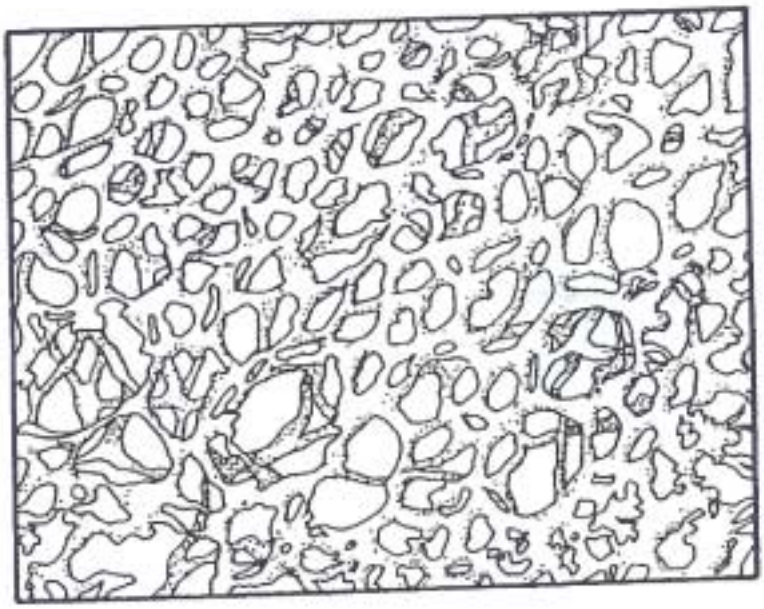


FIG. 1

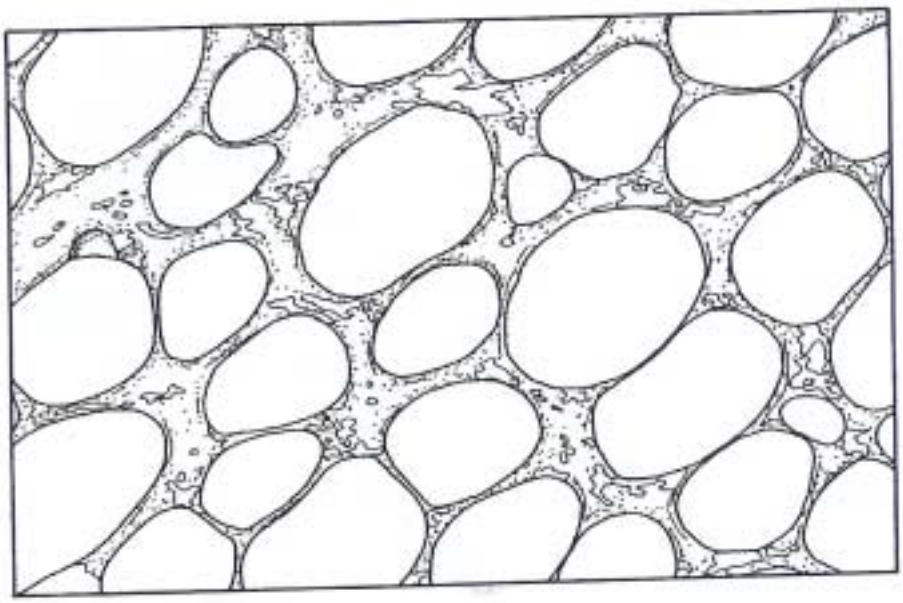


FIG. 2

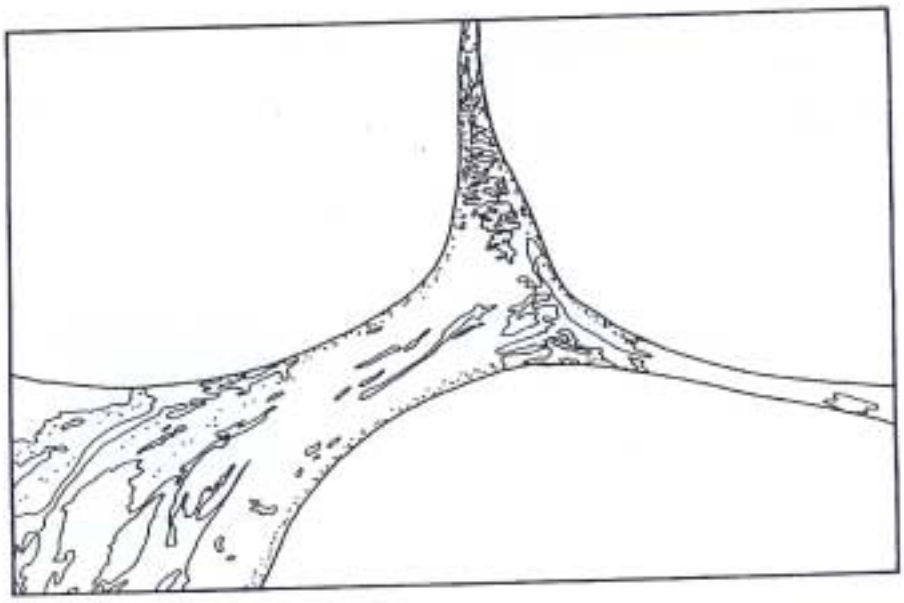


FIG. 3

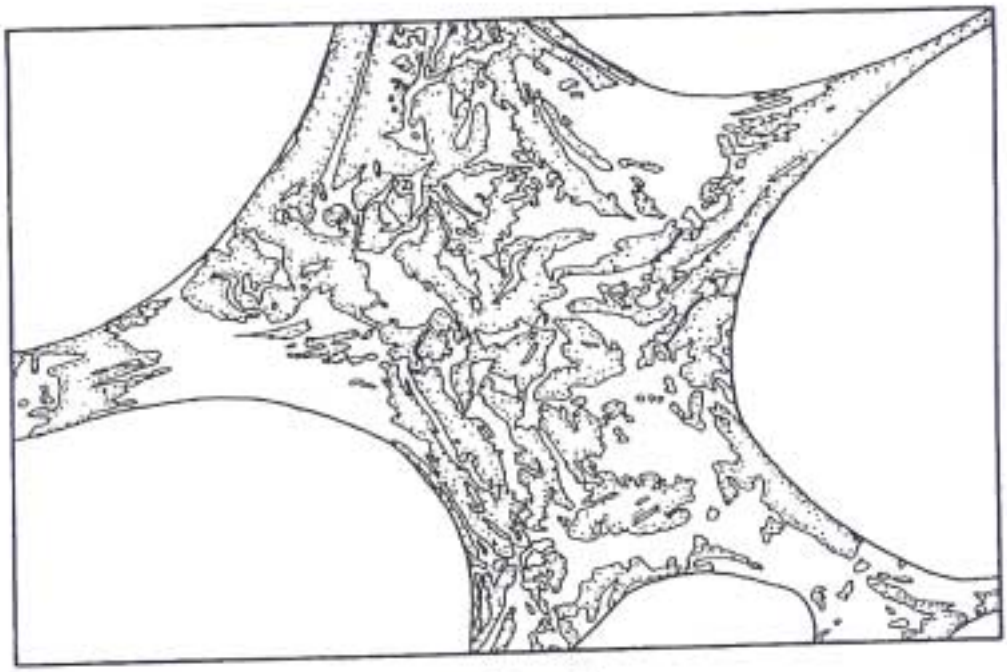


FIG. 4

