SERIES 7000 CIRCUIT MEMO #31

SUBJECT: **CORE DRIVER TRANSISTOR FABRICATION TECHNIQUE**

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ABSTRACT: This memo describes the techniques and processes used in fabrication of the core driver transistor for the SILO memories, specifications and yields are given.

MOCK-UP REFRIGERATION SYSTEM

Description

To prove the effectiveness of stabilizing the core temperature by utilizing the latent heat of vaporization, a mock-up refrigeration system was constructed. An experimental array consisting of four planes 16 x 16 was also built.

A glass aquarium was used for a tank, and a lucite lid was fitted to the top with a gasket. The experimental array, supported by the lid, was submerged in Freon.

As can be seen from Figure 1, the refrigeration system was a closed circuit, using water as a refrigerant. The refrigerant flowed through a coil of copper tubing in the top of the tank and condensed the Freon vapors. The heat taken from the Freon vapors was rejected to a container of ice water as the refrigerant flowed through a heat rejecting coil.

A rubber-impeller-pump was used to circulate the refrigerant. When in operation, the refrigeration system condensed Freon vapors at a rate adequate to maintain the liquid Freon at a constant temperature.

HIGH-SPEED MEMORY SEGMENT CROSS-SECTION, REFRIGERATION SYSTEM

The mock-up refrigeration system proved the effectiveness of stabilizing the temperature of cores by vaporizing Freon-11. The work that continued was in applying this method to a machine to determine the feasibility of its use. A system was constructed to stabilize the temperature of a cross-section of a segment of the high-speed memory array.

For the high-speed memory, heat dissipation also had to be considered for the driver circuits, the X and Y matrix switches, and the terminating resistors. The heat dissipation from these components plus the core array was equivalent to an input of 3 kilowatts, and the temperature in the tank was to be maintained at 25° C $\pm$ 1° C. An order was placed with York Corporation to supply and install a compressor unit for use in the system.

A meeting was held with representatives from the Dupont Corporation concerning the use of Freon-11. Such things as its effect on electrical components and the tank, and safety hazards were discussed.

Several tests were conducted to determine the compatibility of some materials with Freon 11. Visual inspection was used to evaluate distortion or deterioration. Styrene was used for the core supports and lucite for the frame-work. Neither of these were affected by Freon. Also, Armstrong Cork Company DC179 cork and rubber composition showed the most promise for use as a material for sealing Freon.

A tank was constructed to contain Freon-11 and the heat dissipating components. From layouts of the component packaging, the size of the tank was established at 29" x 29" with a depth of 6" of Freon. With space for the condensing coils and electrical connections from the tank, the total height of the tank was increased to 18 inches.

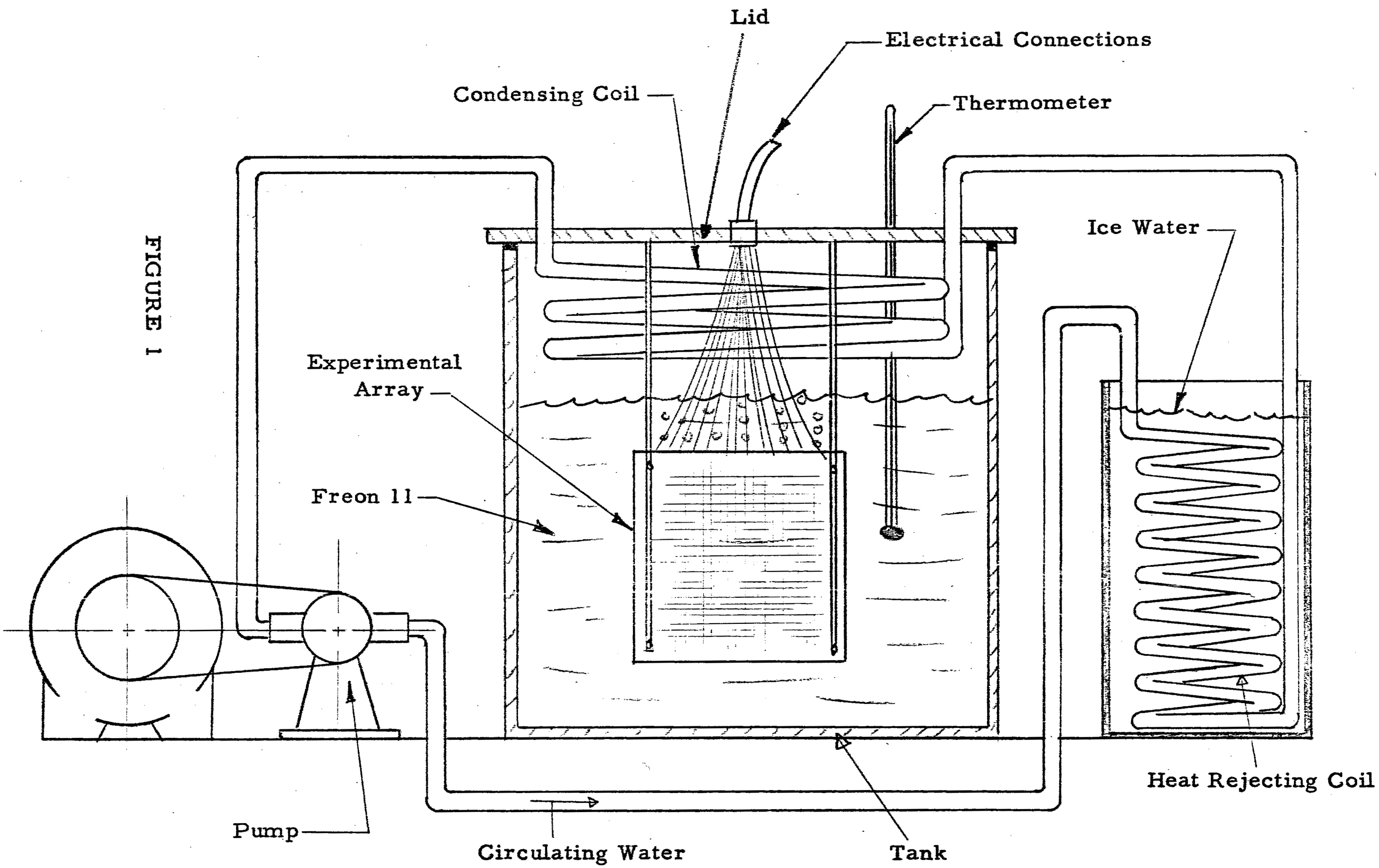
The tank was made of stainless steel. Eight clamps held the top to the bottom, with a neoprene-cork gasket between them. The electrical connections were made through hermetically sealed terminal panels on the sides of the tank. A photograph of the tank is shown in Figure 2.

