law of Electrolysis (reference (d)), or can be determined from the readings of a hydrogen detector fitted to the ventilation system.

8. Some theoretical work has been done on the problem of predicting the loss by evaporation of liquids exposed to an air stream. But since this evaporation depends on so many factors, this theoretical work is of limited value in the present problem. It does, however, show that the loss of water from a submarine cell by evaporation depends on the following variables: the rate of flow of ventilation air; the temperature of the cell and of the ventilation air; the humidity of the incoming air; the specific gravity and temperature of the electrolyte; the shape of the cell interior; and whether the electrolyte surface is quiescent or is disturbed, as by gassing.

NARRATIVE OF ORIGINAL WORK DONE AT THIS LABORATORY ON THE PROBLEM

9. Early in the submarine battery work at this Laboratory, the lack of quantitative data on the water loss from submarine batteries was recognized and some data were taken under service conditions on the submarines U.S.S. R-3 and U.S.S. BASS. The use of water meters in the battery watering system permitted the determination of the water consumption, while humidity determinations of the ventilation air before and after passage through the battery gave an idea of how much water was lost by evaporation. On the BASS, the difficulty of making accurate humidity measurements proved to be so great as to make the results of limited value.

10. In the present work, the water lost from a single submarine cell under carefully controlled conditions was determined.

METHODS

(a) Preparation of Materials, Etc.

11. In the present experiments, a WLH-29 cell with 1280 specific gravity electrolyte was used. It was mounted in a tank of water which could be heated or cooled by electric heating and refrigerating equipment

so that the temperature of the cell could be maintained approximately constant (Plate 1). The intake of the cell was connected to a simple home-made air conditioning device which maintained the temperature and humidity of the ventilation air at a constant value (Plate 2). The volume of the ventilation air was measured with a calibrated flow meter, while its hydrogen content was determined with a hydrogen detector. The temperature and humidity of the ventilation air before and after passing through the cell was measured with wet and dry bulb thermometers and with chemical hygrometers. The latter operated on the following principle: A known volume of ventilation air was drawn through a chemical water absorber, the weight of which was determined before and after passage of the air. The increase in weight then gave the water content of this volume of air. The cell was charged in the usual manner from a motor generator, the charge being controlled by suitable instruments.

(b) Description of Experiments

12. An experiment was made as follows: The cell was discharged a known amount (4250 A.H.) and then the charge was started with the cell temperature and the temperature, and humidity of the incoming ventilation air being kept as nearly constant as possible. The temperature and humidity of the ventilation air, after having passed through the cell at the rate of 2 C.F.M. were then determined at intervals throughout the experiment. At the same time, all pertinent data related to the charge were taken. Two types of charge were used: the old type manufacturer's two-step charge and an old type Bureau multi-step charge, the TVG curve being used for control in each type.

DATA OBTAINED

13. The essential data from several charges are given in Tables 1 - 32 and some of these are summarized in the curves of Plate 3.

14. Humidity measurements of the type used in this work are subject to large errors, necessitating, as they do, the reading of small differences in temperature. It is considered, however, that with the large number of charges made, the data obtained are sufficiently accurate for the purpose. The devising of accurate methods of humidity measurement under the conditions obtaining in the present experiments would itself be a time-consuming research problem.

CONCLUSIONS AND RECOMMENDATIONS

(a) Facts Established

15. From the above results, the following facts are established:

(a) Storage battery electrolytes have a lower vapor pressure than does pure water at the same temperature (Plate 5). Expressed in humidity, air in equilibrium with electrolyte of 1280 specific gravity has a humidity of approximately 60%, 1210 specific gravity electrolyte a humidity of about 75%.

(b) If ventilation air which is drier than air containing an equilibrium amount of water vapor for a given electrolyte and cell temperature is passed through a cell, the cell loses water by evaporation.

(c) If the ventilation air has a higher humidity than this equilibrium humidity, the cell will actually pick up water.

(d) With dry air, the water loss increases rapidly with increase in temperature.

(e) At a given temperature, the water loss increases rapidly with decreasing humidity of the ventilation air.

(f) Dry ventilation air passing through a cell does not become anywhere near saturated with water. For example, dry air at 122^{o} becomes less than 15% saturated.

(g) The water loss by evaporation with the two types of charge is about equal under the same conditions.

(b) Opinions

16. A striking feature of the above results is the wide range of humidity over which a cell of 1280 specific gravity actually picks up rather than loses water. Since U.S.Navy submarines frequently operate in climates where the humidity is high, it might therefore be expected that submarine batteries would actually pick up water from the ventilation air even with 1210 specific gravity electrolyte. It is believed that the reason why these batteries do not do so is this: If a submarine is taking in outside air having a temperature of 60^{o} and a humidity of 90%, as this air passes through the submarine its temperature may reach 80^{o} and, assuming it to pick up no water, its humidity will then be only 48%, so that it would evaporate water from the battery.

17. Submarine batteries with war-time electrolyte should lose battery water at a slower rate than with 1210 electrolyte at the same temperature; but as the operating temperatures are expected to be higher than in peace-time, the water loss may be greater with the higher specific gravity electrolyte.

18. It has previously been suggested that the glass plates now used in submarine cells might advantageously be replaced by a floating rubber plate of the type shown in Plate 4. This floating plate would serve the same function as the glass plate in reducing spray loss and would, at the same time, reduce water loss by evaporation by reducing to a minimum the exposed surface of electrolyte.

(c) Recommendations

19. It is recommended that the feasibility of connecting the battery ventilation system to the main ship's ventilation system in the manner suggested by the Bureau of Engineering in reference (e) be considered.

If this were done, the ventilation air reaching the battery would be cooler and have a higher humidity than with the present system with the result that the batteries would be cooler and the water loss would be reduced.

Table 1

Time Hours	Charging Rate, Amperes	Temperature: Cell	Temperature: Incoming Air	Humidity, grains per cu.ft.: Incoming Air	Humidity, grains per cu.ft.: Outgoing Air	Water Loss by Evaporation, grains: per Cu.Ft.	Water Loss by Evaporation, grains: per Half-hour
0	0-1300	46	41	-	-	-	-
1/2	1300	50	48	.15	1.05	.90	54
1	"	52	50	.15	1.15	1.00	60
1-1/2	"	55	"	.15	1.3	1.15	69
2	"	59	"	.15	1.25	1.10	66
2-1/2	1300-800	60	"	.20	1.4	1.2	72
3	550	60	"	.25	1.4	1.2	72
3-1/2	330	59	48	.30	1.4	1.1	66
4	330	58	43	.30	1.25	.95	57
4-1/2	330-250	57	46	.15	1.05	.90	54
5	250-190	55	"	.10	.9	.8	48
5-1/2	190-165	54	"	.10	.85	.75	45
6	165	53	"	.15	.9	.75	45
6-1/2	"	52	"	.10	.9	.8	48
7	"	52	"	.05	.9	.85	51
7-1/2	"	52	"	.25	.9	.65	39
8	"	52	"	.5	1.1	.6	36
						Total -	936

Table 2

Time Hours	Charging Rate, Amperes	Temperature: Cell	Temperature: Incoming Air	Humidity, grains per cu.ft.: Incoming Air	Humidity, grains per cu.ft.: Outgoing Air	Water Loss by Evaporation, grains: Cu.Ft.	Water Loss by Evaporation, grains: per Half-hour
0	0-1050	48	-	-	-	-	-
1/2	1050	50	45	.45	1.05	.60	36
1	"	52	49	.45	1.05	.60	36
1-1/2	"	53	50	.5	1.7	1.2	72
2	"	55	50	.6	1.7	1.1	66
2-1/2	"	56	48	.6	1.3	.7	42
3	1050-330	57	59	.25	1.25	1.0	60
3-1/2	330	57	63	.4	1.35	.95	57
4	"	57	62	.75	1.35	.6	36
4-1/2	"	56	66	.7	1.3	.6	36
5	"	56	50	.4	1.15	.75	45
5-1/2	"	55	61	.4	1.2	.8	48
6	"	54	61	.6	1.3	.7	42
6-1/2	"	52	60	.45	1.05	.6	36
7	"	51	50	.45	1.1	.65	39
7-1/2	"	51	59	.35	1.05	.7	42
8	"	51	59	.35	1.05	.7	42
						Total -	735