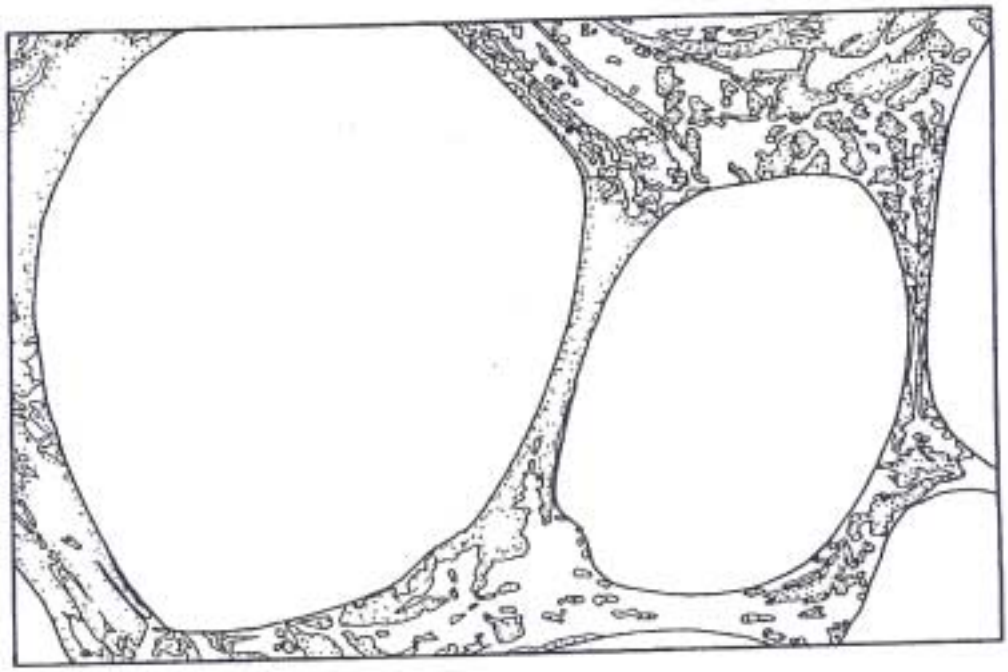


FIG. 5

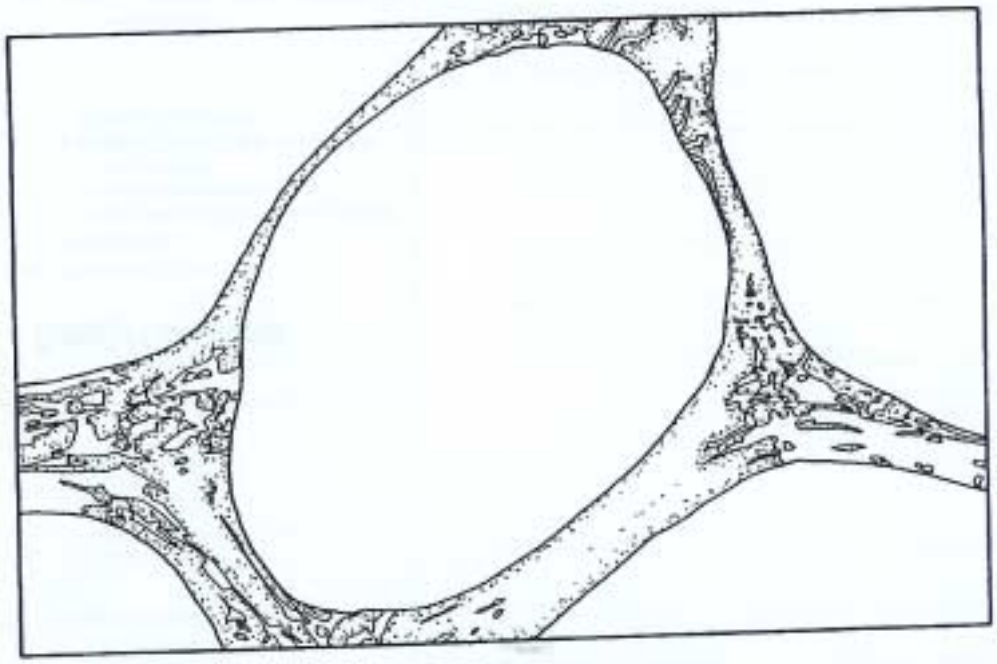


FIG. 6



FIG. 7

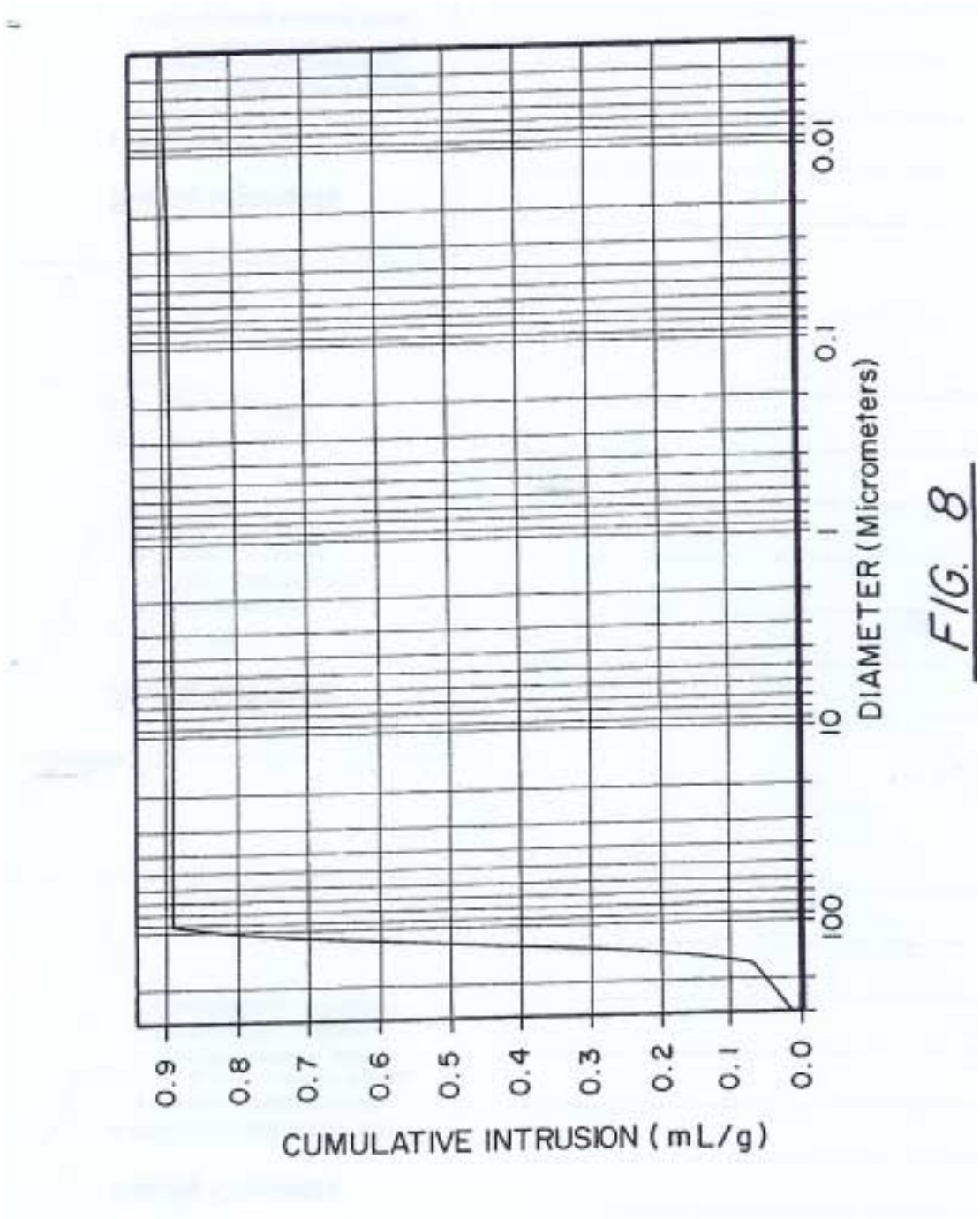

0.01
0.1
1
10
100
DIAMETER (Micrometers)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