A schematic of the refrigeration system is shown in Figure 3. The compressor unit was purchased from the York Corporation. It was York Model A 10M12 Freon 12 air cooled 1 HP condensing unit. It contained an immersion type thermostat, a thermal expansion valve, a drier, a pressure switch, a liquid indicator, and pressure gauges. The unit was tied into the evaporating coils in the tank by flexible hoses. The system is shown in Figure 2 and Figure 4.

Operation tests were conducted with the system. It was desired to establish practical limits within which the system could be safely operated. A heating element was placed in the tank to simulate the heat dissipating components. Various loads were applied to the refrigeration system by varying the current in the heating element. Figures 5 through 10 show the effect these changes had on the temperature and pressure in the tank.

These tests show that a maximum safe change in load for the system is 600 watts, and it takes the system about 20 minutes to recover from this change. It also shows that the system is capable of maintaining a constant temperature within the tank.

FIGURE 1



Mock-Up Refrigeration System

[redacted]

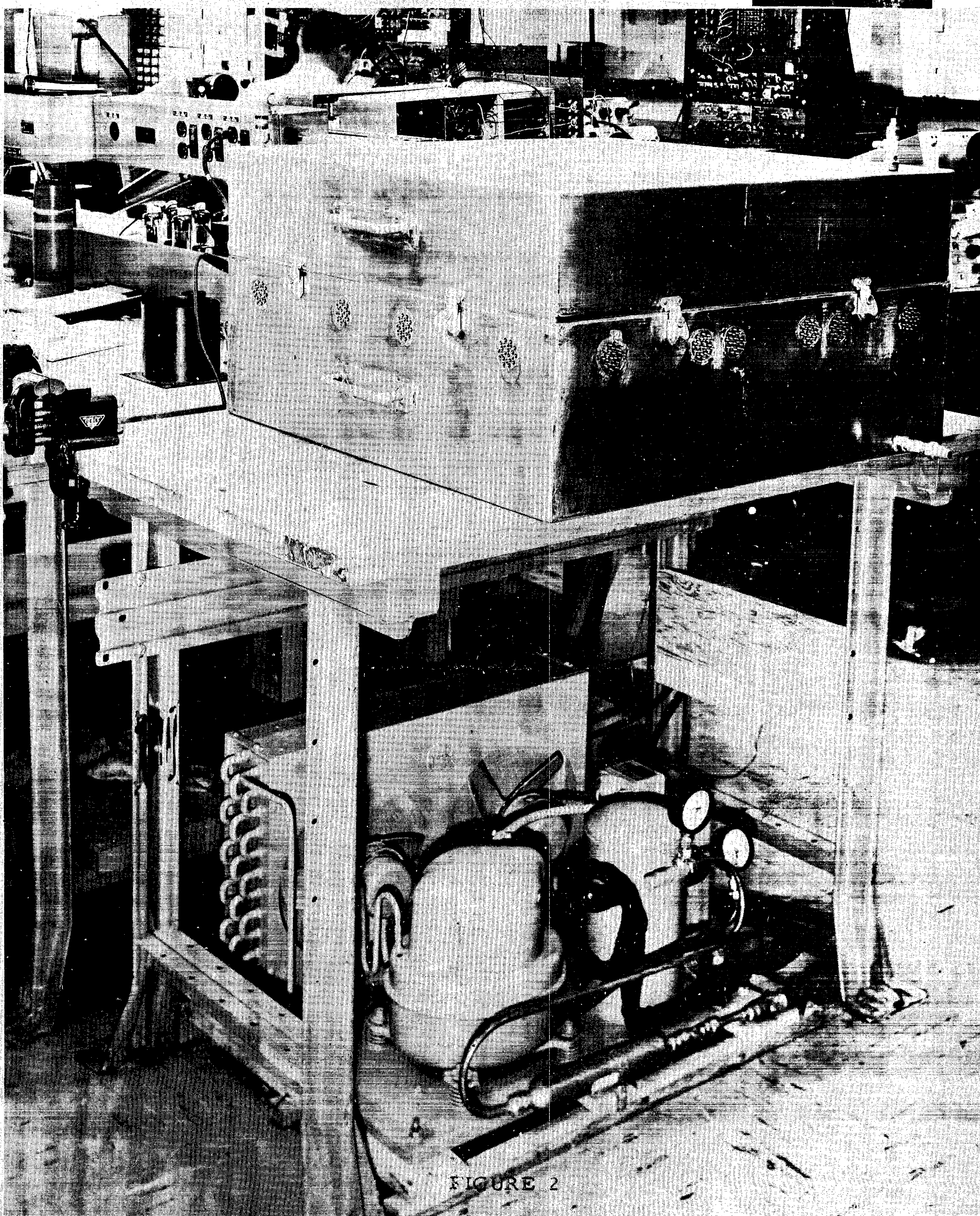
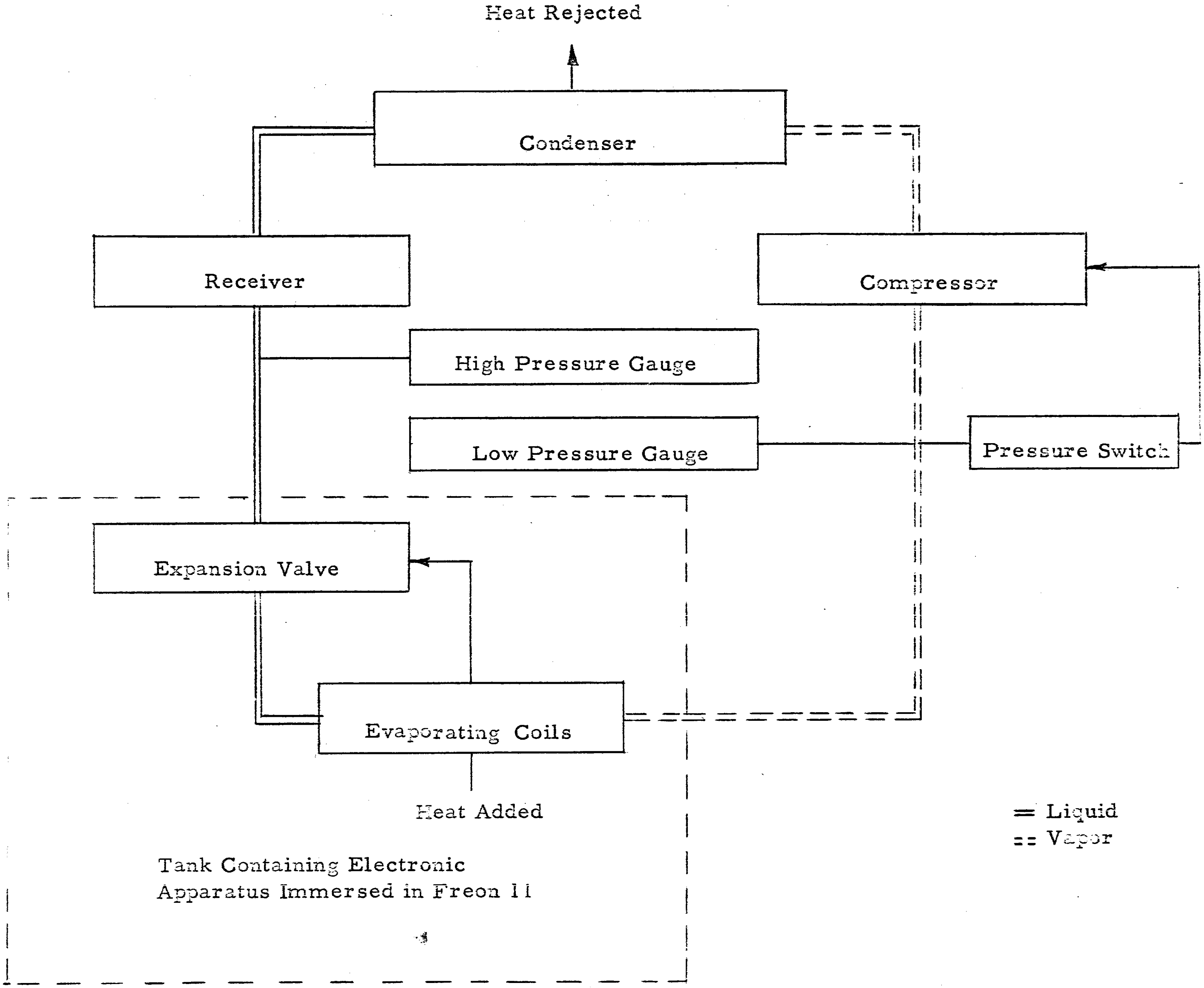