Table 3

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1300	57	-	-	-	-	-
1/2	1300	61	59	4.4	4.2	-.2	-12
1	"	63	"	"	4.1	-.3	-18
1-1/2	"	65	"	"	4.4	0	0
2	1300-1050	66	"	"	4.5	.1	6
2-1/2	1050- 800	65	"	"	4.5	.1	6
3	800- 550	64	"	"	4.2	-.2	12
3-1/2	550- 330	63	"	"	4.4	0	0
4	330	62	"	"	4.5	.1	6
4-1/2	330- 250	61	"	"	3.9	-.5	-30
5	250	60	"	"	4.2	-.2	-12
5-1/2	190	60	"	"	4.0	-.4	-24
6	190- 165	59	"	"	4.0	-.4	-24
6-1/2	165	59	"	"	4.0	-.4	-24
7	"	59	"	"	4.0	-.4	-24
7-1/2	"	58	"	"	4.0	-.4	-24
8	"	58	"	"	4.0	-.4	-24
						Total -	-186

Table 4

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1050	59	-	-	-	-	-
1/2	1050	60	59	4.4	4.3	-.1	- 6
1	"	62	"	"	"	-.1	- 6
1-1/2	"	63	"	"	4.2	-.2	-12
2	"	63	"	"	"	-.2	-12
2-1/2	"	63	"	"	"	-.2	-12
3	"	63	"	"	4.1	-.3	-18
3-1/2	330	62	"	"	"	-.3	-18
4	"	61	"	"	4.3	-.1	- 6
4-1/2	"	59	"	"	3.9	-.5	-30
5	"	59	"	"	4.0	-.4	-24
5-1/2	"	58	"	"	"	-.4	-24
6	"	57	"	"	"	-.4	-24
6-1/2	"	62	"	"	"	-.4	-24
7	"	50	"	"	3.8	-.6	-36
7-1/2	"	50	"	"	"	-.6	-36
8	"	50	"	"	"	-.6	-36
						Total -	-324

Table 5

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1300	48	-	-	-	-	-
1/2	1300	50	61	.09	-	1.0	60
1	"	51	63	0	-	1.0	60
1-1/2	"	53	64	0	-	1.0	60
2	1300-1050	56	64	.04	1.1	1.05	63
2-1/2	1050 -800	57	64	.04	1.1	1.05	63
3	800 -550	57	66	.1	1.1	1.0	60
3-1/2	550 -330	56	66	.04	1.1	1.05	63
4	330	56	66	.04	.9	.85	51
4-1/2	330 -250	54	67	.04	.9	.85	51
5	250 -190	54	68	.04	.9	.85	51
5-1/2	190	53	70	.10	1.0	.9	54
6	190 -165	52	72	.09	.8	.7	42
6-1/2	165	53	72	.09	.8	.7	42
7	"	53	72	.09	.8	.7	42
7-1/2	"	52	71	.13	.8	.7	42
8	"	51	70	.20	.8	.6	36
						Total -	840

Table 6

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1050	48	-	-	-	-	-
1/2	1050	51	66	.13	1.2	1.05	63
1	"	53	72	.13	1.2	1.05	63
1-1/2	"	44	76	.13	1.1	1.0	60
2	"	55	73	.17	1.1	.95	57
2-1/2	"	56	81	.17	1.0	.85	51
3	1050-330	57	80	.04	1.0	.95	57
3-1/2	330	57	81	.09	.9	.8	48
4	"	56	82	.09	.8	.7	42
4-1/2	"	56	81	.09	.7	.6	36
5	"	55	81	.04	.7	.65	39
5-1/2	"	54	82	.13	.8	.65	39
6	"	52	77	.30	.8	.5	30
6-1/2	"	52	75	1.0	1.5	.5	30
7	"	52	75	1.5	1.9	.4	24
7-1/2	"	53	75	1.5	1.9	.4	24
8	"	54	75	1.5	1.9	.4	24
						Total -	687

Table 7

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1300	59	86	-	-	-	-
1/2	1300	62	"	-	-	-	-24
1	"	67	"	8.7	8.3	- .4	-24
1-1/2	"	69	"	"	8.5	- .2	-12
2	"	71	"	"	8.2	- .5	-30
2-1/2	1050-800	73	"	"	8.0	- .7	-42
3	800-550	73	"	"	8.2	- .5	-30
3-1/2	550-330	72	"	"	8.3	- .4	-24
4	330	71	"	"	8.3	- .4	-24
4-1/2	330-250	70	"	"	8.3	- .4	-24
5	250-190	69	"	"	8.1	- .6	-36
5-1/2	190-165	68	"	"	8.3	- .4	-24
6	165	67	"	"	7.7	-1.0	-60
6-1/2	"	66	"	"	7.6	-1.1	-66
7	"	64	"	"	7.6	-1.1	-66
7-1/2	"	64	"	"	7.7	-1.0	-60
8	"	64	"	"	7.5	-1.2	-72
						Total -	-618

Table 8

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1050	56	86	-	-	-	-
1/2	1050	60	"	8.7	8.3	- .4	-24
1	"	64	"	"	8.2	- .5	-30
1-1/2	"	65	"	"	8.0	- .7	-42
2	"	66	"	"	8.1	- .6	-36
2-1/2	"	68	"	"	8.3	- .4	-24
3	1050-330	68	"	"	8.1	- .6	-36
3-1/2	330	68	"	"	8.1	- .6	-36
4	"	68	"	"	8.1	- .6	-36
4-1/2	"	68	"	"	8.3	- .4	-24
5	"	66	"	"	8.3	- .4	-24
5-1/2	"	68	"	"	8.3	- .4	-24
6	"	65	"	"	8.3	- .4	-24
6-1/2	"	64	"	"	7.8	- .9	-54
7	"	63	"	"	7.7	-1.0	-60
7-1/2	"	64	"	"	7.4	-1.3	-78
8	"	65	"	"	7.1	-1.6	-96
						Total -	-648

Table 9

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity grains per cu.ft. Incoming Air	Humidity grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1300	86	90	2.8	-	-	-
1/2	1300	88	"	"	-	-	72
1	"	91	"	"	4.0	1.2	72
1-1/2	"	95	"	"	4.1	1.1	66
2	"	96	"	"	4.2	1.4	84
2-1/2	1300-1050	96	"	"	4.4	1.6	96
3	800-550	94	"	"	4.4	1.6	96
3-1/2	550-330	92	"	"	4.1	1.3	78
4	330	91	"	"	4.1	1.3	78
4-1/2	250-190	88	"	"	4.1	1.3	78
5	190-165	89	"	"	3.7	.9	54
5-1/2	165	88	"	"	3.8	1.0	60
6	"	88	"	"	3.7	.9	54
6-1/2	"	88	"	"	3.8	1.0	60
7	"	89	"	"	4.0	1.2	72
7-1/2	"	93	"	"	4.1	1.3	78
8	"	93	"	"	4.0	1.2	72
						Total -	1170

Table 10

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity grains per cu.ft. Incoming Air	Humidity grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1050	88	90	2.8	-	-	-
1/2	1050	"	"	"	-	-	60
1	"	"	"	"	3.8	1.0	60
1-1/2	"	90	"	"	3.8	1.0	60
2	"	91	"	"	"	1.0	60
2-1/2	"	91	"	"	3.2	0.4	24
3	"	90	"	"	4.2	1.4	84
3-1/2	1050-330	90	"	"	4.0	1.2	72
4	330	89	"	"	3.8	1.0	60
4-1/2	"	85	"	"	3.6	.8	48
5	"	85	"	"	3.4	.6	36
5-1/2	"	86	"	"	3.4	.6	36
6	"	89	"	"	3.7	.9	54
6-1/2	"	91	"	"	3.8	1.0	60
7	"	93	"	"	4.1	1.3	78
7-1/2	"	94	"	"	4.1	1.3	78
8	"	94	"	"	3.9	1.1	66
						Total -	936