CUMULATIVE INTRUSION (mL/g)

FIG. 8

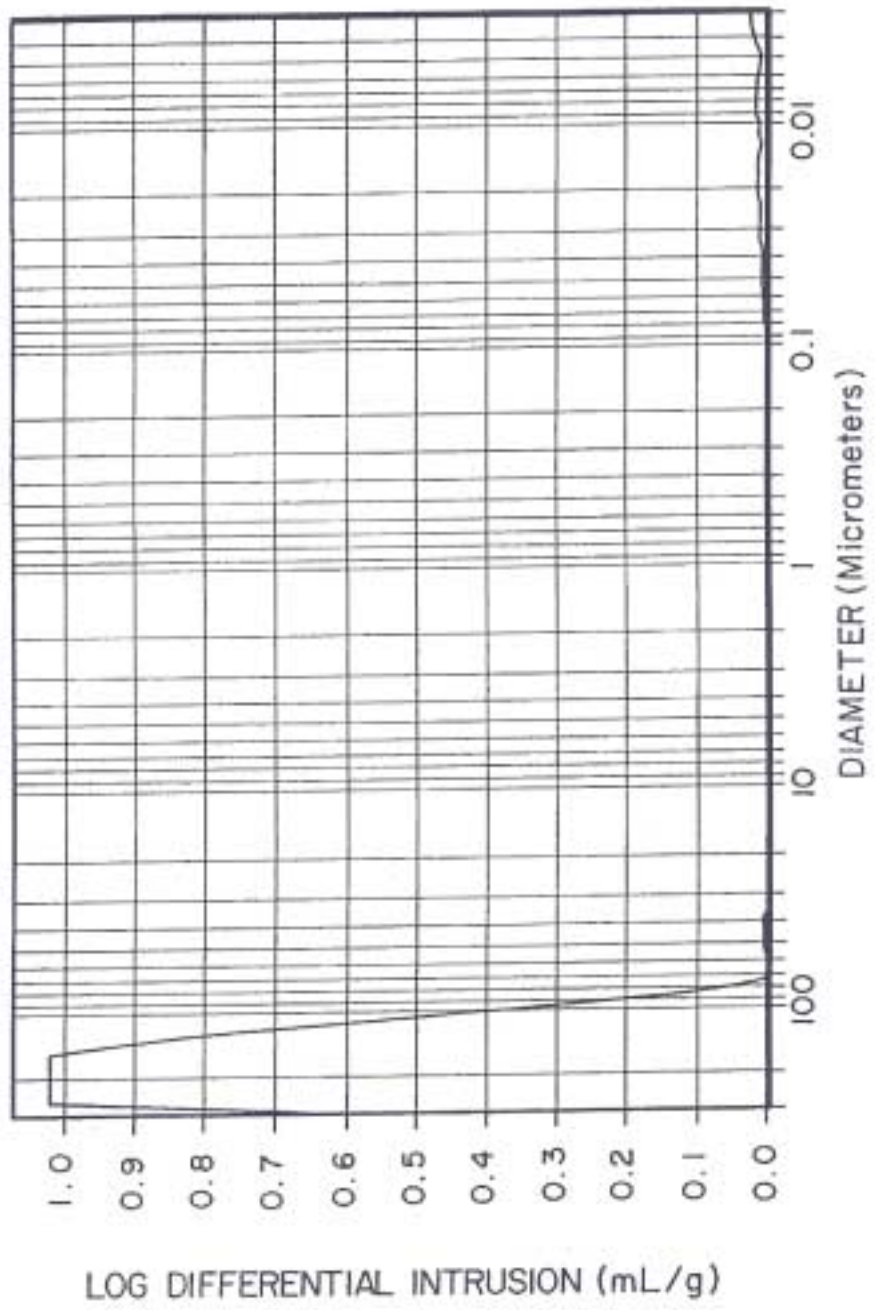

0.01
0.1
1
10
100
DIAMETER (Micrometers)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
LOG DIFFERENTIAL INTRUSION (mL/g)