FIGURE 2

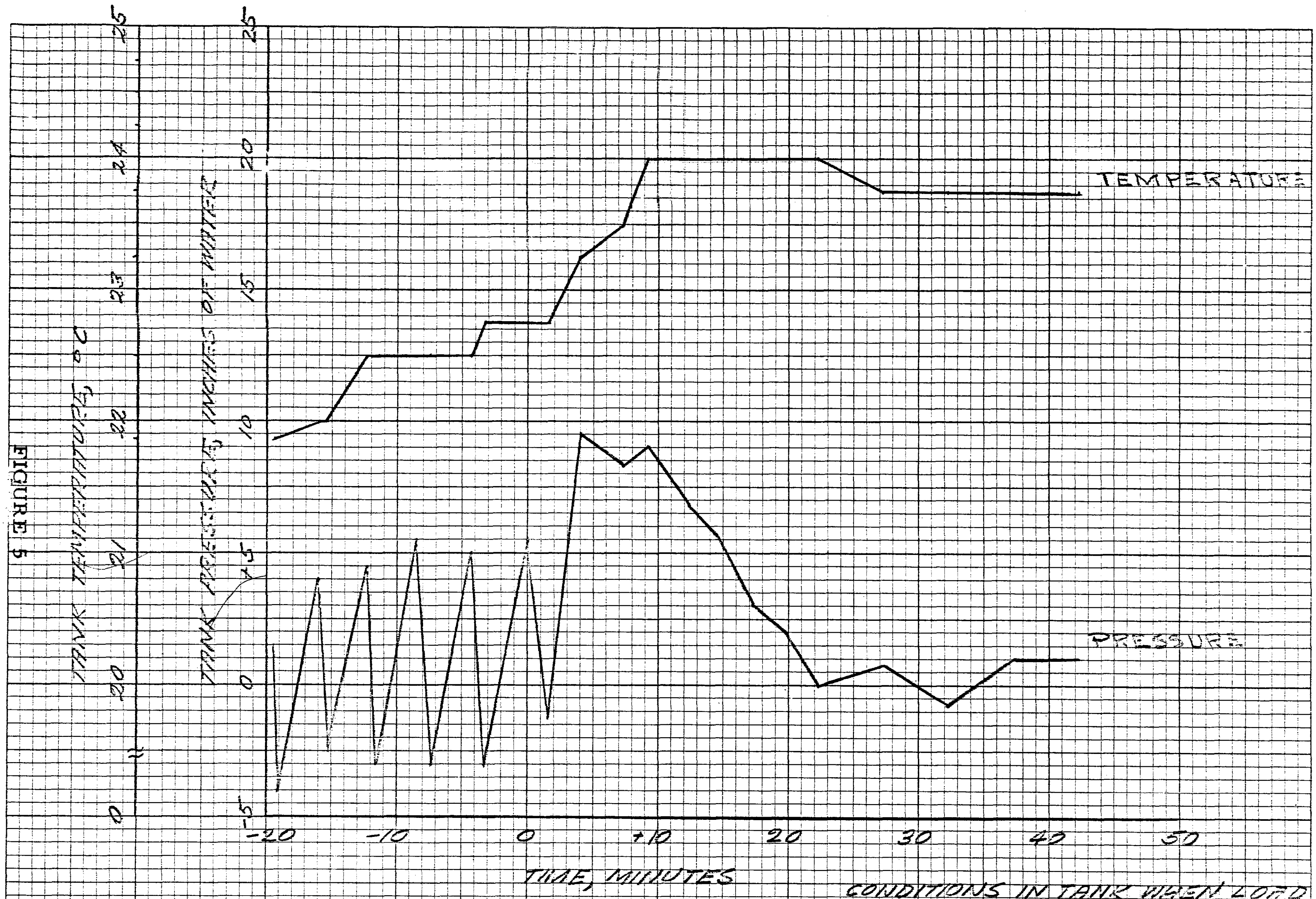
FIGURE 3



<u>Schematic of Refrigeration System</u>

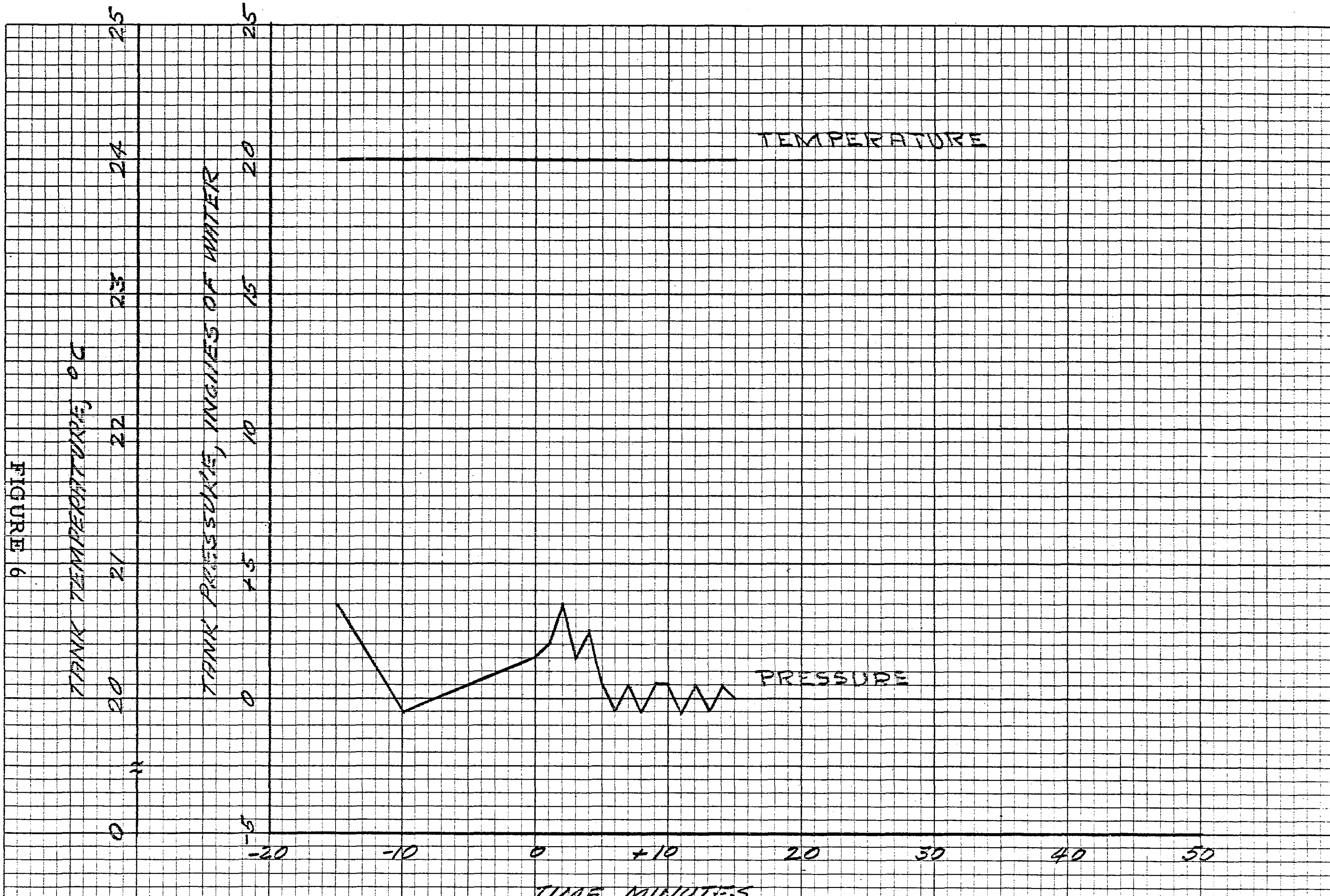
Figure [illegible]

FIGURE 5



CONDITIONS IN TANK WHEN LOAD IS CHANGED FROM 200 WATTS TO 400 WATTS.

FIGURE 6



CONDITIONS IN TANK WHEN LOAD IS CHANGED FROM 400 WATTS TO 600 WATTS.