Table 11

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1300	79	-	-	-	-	-
1/2	1300	82	94	4.6	-	-	114
1	"	101	95	"	-	-	114
1-1/2	"	100	"	"	-	-	114
2	"	99	"	"	6.5	1.9	114
2-1/2	1300-1050	99	"	"	"	1.9	114
3	800	99	"	"	6.4	1.8	108
3-1/2	550	99	"	"	6.4	1.8	108
4	330	100	"	"	6.2	1.6	96
4-1/2	330-250	101	"	"	"	1.6	96
5	250	101	"	"	6.4	1.8	108
5-1/2	"	102	"	"	"	1.8	108
6	250-190	102	"	"	6.55	1.9	114
6-1/2	190	102	"	"	"	1.9	114
7	"	102	"	"	6.4	1.8	108
7-1/2	165	102	"	"	6.4	1.8	108
8	165	102	"	"	"	1.8	108
						Total -	1746

Table 12

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1050	83	-	-	-	-	-
1/2	1050	84-1/2	97	4.65	-	-	78
1	"	88	95	"	-	-	78
1-1/2	"	88-1/2	"	"	5.95	1.3	78
2	"	92	"	"	"	1.3	78
2-1/2	"	94	97	"	6.2	1.5	90
3	"	96	95	"	6.25	1.6	96
3-1/2	1050-330	97	97	"	"	1.6	96
4	330	97	95	"	6.25	1.6	96
4-1/2	"	96	"	"	6.25	1.6	96
5	"	96	"	"	"	1.6	96
5-1/2	"	96	"	"	"	1.6	96
6	"	97-1/2	"	"	6.1	1.5	90
6-1/2	"	98-1/2	"	"	6.1	1.5	90
7	"	99	"	"	6.1	1.5	90
7-1/2	"	99	"	"	"	"	90
8	"	101	"	"	"	"	90
						Total -	1428

Table 13

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1300	77	95	6.0	-	-	-
1/2	1300	82	"	"	6.9	.9	54
1	"	85	"	"	6.95	.95	57
1-1/2	"	91	"	"	7.15	1.15	69
2	"	94	"	"	7.25	1.25	75
2-1/2	1050	96	"	"	7.4	1.4	84
3	800-550	97	"	"	7.3	1.3	78
3-1/2	550-330	97	"	"	7.05	1.05	63
4	330	97	"	"	7.2	1.2	72
4-1/2	330-250	97	"	"	7.2	1.2	72
5	250-190	97	"	"	7.1	1.1	66
5-1/2	190-165	97	"	"	6.85	.85	51
6	165	96	"	"	6.85	.85	51
6-1/2	"	96	"	"	6.85	.85	51
7	"	96	"	"	6.85	.85	51
7-1/2	"	96	"	"	6.85	.85	51
8	"	96	"	"	6.85	.85	51
						Total -	996

Table 14

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1050	77	95	6.0	-	-	-
1/2	1050	79	"	"	-	-	78
1	"	81	"	"	-	-	78
1-1/2	"	88	"	"	7.3	1.3	78
2	"	91	"	"	"	1.3	78
2-1/2	"	95	"	"	"	1.3	78
3	"	97	"	"	7.4	1.4	84
3-1/2	330	98	"	"	7.35	1.35	81
4	"	97	"	"	7.35	1.35	81
4-1/2	"	96	"	"	"	"	81
5	"	96	"	"	7.1	1.1	66
5-1/2	"	95	"	"	"	"	66
6	"	96	"	"	7.15	1.15	69
6-1/2	"	97	"	"	"	"	69
7	"	98	"	"	"	"	69
7-1/2	"	99	"	"	"	"	69
8	"	100	"	"	"	"	69
						Total -	1194

Table 15

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per Cu.Ft. Incoming Air	Humidity, grains per Cu.Ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1300	78	95	7.25	-	-	-
1/2	1300	82	"	7.45	7.6	.15	8
1	"	85	"	"	7.95	.5	30
1-1/2	"	91	"	"	8.0	.55	33
2	"	94	"	"	8.4	.95	57
2-1/2	1050	97	"	"	8.5	1.05	63
3	800	98	"	"	8.6	1.15	69
3-1/2	550	99	"	"	8.15	.7	42
4	330	"	"	"	"	"	42
4-1/2	330-250	"	"	"	"	"	42
5	250-190	98	"	"	8.2	.75	45
5-1/2	190	96	"	"	8.0	.55	33
6	190-165	95	"	"	"	"	33
6-1/2	165	"	"	"	7.9	.45	27
7	"	"	"	"	7.95	.5	30
7-1/2	"	"	"	"	7.7	.25	15
8	"	"	"	"	7.85	.4	24

Total - 593

Table 16

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains. per Cu.Ft.	Water Loss by Evaporation, grains. per Half-hour
0	0-1050	84	-	-	-	-	-
1/2	1050	86	95	8.4	8.95	.55	33
1	"	90	"	7.45	8.4	.95	57
1-1/2	"	93	"	"	8.35	1.95	54
2	"	95	"	"	8.6	1.15	69
2-1/2	"	97	"	"	"	"	69
3	"	98	"	"	"	"	69
3-1/2	330	"	"	"	"	"	69
4	"	"	"	"	8.35	.9	54
4-1/2	"	97	97	7.3	"	1.05	63
5	"	"	95	7.45	"	.9	54
5-1/2	"	"	"	"	8.15	.7	42
6	"	98	"	7.7	8.6	.9	54
6-1/2	"	"	"	7.45	8.35	"	54
7	"	99	"	7.8	8.9	1.1	66
7-1/2	"	"	97	7.45	8.65	1.2	72
8	"	"	95	7.1	8.45	1.3	78

Total - 957

Table 17

Time Hours	Charging Rate, Amperes	Temperature: Cell	Temperature: Incoming Air	Humidity, grains per cu.ft.: Incoming Air	Humidity, grains per cu.ft.: Outgoing Air	Water Loss by Evaporation, grains: per Cu.Ft.	Water Loss by Evaporation, grains: per Half-hour
0	0-1300	77	-	-	-	-	-
1/2	1300	80	93	8.15	8.3	.15	9
1	"	85	95	9.15	9.25	.1	6
1-1/2	"	91	"	"	9.65	.5	30
2	"	95	"	"	"	"	30
2-1/2	1300-1050	98	"	9.0	9.7	.7	42
3	800- 550	"	"	9.15	9.8	.65	39
3-1/2	550	97	"	"	"	"	39
4	330	97	"	9.6	9.95	.35	21
4-1/2	330-250	96	"	9.15	9.7	.55	33
5	250-190	"	"	9.6	9.95	.35	21
5-1/2	190	95	"	9.15	9.35	.2	12
6	190-165	95	"	"	9.2	.05	3
6-1/2	165	94	"	"	9.35	.2	12
7	"	"	"	"	"	"	12
7-1/2	"	"	"	8.75	9.15	.4	24
8	"	93	"	9.15	"	0	0
						Total -	333

Table 18

Time Hours	Charging Rate, Amperes	Temperature: Cell	Temperature: Incoming Air	Humidity, grains per cu.ft.: Incoming Air	Humidity, grains per cu.ft.: Outgoing Air	Water Loss by Evaporation, grains: per Cu.Ft.	Water Loss by Evaporation, grains: per Half-hour.
0	0-1050	80	95	-	-	-	-
1-2	1050	83	"	9.85	9.25	-.6	-36
1	"	86	"	9.95	9.6	-.35	-21
1-1/2	"	90	"	9.45	9.6	.15	9
2	"	93	"	9.15	"	.45	27
2-1/2	"	96	"	9.35	9.7	.35	21
3	"	98	"	9.15	9.85	.7	42
3-1/2	330	98	"	"	9.8	.65	39
4	"	"	"	"	9.45	.3	18
4-1/2	"	"	"	"	"	"	18
5	"	"	"	"	9.7	.55	33
5-1/2	"	"	"	9.0	9.6	.6	36
6	"	"	"	9.15	"	.45	27
6-1/2	"	"	"	8.8	9.3	.5	30
7	"	"	"	9.15	9.55	.4	24
7-1/2	"	99	"	"	9.5	.35	21
8	"	"	"	"	"	"	21
						Total -	309