FIG. 9

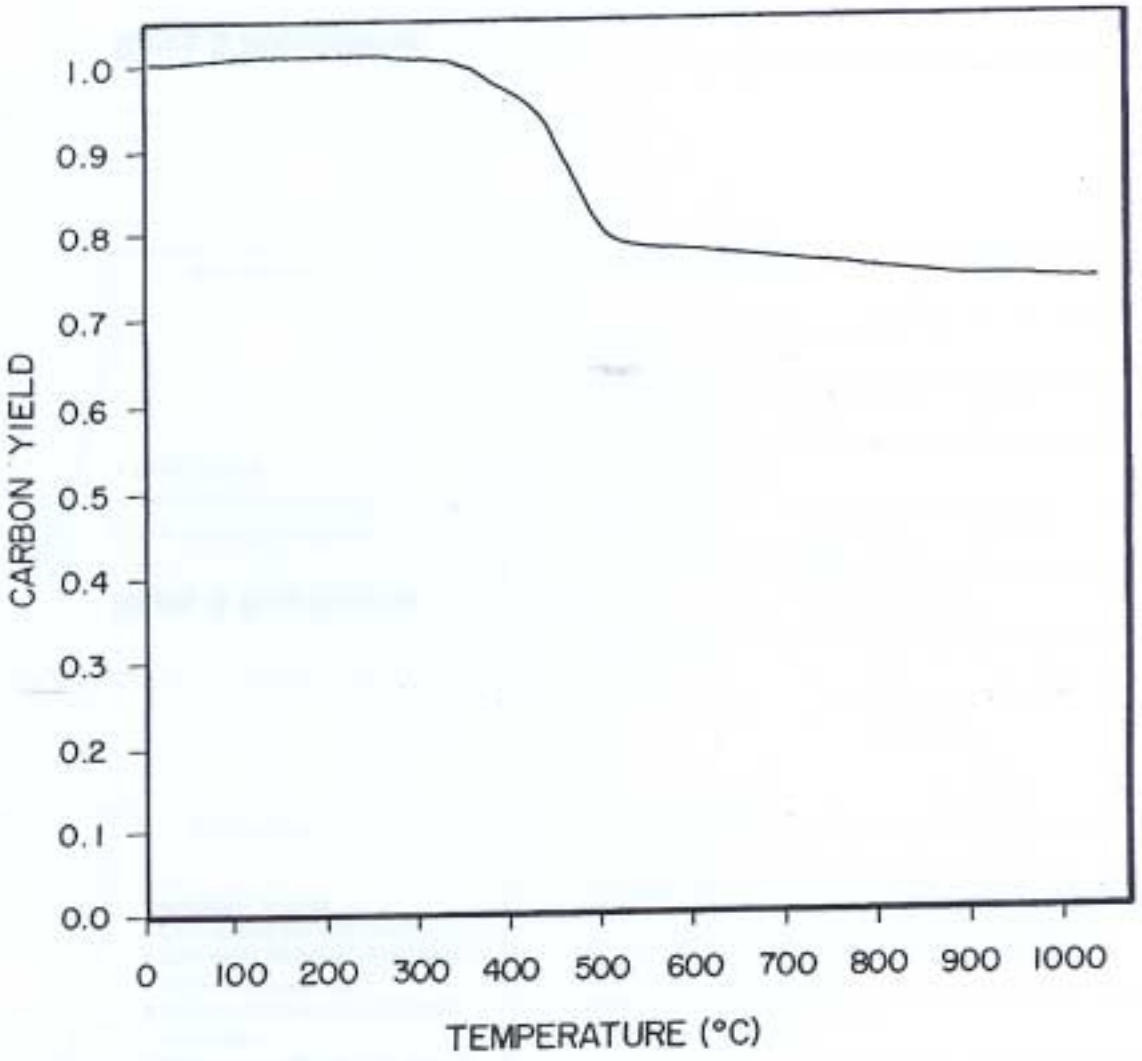

CARBON YIELD
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
100
200
300
400
500
600
700
800
900
1000
TEMPERATURE (°C)

FIG. 10

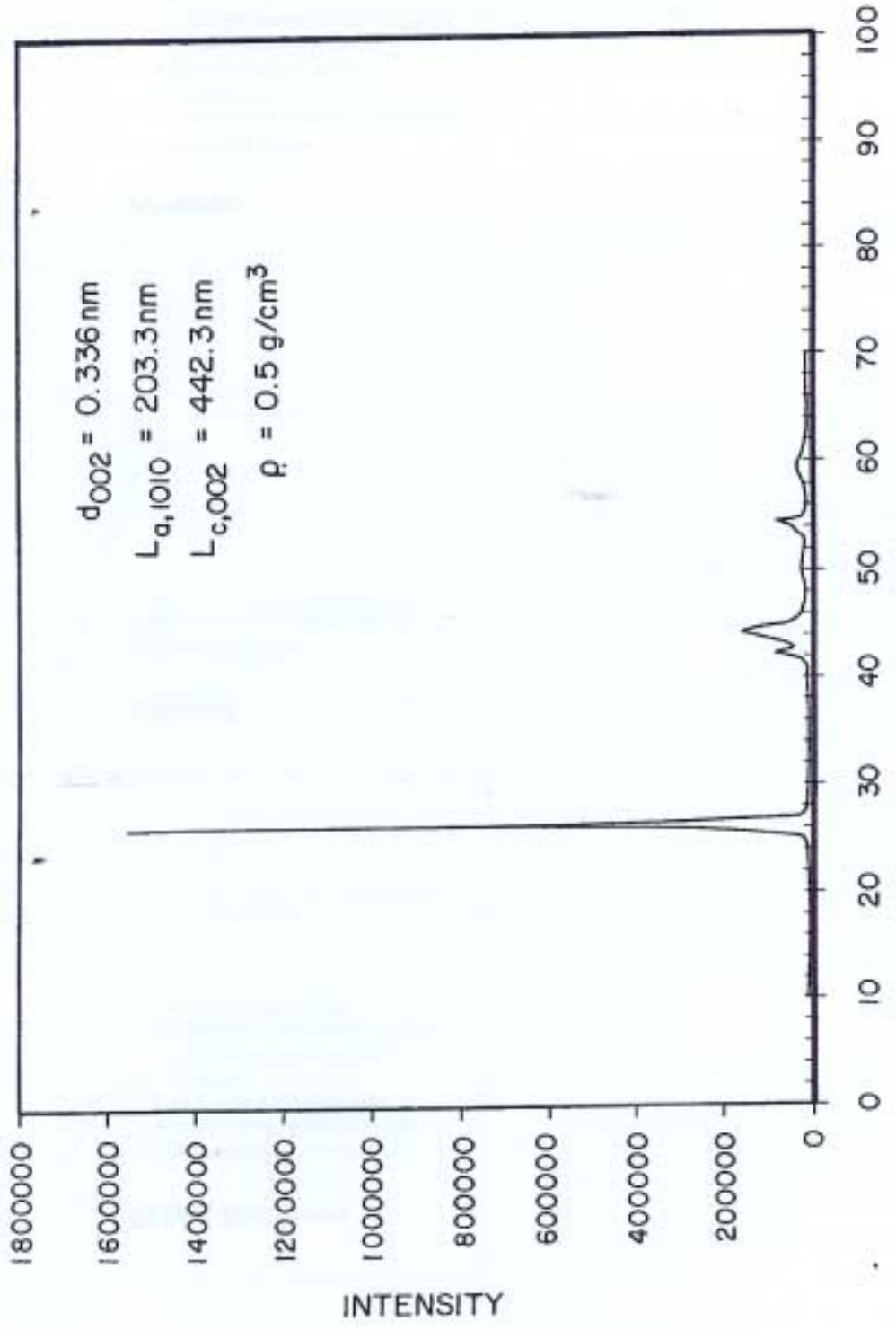
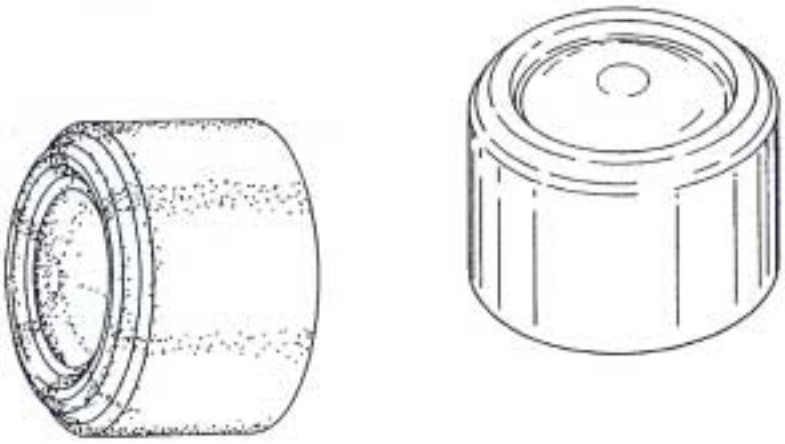
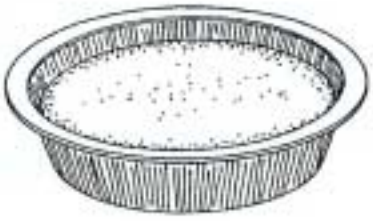