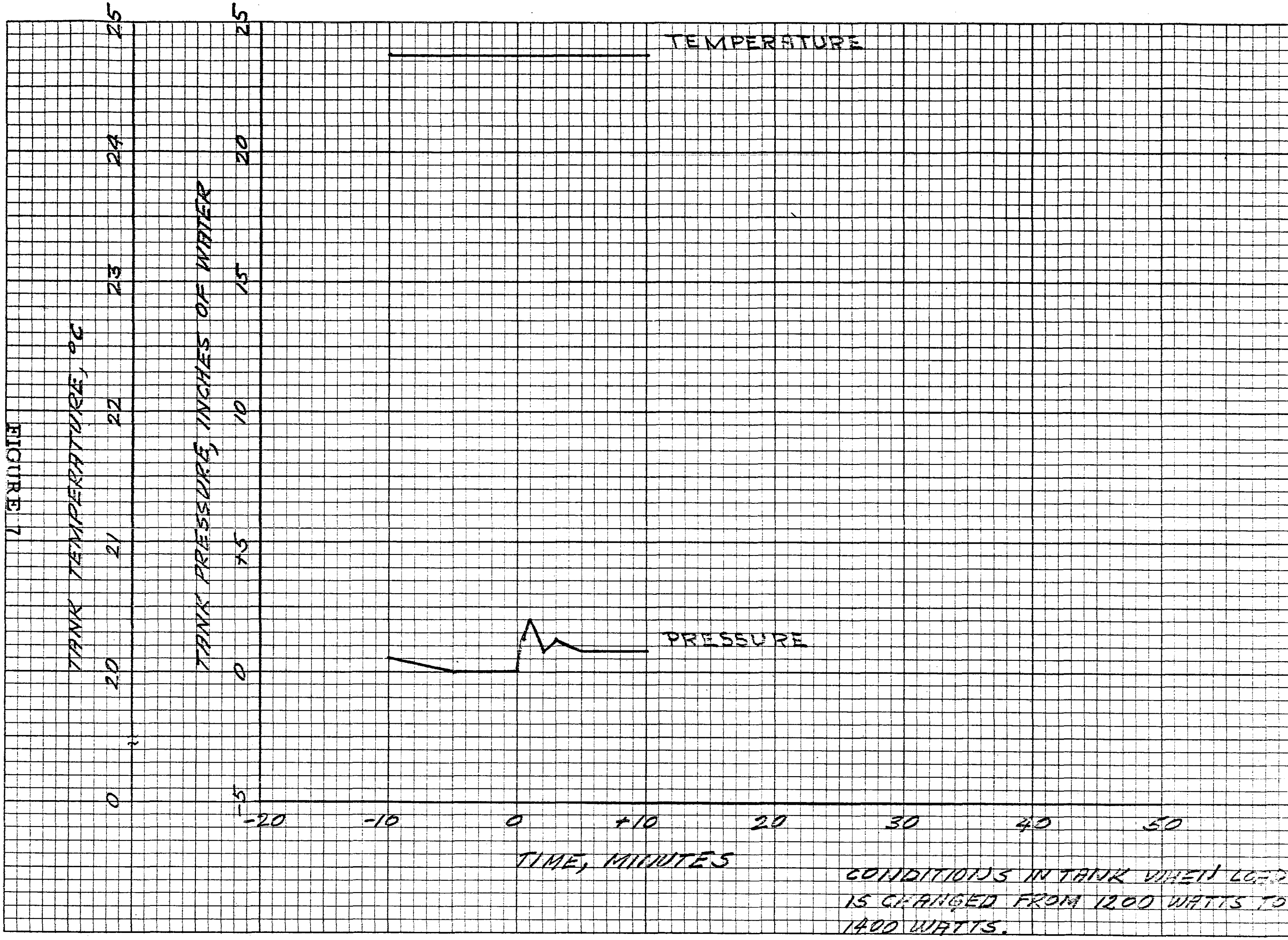


FIGURE 7

CONDITIONS IN TANK WHEN LOAD IS CHANGED FROM 1200 WATTS TO 1400 WATTS.