Table 19

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-hour
0	0 - 1300	73	-	-	-	-	-
1/2	1300	79	91	11.45	10.5	- .05	-3
1	"	83	95	10.9	10.5	- .4	-24
1-1/2	"	88	"	11.25	11.35	.1	6
2	"	92	"	10.9	11.45	.55	33
2-1/2	1050	95	"	"	11.3	.4	24
3	800-550	98	"	"	11.65	.65	39
3-1/2	550	"	"	"	11.0	.1	6
4	330	"	"	"	10.9	0	0
4-1/2	330-250	97	"	"	11.0	.1	6
5	250	96	"	"	"	"	6
5-1/2	190	"	"	"	10.8	-.1	-6
6	190-165	"	"	"	10.9	0	0
6-1/2	165	97	"	"	11.0	.1	6
7	"	"	"	"	10.9	0	0
7-1/2	"	"	"	"	10.9	0	0
8	"	"	"	"	10.8	-.1	-6
						Total -	81

Table 20

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	0 - 1050	72	-	-	-	-	-
1/2	1050	75	97	11.8	10.9	- .9	- 54
1	"	79	95	11.3	11.0	- .3	- 27
1-1/2	"	84	"	11.25	11.45	.2	18
2	"	89	"	10.9	11.0	.1	6
2-1/2	"	92	"	10.65	10.6	- .05	- 3
3	1050-330	94	"	10.9	10.85	- .05	- 3
3-1/2	330	"	"	"	11.15	.25	15
4	"	"	"	"	11.1	.2	12
4-1/2	"	93	"	10.8	10.85	.05	3
5	"	"	"	11.55	11.25	- .3	-18
5-1/2	"	"	"	10.9	10.9	0	0
6	"	"	"	"	11.0	.1	6
6-1/2	"	92	"	"	10.9	0	0
7	"	"	"	"	10.6	- .3	-18
7-1/2	"	"	"	"	10.15	- .75	-45
8	"	"	"	"	"	"	-45
						Total -	-153

Table 21

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	0-1300	76	-	-	-	-	-
1/2	1300	81	95	-	-	-	-
1	"	86	"	11.8	11.4	- .4	-24
1-1/2	"	91	"	14.1	13.5	- .6	-36
2	"	95	"	13.2	12.9	- .3	-18
2-1/2	1300-1050	98	"	12.8	12.5	- .3	-18
3	800- 550	99	"	"	"	"	-18
3-1/2	550-330	98	"	"	12.4	- .4	-24
4	330	96	"	"	11.9	- .9	-54
4-1/2	330-250	95	"	"	12.0	- .8	-48
5	250-190	96	"	"	12.3	- .5	-30
5-1/2	190	97	"	"	12.4	- .4	-24
6	190-165	100	"	"	12.3	- .5	-30
6-1/2	165	103	"	"	12.6	- .2	-12
7	"	104	"	"	12.8	0	0
7-1/2	"	"	"	13.4	13.0	- .4	-24
8	"	"	"	12.8	12.8	0	0
					Total	-	- 360

Table 22

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	0 - 1050	81	-	-	-	-	-
1/2	1050	84	93	11.15	9.8	- .35	-21
1	"	87	95	13.1	10.7	- .4	-24
1-1/2	"	89	"	12.3	11.55	- .75	-45
2	"	90	"	12.8	11.4	-1.4	-84
2-1/2	"	91	"	12.9	11.3	-1.6	-96
3	"	92	"	13.0	12.25	- .75	-45
3-1/2	330	93	"	12.3	11.85	- .45	-27
4	"	92	"	12.55	11.8	- .75	-45
4-1/2	"	91	"	12.8	12.2	- .6	-36
5	"	90	"	13.0	12.3	- .7	-42
5-1/2	"	91	"	12.8	12.45	- .35	-21
6	"	92	"	"	12.2	- .6	-36
6-1/2	"	94	"	12.55	11.7	- .85	-51
7	"	96	"	12.8	12.05	- .75	-45
7-1/2	"	97	"	"	12.3	- .5	-30
8	"	98	"	13.0	11.8	-1.2	-72
					Total	-	-720

Table 23

Time Hours	Charging Rate, Amperes	Temperature: Cell	Temperature: Incoming Air	Humidity, grains per cu.ft.: Incoming Air	Humidity, grains per cu.ft.: Outgoing Air	Water Loss by Evaporation, grains: per Cu.Ft.	Water Loss by Evaporation, grains: per Half-Hour
0	0 - 1300	102	-	-	-	-	-
1/2	1300	104	96	16.5	16.0	- .5	-30
1	"	106	"	14.6	15.1	.5	30
1-1/2	"	109	95	14.9	15.0	.1	6
2	1300-1050	109	"	15.3	15.6	.3	18
2-1/2	1050	107	"	14.9	14.8	- .1	-6
3	800-550	105	"	14.6	14.6	0	0
3-1/2	550	102	"	14.9	14.2	- .7	-42
4	330	100	"	"	14.3	- .6	-36
4-1/2	330-250	99	"	14.9	14.3	- .6	-36
5	250	97	"	14.9	14.1	- .8	-48
5-1/2	190	95	"	14.9	14.2	- .7	-42
6	"	92	"	"	14.1	- .8	-48
7-1/2	"	90	"	"	13.7	-1.2	-72
8	165	89	"	"	13.7	-1.2	-72
8-1/2	"	89	"	"	"	"	-72
9	"	88	"	"	13.6	-1.3	-78
						Total -	-528

Table 24

Time Hours	Charging Rate, Amperes	Temperature: Cell	Temperature: Incoming Air	Humidity, grains per cu.ft.: Incoming Air	Humidity, grains per cu.ft.: Outgoing Air	Water Loss by Evaporation, grains: per Cu.Ft.	Water Loss by Evaporation, grains: per Half-Hour
0	0-1050	98	-	-	-	-	-
1/2	1050	95	95	-	-	-	6
1	"	97	"	-	-	-	6
1-1/2	"	99	"	15.6	15.7	.1	6
2	"	101	"	15.1	14.9	-.2	-12
2-1/2	"	"	"	14.9	14.9	0	0
3	"	"	"	"	14.4	-.5	-30
3-1/2	330	99	"	"	"	-.5	-30
4	"	97	"	"	14.2	-.7	-42
4-1/2	"	96	"	"	"	-.7	-42
5	"	94	"	"	13.9	-1.0	-60
5-1/2	"	93	"	"	14.3	-.6	-36
6	"	91	"	"	13.8	-1.1	-66
6-1/2	"	91	"	"	13.2	-1.7	-102
7	"	"	"	"	13.9	-1.0	-60
7-1/2	"	"	"	"	13.7	-1.2	-72
8	"	"	"	"	"	"	-72
						Total -	-606

Table 25

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	0 - 1300	71	-	-	-	-	-
1/2	1300	77	-	-	-	-	-108
1	"	81	95	-	-	-	-108
1-1/2	"	84	"	16.8	15.0	-1.8	-108
2	"	86	"	17.4	15.6	-1.8	-108
2-1/2	1050-800	88	"	17.1	15.1	-2.0	-120
3	800-550	90	"	"	15.5	-1.6	-96
3-1/2	550	92	"	"	15.8	-1.3	-78
4	330	93	"	"	15.9	-1.2	-72
4-1/2	330-250	93	"	"	16.7	-.4	-24
5	250-190	"	"	18.0	"	-1.3	-78
5-1/2	190-165	"	"	17.1	15.8	-1.3	-78
6	165	"	"	"	15.8	-1.3	-78
6-1/2	"	"	"	"	16.0	-1.1	-66
7	"	92	"	"	15.6	-1.5	-90
7-1/2	"	"	"	"	"	"	-90
8	"	"	"	"	15.4	-1.7	-102
						Total -	-1404