d_{002} = 0.336 nm
$L_{a,1010}$ = 203.3 nm
$L_{c,002}$ = 442.3 nm
ρ = 0.5 g/cm^3
INTENSITY
2θ
0
200000
400000
600000
800000
1000000
1200000
1400000
1600000
1800000
0
10
20
30
40
50
60
70
80
90
100

FIG. 11



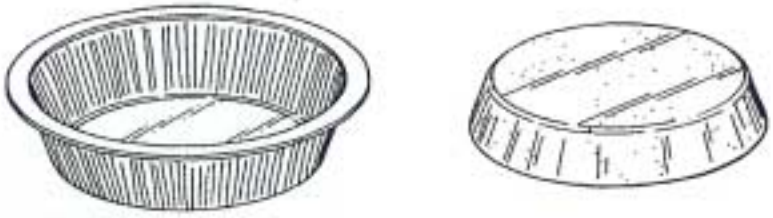
FOAM PRODUCED IN BOTTOM OF SODA CAN.

FIG. 12A



FOAM PRODUCED IN ALUMINUM WEIGHING DISH.

FIG. 12B



FOAM REMOVED FROM ALUMINUM WEIGHING DISH AND TURNED OVER, EXPOSING SMOOTH INTEGRATED SURFACE (FACE)