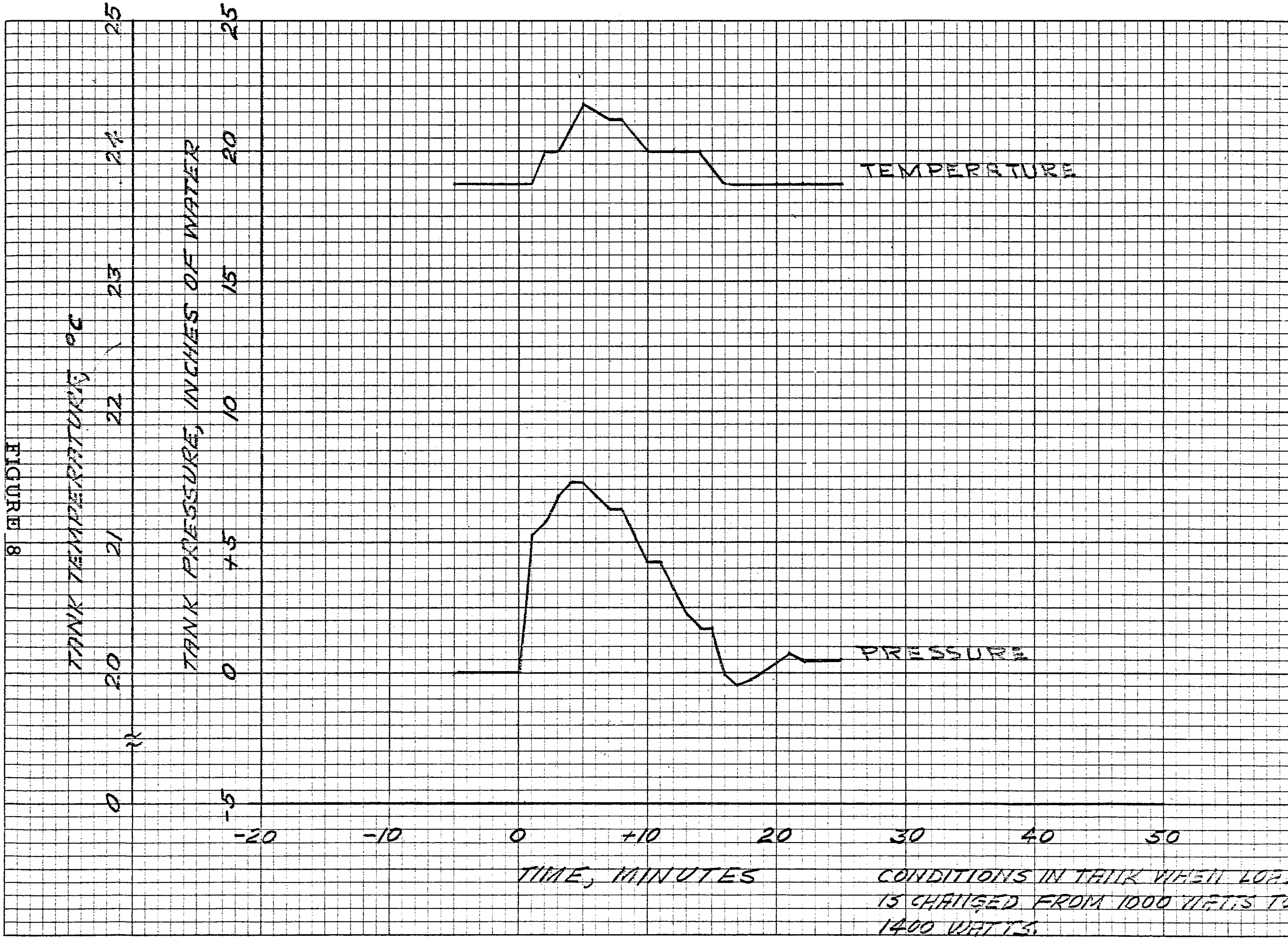
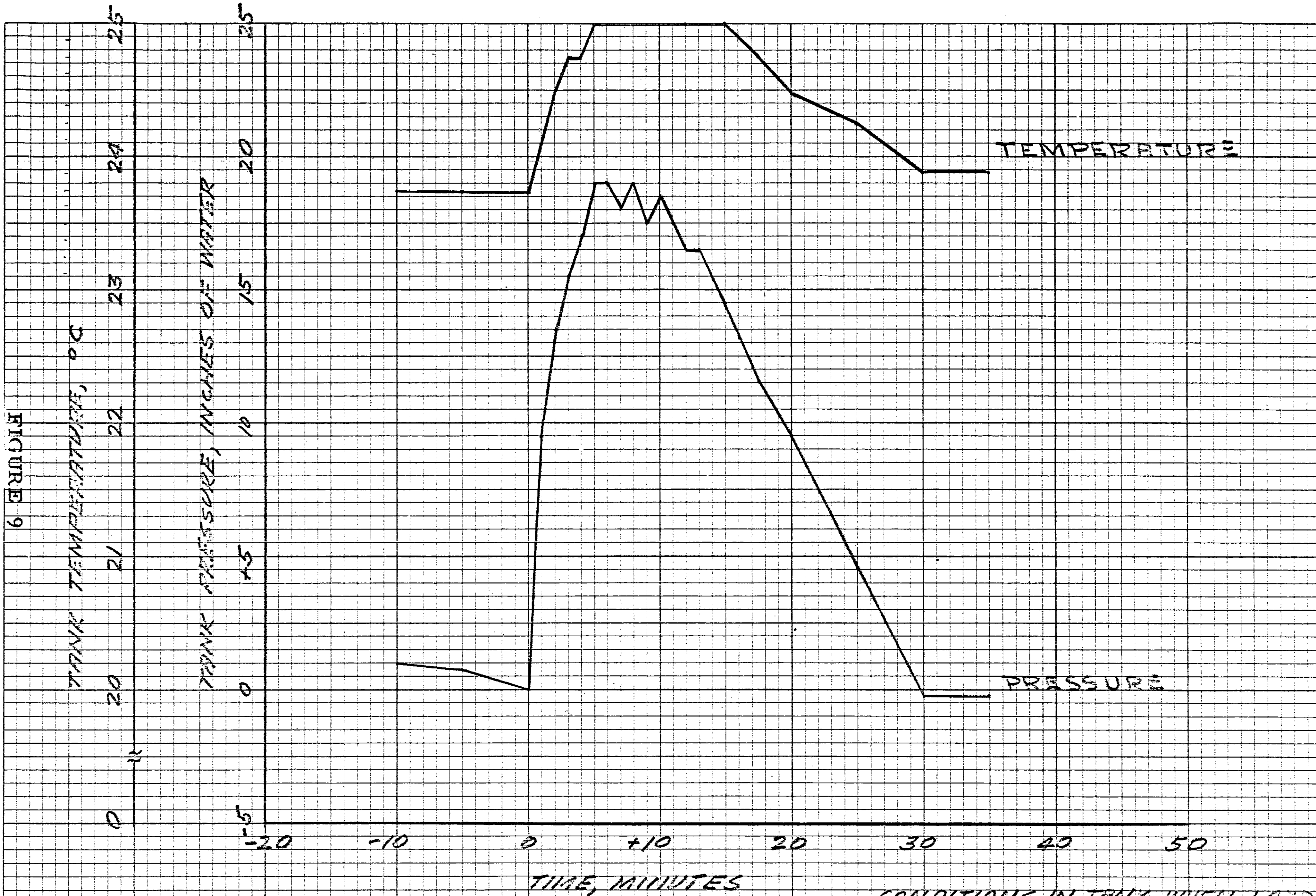