Table 26

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	0 - 1050	75	-	-	-	-	-
1/2	1050	79	95	16.05	14.75	-1.3	-78
1	"	84	"	17.1	16.1	-1.0	-60
1-1/2	"	89	"	"	16.1	-1.0	-60
2	"	93	"	"	15.8	-1.3	-78
2-1/2	"	95	"	"	16.4	-.7	-42
3	"	97	"	"	16.4	-.7	-42
3-1/2	330	98	"	16.7	15.9	-.8	-48
4	"	98	"	17.1	16.1	-1.0	-60
4-1/2	"	97	"	"	15.8	-1.3	-78
5	"	"	"	"	"	"	-78
5-1/2	"	"	"	"	"	"	-78
6	"	"	"	"	16.0	-1.1	-66
6-1/2	"	98	"	"	15.3	-1.8	-108
7	"	99	"	"	16.4	-.7	-42
7-1/2	"	100	97	18.0	"	-1.6	-96
8	"	101	"	"	"	"	-96
						Total -	-1110

Table 27

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	0 - 1300	75	-	-	-	-	-
1/2	1300	80	102	19.45	16.1	-3.35	-201
1-1/2	"	87	104	22.15	20.1	-2.05	-123
2	"	92	"	22.1	20.3	-1.8	-108
2-1/2	"	99	"	"	20.5	-1.6	-96
3	1050	103	"	"	20.1	-2.0	-120
3-1/2	800-550	105	"	"	20.5	-1.6	-96
4	550	"	"	21.85	19.75	-2.1	-126
4-1/2	330	104	"	21.8	19.95	-1.8	-108
5	330-250	103	"	22.15	20.1	-2.0	-120
5-1/2	250	102	"	"	19.15	-3.0	-180
6	190	"	"	"	19.3	-2.8	-168
6-1/2	"	103	"	"	19.8	-2.3	-138
7	190-165	104	"	"	20.1	-2.0	-120
7-1/2	165	"	"	"	20.24	-1.9	-114
8	"	105	"	"	19.5	-2.6	-156
8-1/2	"	"	"	"	19.5	-2.6	-156
						Total -	-2130

Table 28

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	0 - 1050	75	-	-	-	-	-
1/2	1050	80	-	-	-	-	-168
1	"	88	106	21.4	18.6	-2.8	-168
1-1/2	"	91	104	21.7	19.5	-2.2	-132
2	"	98	"	22.1	19.9	-2.2	-132
2-1/2	"	99	"	22.7	21.4	-1.3	-78
3	"	103	"	22.7	21.8	- .9	-54
3-1/2	330	104	"	"	21.1	- .6	-36
4	"	103	"	"	21.8	- .9	-54
4-1/2	"	"	"	22.2	21.4	- .8	-48
5	"	"	"	"	21.3	- .9	-54
5-1/2	"	"	"	"	20.4	-1.8	-108
6	"	"	"	"	20.2	-2.0	-120
6-1/2	"	"	"	"	19.9	-2.3	-138
7	"	104	"	"	20.0	-2.2	-132
7-1/2	"	105	"	"	20.0	-2.2	-132
8	"	"	"	"	20.0	-2.2	-132
						Total -	-1686

Table 29

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	1300	107	122	-	-	-	-
1/2	"	103	"	.2	3.7	3.5	210
1-1/2	"	102	"	"	4.0	3.8	228
2	"	110	"	"	3.7	3.5	210
2-1/2	1300-1050	116	"	0	3.4	3.4	204
3	1050-800	119	"	.15	3.8	3.6	216
3-1/2	800-550	121	"	.2	4.7	4.5	270
4	550	123	"	.4	5.3	4.9	294
4-1/2	330	123	"	.4	5.3	4.9	294
5	"	"	"	.6	5.1	4.5	270
5-1/2	330-250	"	"	.8	5.3	4.5	270
6	250-195	"	"	.7	5.1	4.4	264
6-1/2	195-165	"	"	.9	5.3	4.4	264
7	165	122	"	0	4.4	4.4	264
7-1/2	"	122	"	0	4.1	4.1	246
8	"	"	"	.8	4.1	3.3	198
8-1/2	"	"	"	.04	4.1	4.0	240
					Total	-	3942

Table 30

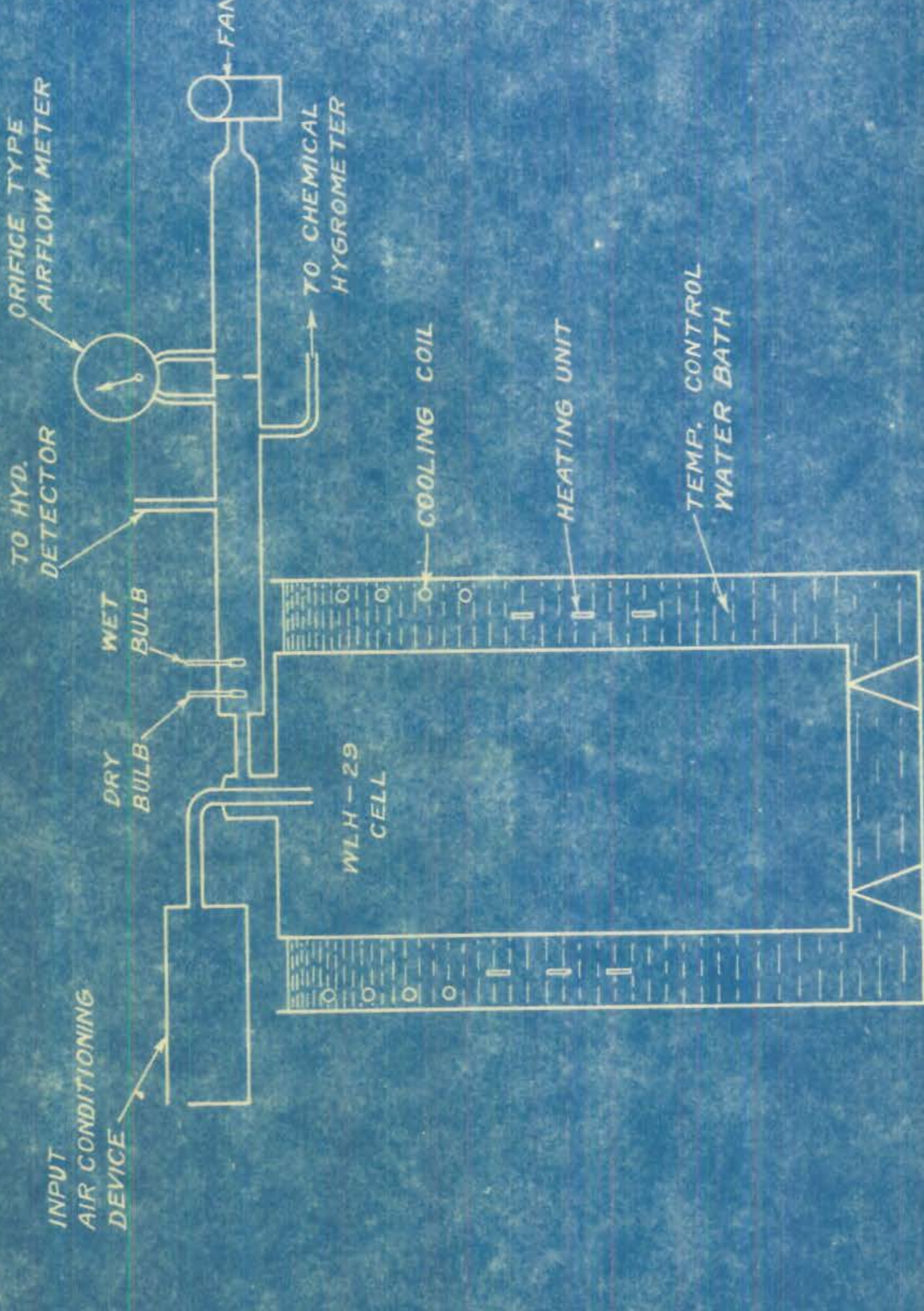
Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft Incoming Air	Humidity, grains per cu.ft Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	0 - 1050	104	122	-	-	-	-
1/2	1050	105	"	0	2.2	2.2	132
1	"	109	"	.09	2.0	1.9	174
1-1/2	"	112	"	.09	2.7	2.6	156
2	"	117	"	.04	3.2	3.2	192
2-1/2	"	119	"	."	3.9	3.9	234
3	330	120	"	."	4.2	4.2	252
3-1/2	"	121	"	."	4.2	4.2	252
4	"	122	"	."	4.1	4.1	246
4-1/2	"	122	"	"	4.0	4.0	240
5	"	121	"	."	4.0	4.0	240
5-1/2	"	120	"	"	3.9	3.9	234
6	"	119	"	"	"	"	234
6-1/2	"	"	"	"	3.8	3.8	228
7	"	120	"	"	"	"	228
7-1/2	"	"	"	"	"	"	228
8	"	"	"	"	"	"	228
					Total	-	3498