FIG. 12C

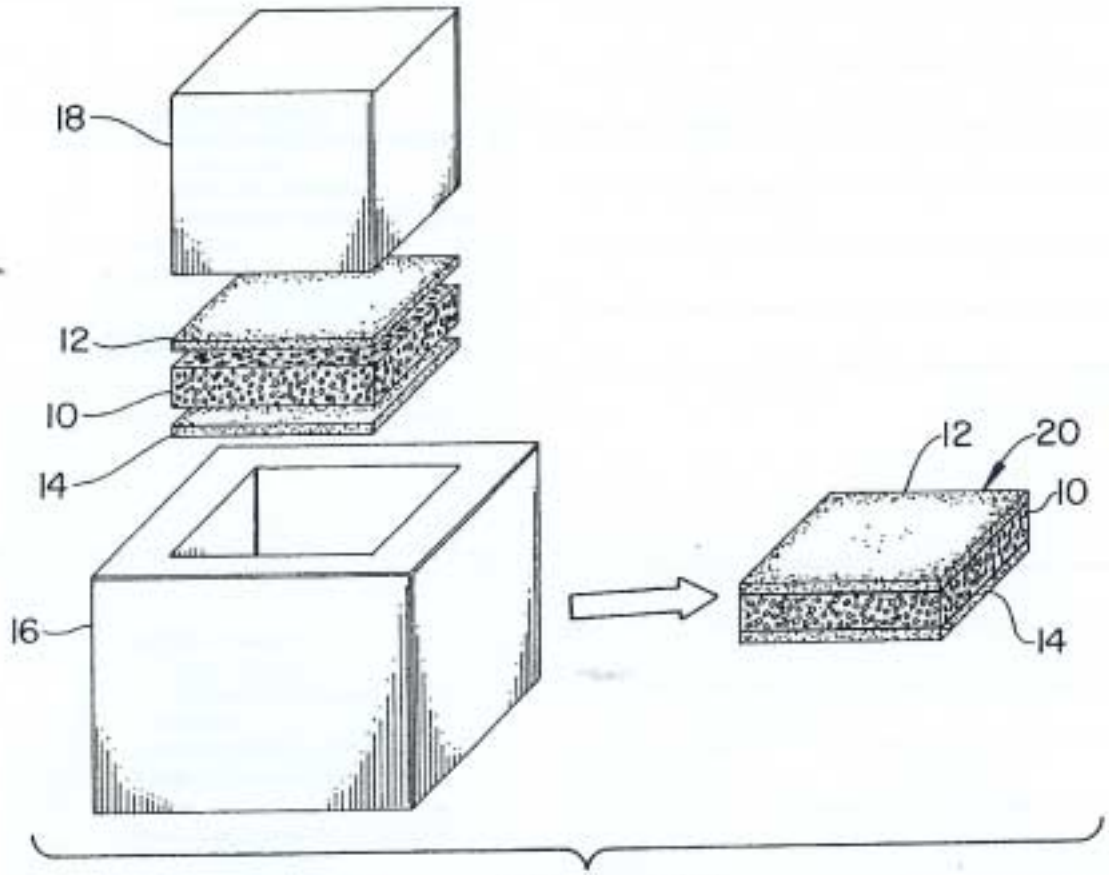


FIG. 13A

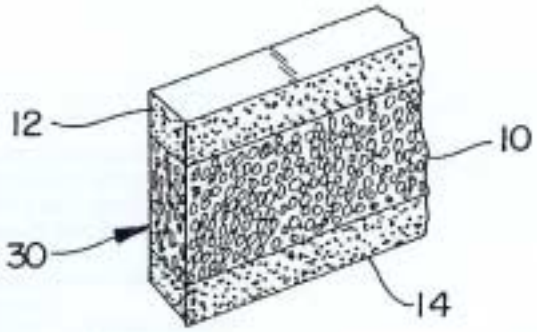
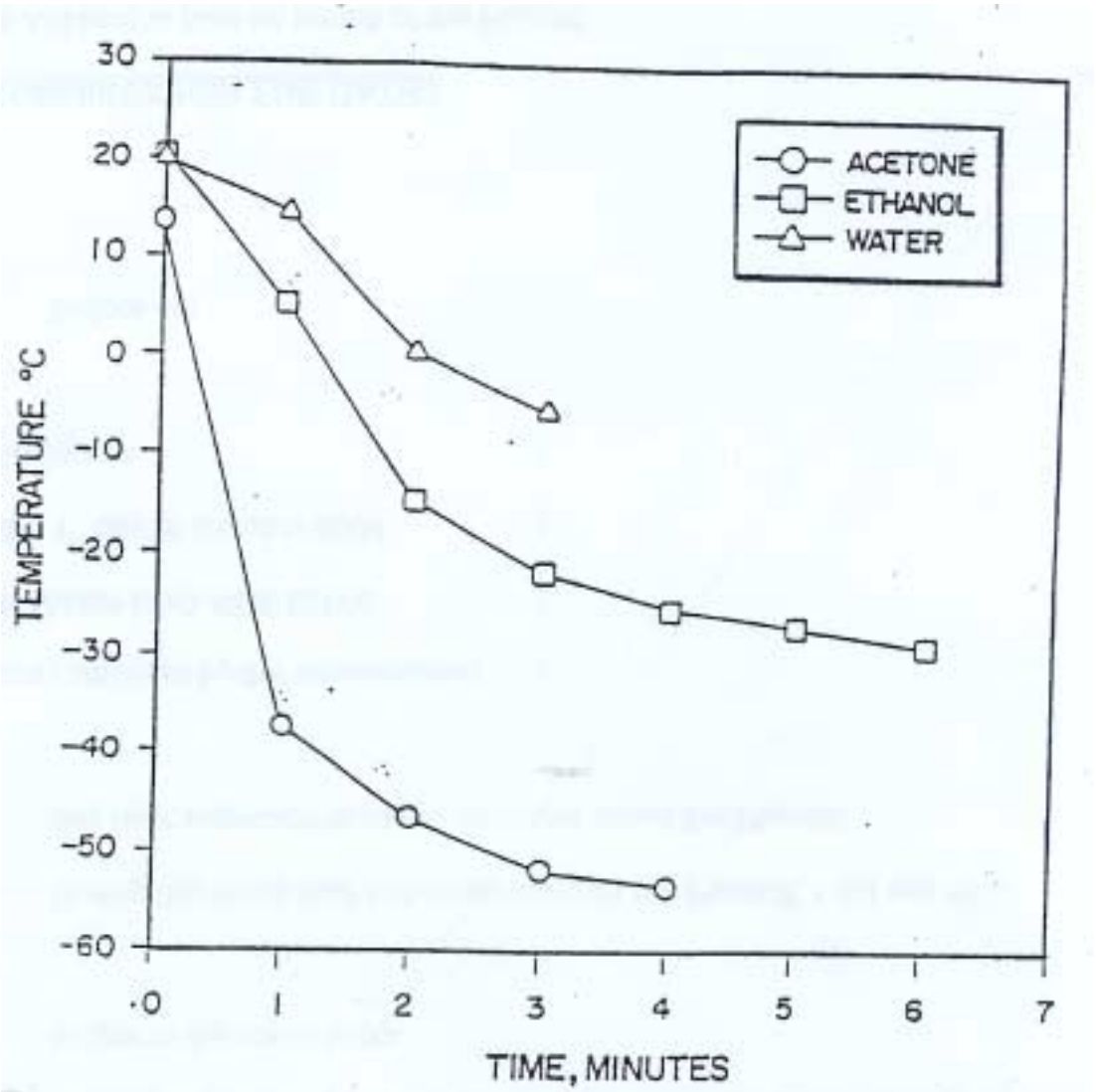