TANK TEMPERATURE °C
20
21
22
23
24
25
0
TANK PRESSURE, INCHES OF WATER
-5
0
+5
10
15
20
25
TEMPERATURE
PRESSURE
-20
-10
0
+10
20
30
40
50
TIME, MINUTES
CONDITIONS IN TANK WHEN LOAD
IS CHANGED FROM 1000 WATTS TO
1400 WATTS.

FIGURE 8

FIGURE 9



CONDITIONS IN TANK WHEN LOAD IS CHANGED FROM 600 WATTS TO 1400 WATTS.

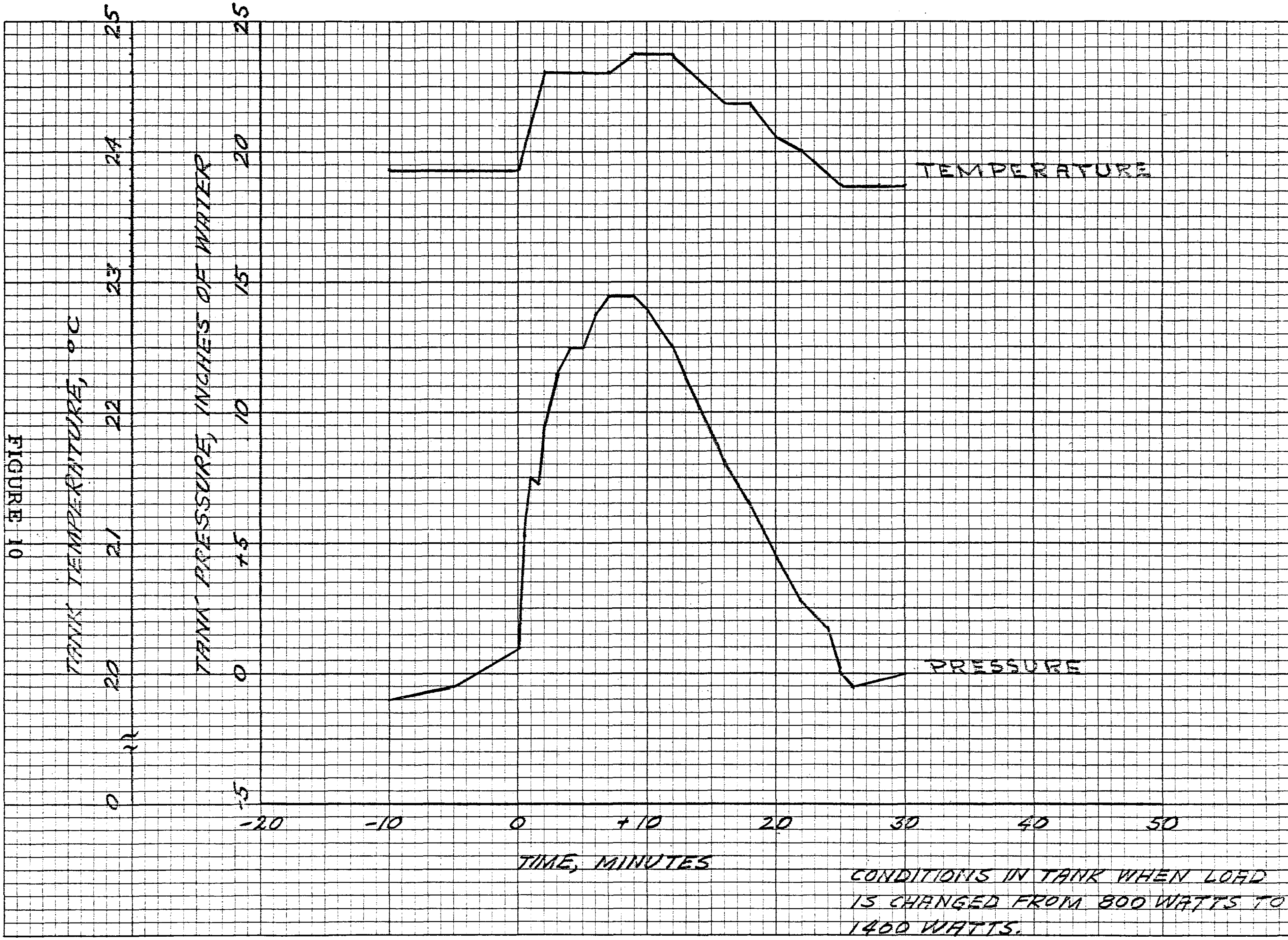


FIGURE 10

CONDITIONS IN TANK WHEN LOAD IS CHANGED FROM 800 WATTS TO 1400 WATTS.