Table 31

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	0 - 1300	122	-	-	-	-	-
1/2	1300	125	129	34	32.9	-1.1	-66
1	"	127	122	32.1	32.3	.2	12
1-1/2	1300-1050	129	122	"	32.8	.7	42
2	1050-800	"	"	"	32.7	.6	36
2-1/2	800	128	124	32.8	31.8	-1.0	-60
3	800-550	127	122	32.1	31.5	-.6	-36
3-1/2	550-330	125	120	30.9	31.2	.3	18
4	330	121	"	"	"	"	"
4-1/2	"	120	"	"	28.6	-1.3	-78
5	330-250	118	"	32.8	30.0	-2.8	-168
5-1/2	250	114	122	32.1	28.9	-3.2	-192
6	"	111	"	"	28.6	-3.5	-210
6-1/2	250-190	107	"	"	29.4	-2.7	-162
7	190	104	"	"	28.9	-3.2	-192
7-1/2	190-165	103	"	"	30.0	-2.1	-126
8	165	103	"	"	"	"	-126
						Total -	-1308

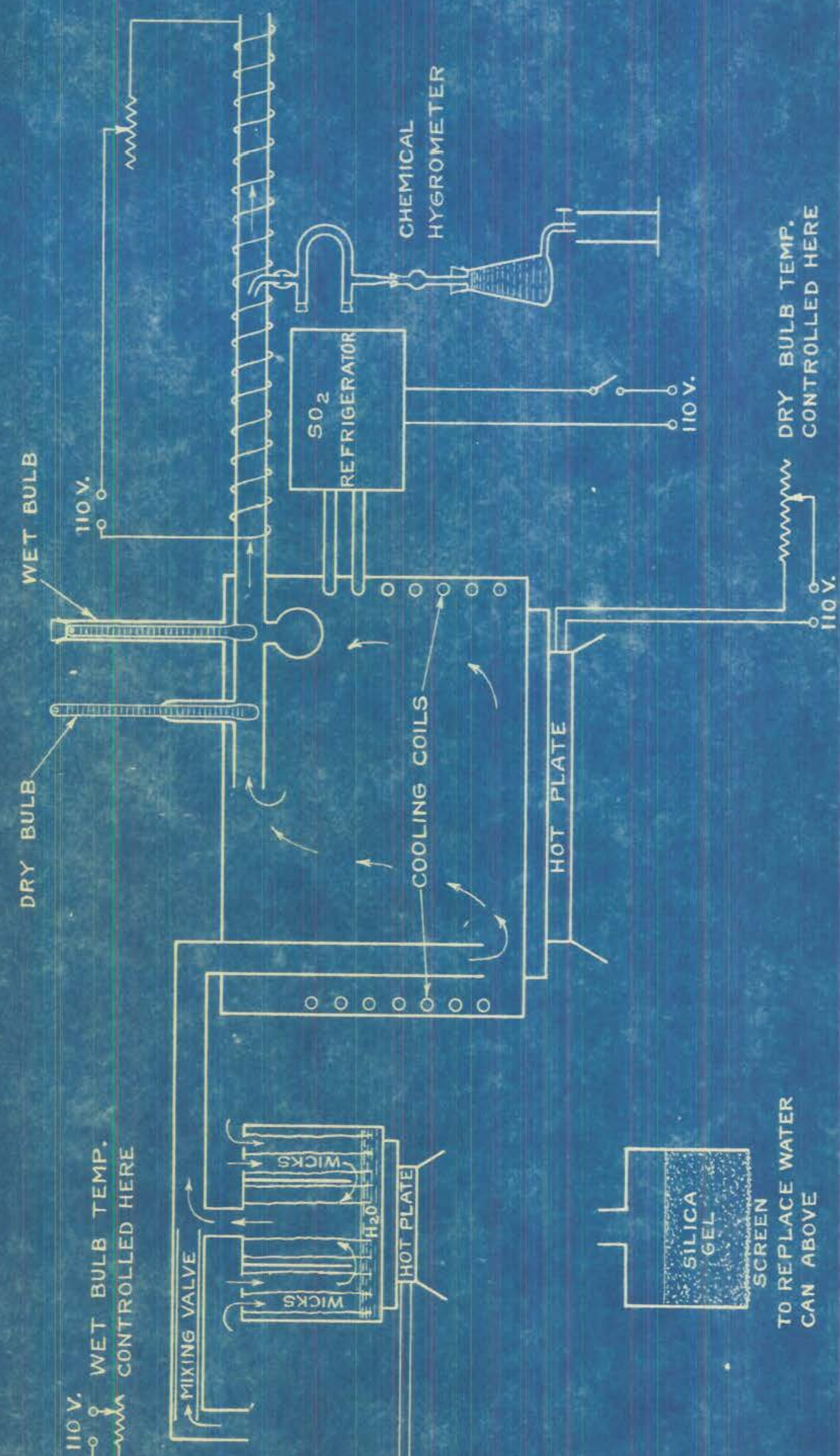
Table 32

Time Hours	Charging Rate, Amperes	Temperature Cell	Temperature Incoming Air	Humidity, grains per cu.ft. Incoming Air	Humidity, grains per cu.ft. Outgoing Air	Water Loss by Evaporation, grains per Cu.Ft.	Water Loss by Evaporation, grains per Half-Hour
0	0 - 1050	113	-	-	-	-	-
1/2	1050	115	132	30.9	29.9	-1.0	-60
1	"	121	120	30.9	30.9	0	0
1-1/2	"	123	122	32.1	31.5	-.6	-36
2	"	123	"	31.1	31.2	.1	6
2-1/2	1050-330	"	"	32.1	31.4	-.7	42
3	330	119	"	32.1	31.4	-.7	42
3-1/2	"	118	"	"	30.7	-1.4	-84
4	"	"	"	"	"	-1.4	-84
4-1/2	"	119	"	"	31.0	-1.1	-66
5	"	120	123	34.7	33.0	-1.7	-102
5-1/2	"	"	124	32.0	31.0	-1.0	-60
6	"	121	122	32.1	31.0	-1.1	-66
6-1/2	"	121	123	32.1	31.5	-.6	-36
7	"	122	122	32.1	31.4	-.7	-42
7-1/2	"	"	120	30.9	29.8	-1.1	-66
8	"	123	119	30.2	29.1	-1.1	-66
						Total -	-678