FIG. 13B


30
20
10
0
-10
-20
-30
-40
-50
-60
TEMPERATURE °C
·0
1
2
3
4
5
6
7
TIME, MINUTES
ACETONE
ETHANOL
WATER

~~Fig. 14~~

FIG. 14

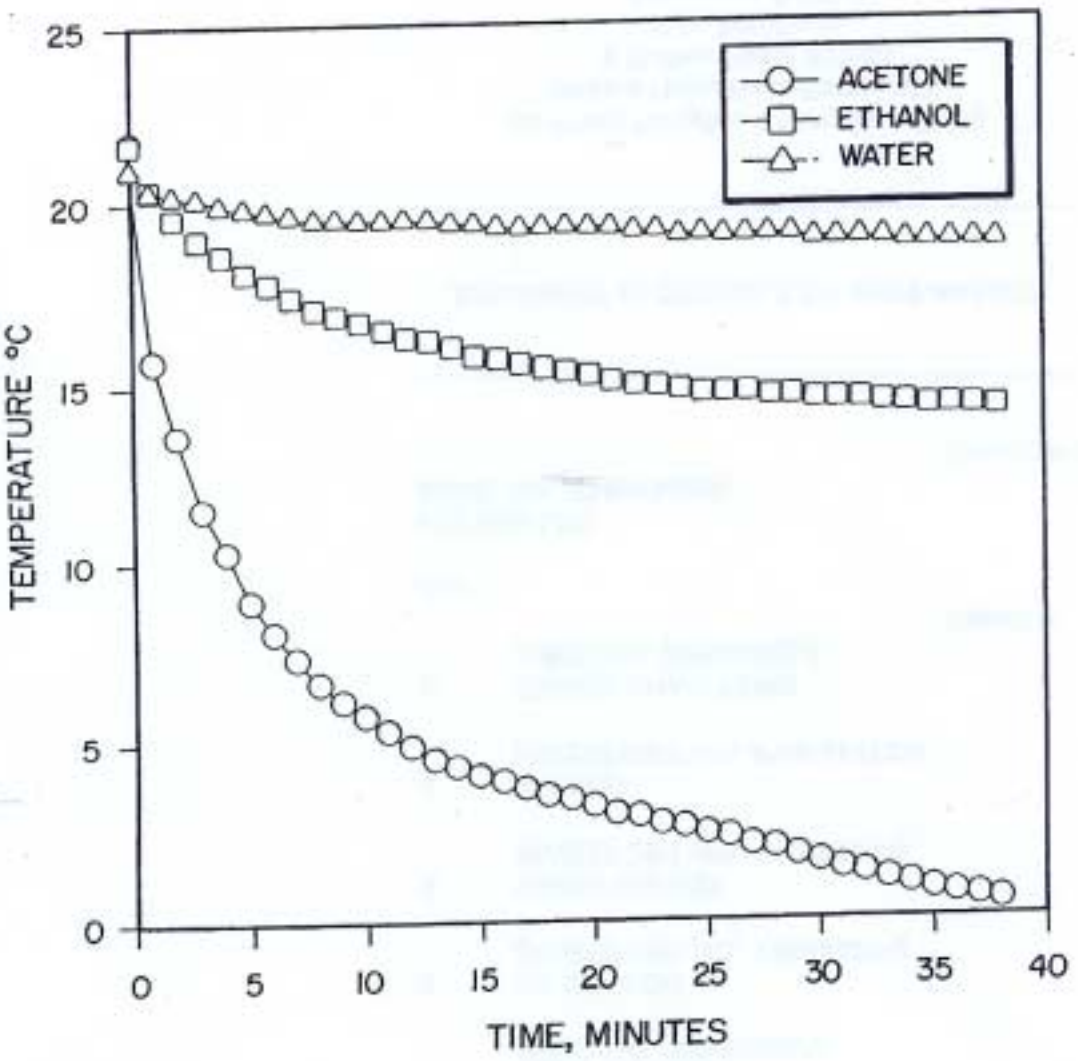

ACETONE
ETHANOL
WATER
TEMPERATURE °C
TIME, MINUTES
0
5
10
15
20
25
30
35
40

FIG. 15

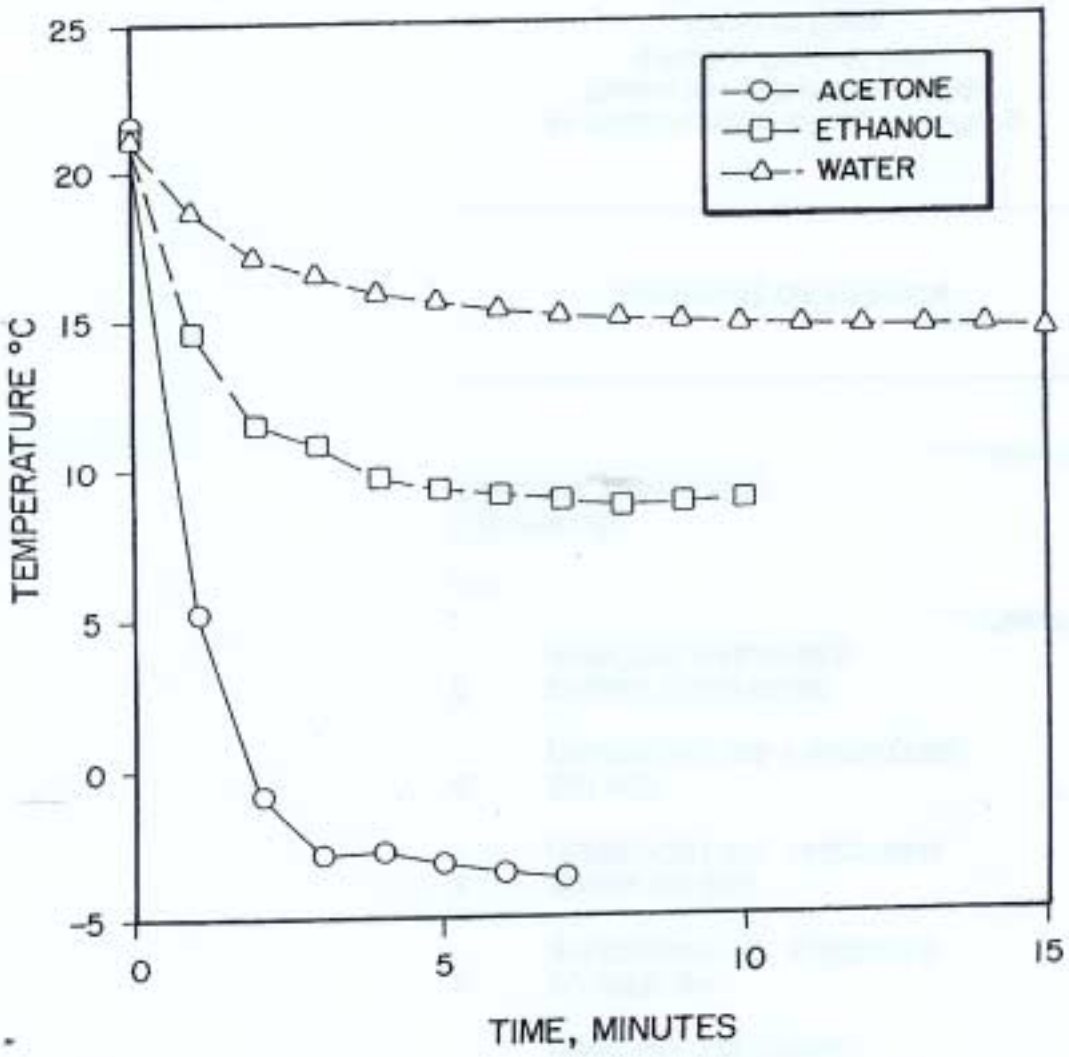

25
20
15
10
5
0
-5
TEMPERATURE °C
0
5
10
15
TIME, MINUTES
ACETONE
ETHANOL
WATER

FIG. 16