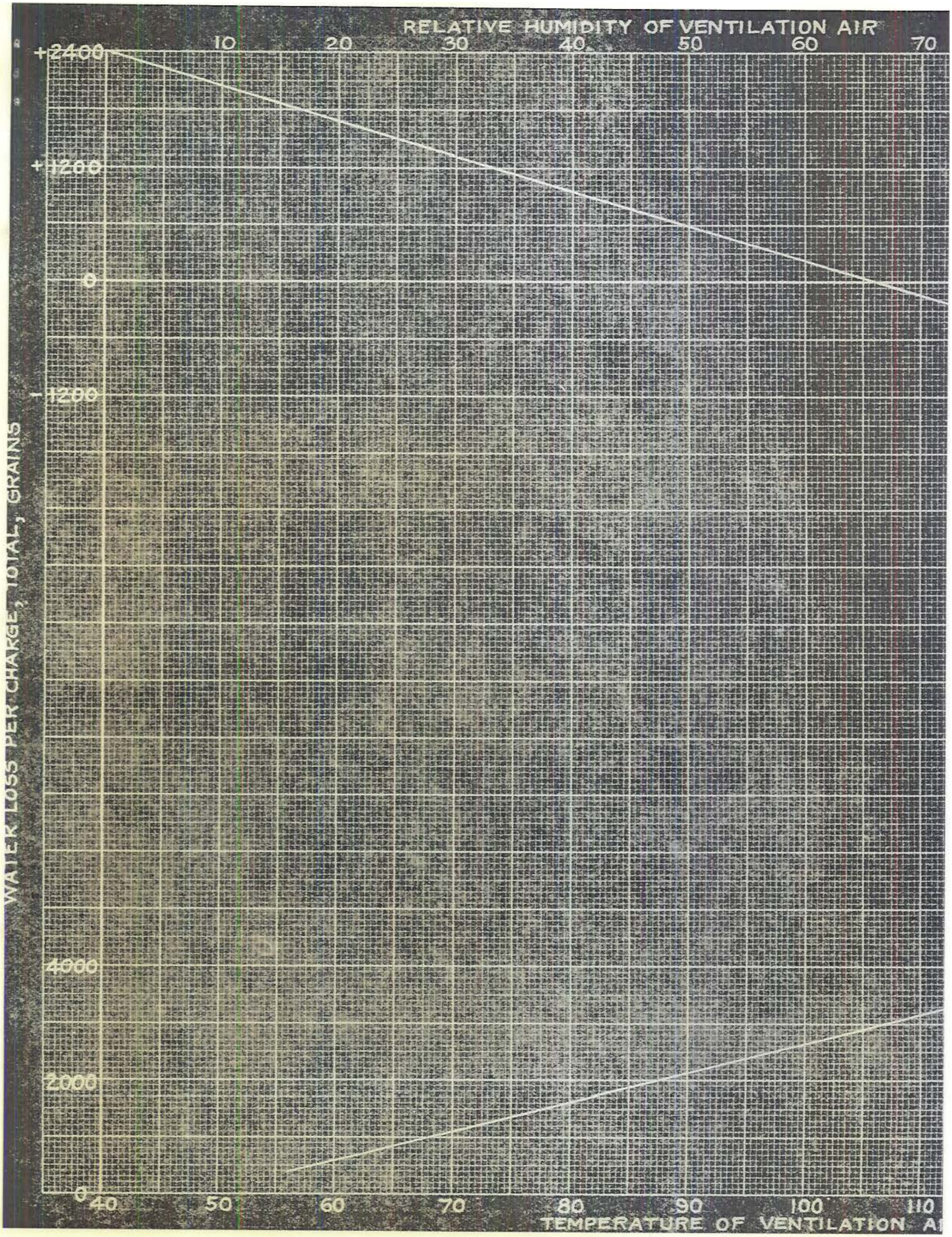
FAN
ORIFICE TYPE
AIRFLOW METER
TO CHEMICAL
HYGROMETER
TO HYD.
DETECTOR
COOLING COIL
HEATING UNIT
TEMP. CONTROL
WATER BATH
WET
BULB
DRY
BULB
WLH - 29
CELL
INPUT
AIR CONDITIONING
DEVICE

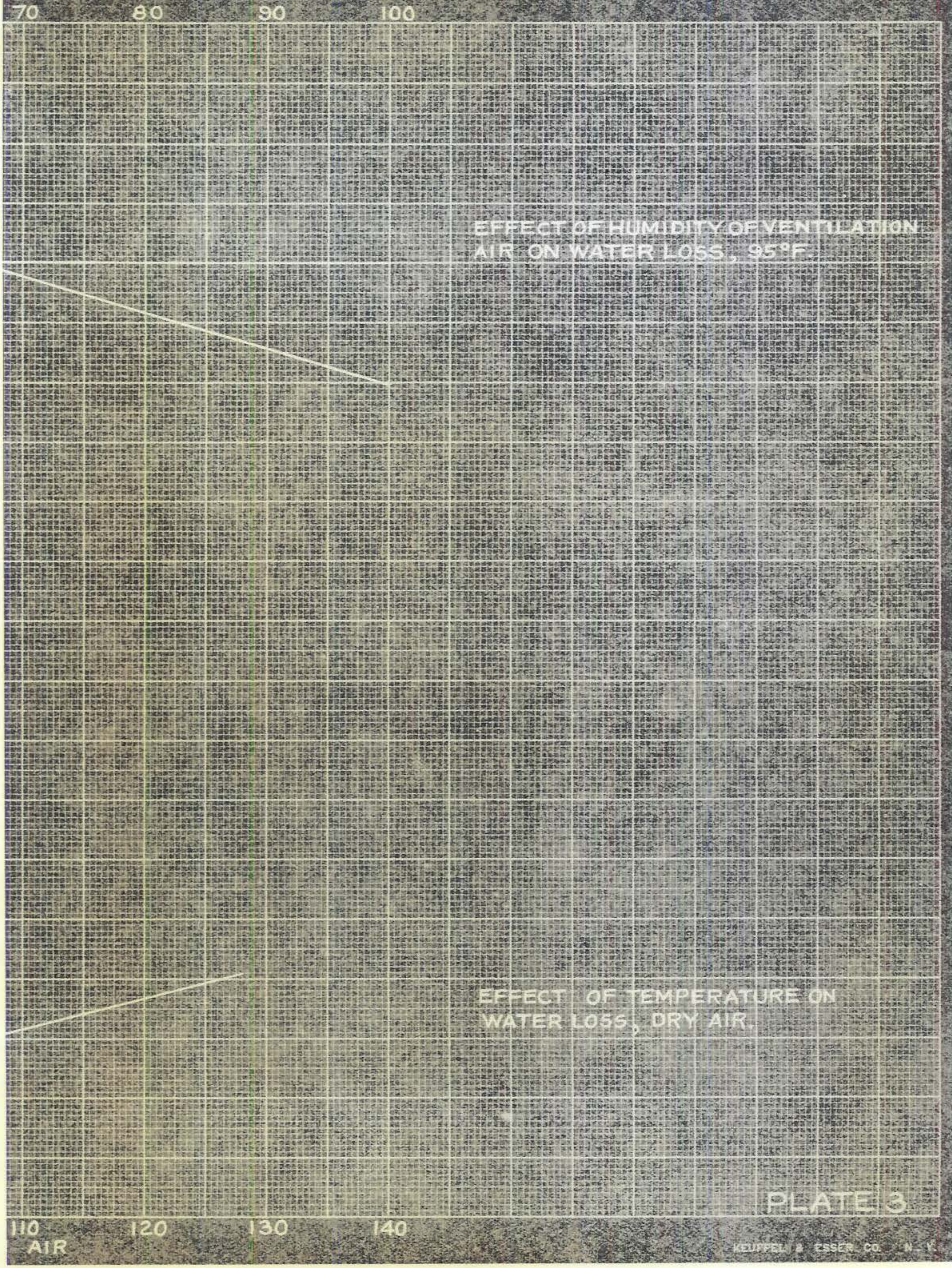
PLATE 1



WET BULB
DRY BULB
110 V.
CHEMICAL HYGROMETER
SO_2 REFRIGERATOR
110 V.
DRY BULB TEMP. CONTROLLED HERE
110 V.
COOLING COILS
HOT PLATE
110 V.
WET BULB TEMP. CONTROLLED HERE
MIXING VALVE
WICKS
WICKS
H_2O
HOT PLATE
SILICA GEL
SCREEN
TO REPLACE WATER CAN ABOVE

PLATE 2


RELATIVE HUMIDITY OF VENTILATION AIR
10
20
30
40
50
60
70
+2400
+1200
0
-1200
4000
2000
0
WATER LOSS PER CHARGE, TOTAL, GRAINS
40
50
60
70
80
90
100
110
TEMPERATURE OF VENTILATION AI


70
80
90
100
EFFECT OF HUMIDITY OF VENTILATION AIR ON WATER LOSS, 95°F.
EFFECT OF TEMPERATURE ON WATER LOSS, DRY AIR.
PLATE 3
110
120
130
140
AIR
KEUFFEL & ESSER CO. N. Y.

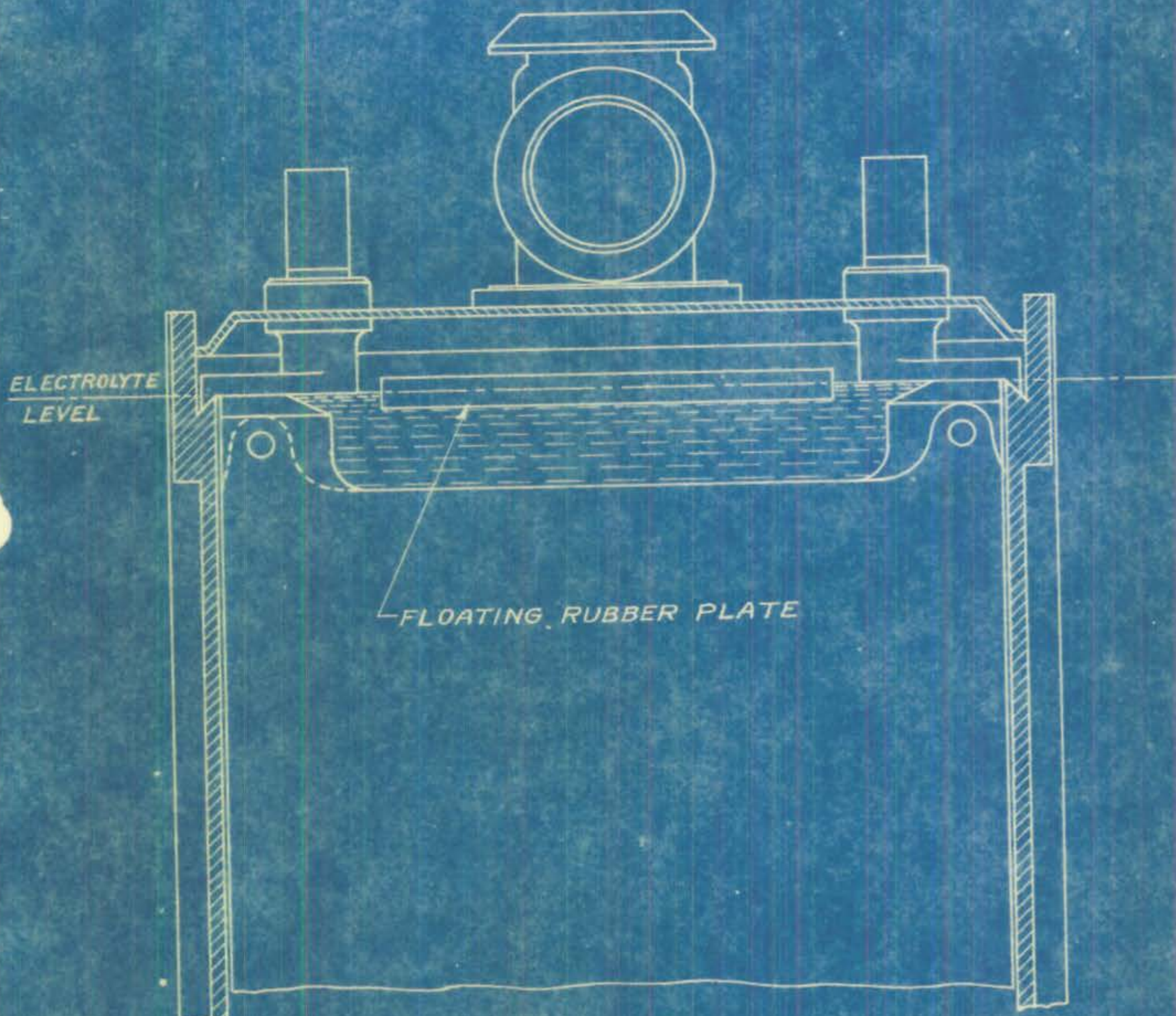


PLATE 4

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

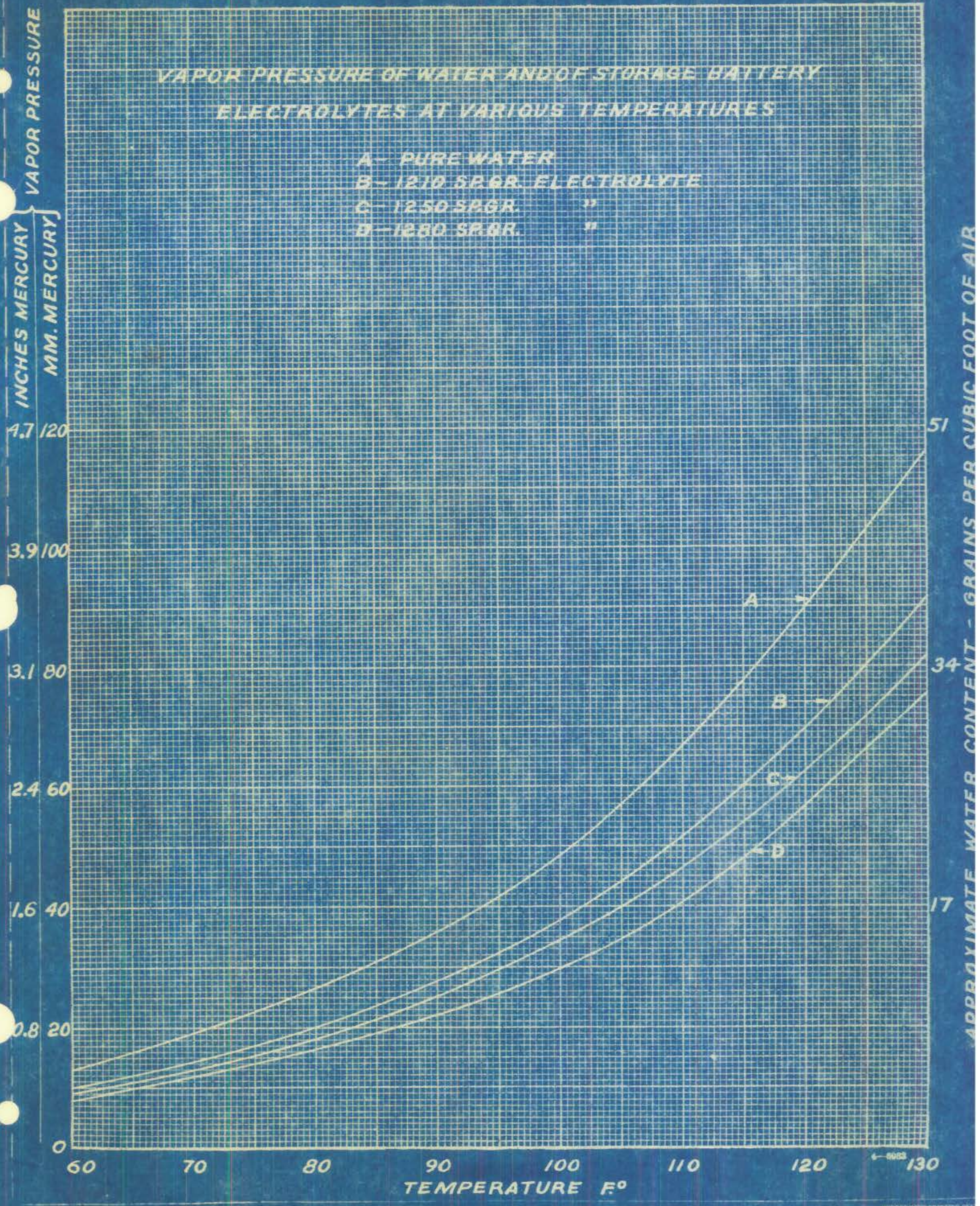


PLATE 5