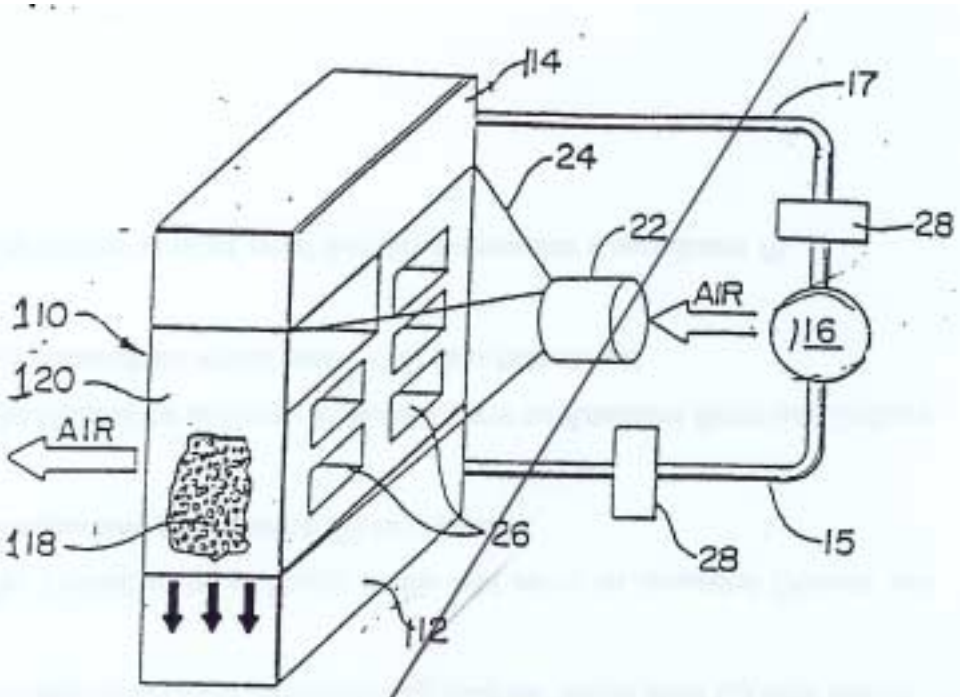

114
17
24
22
28
AIR
116
110
120
AIR
118
26
28
15
112

FIG. 17

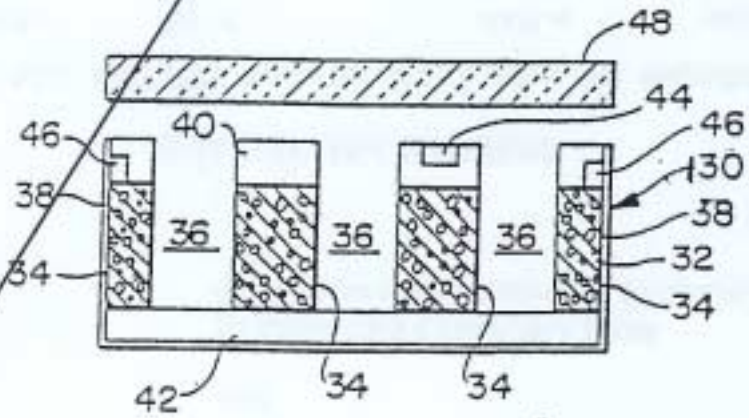

48
44
40
46
46
130
38
38
36
36
36
32
34
34
42
34
34

FIG. 18

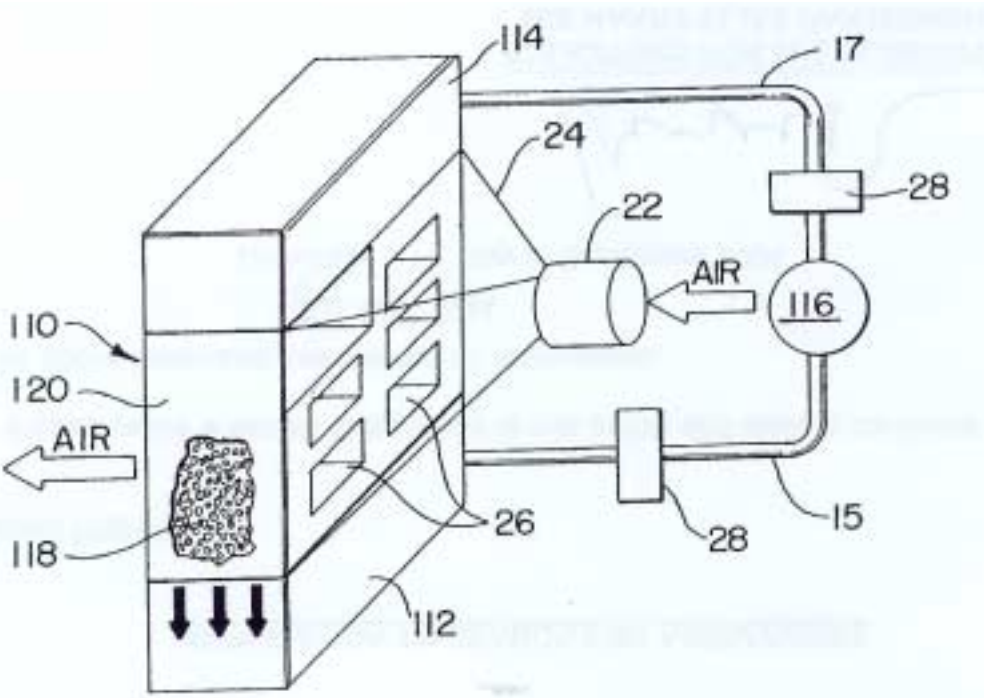

114
17
24
28
22
AIR
116
110
120
AIR
118
26
28
15
112

FIG. 17

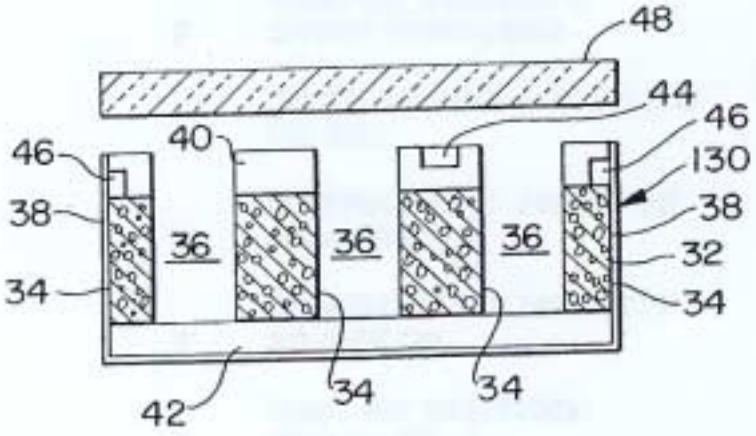

48
44
46
40
46
130
38
38
36
36
36
32
34
34
42
34
34

FIG. 18

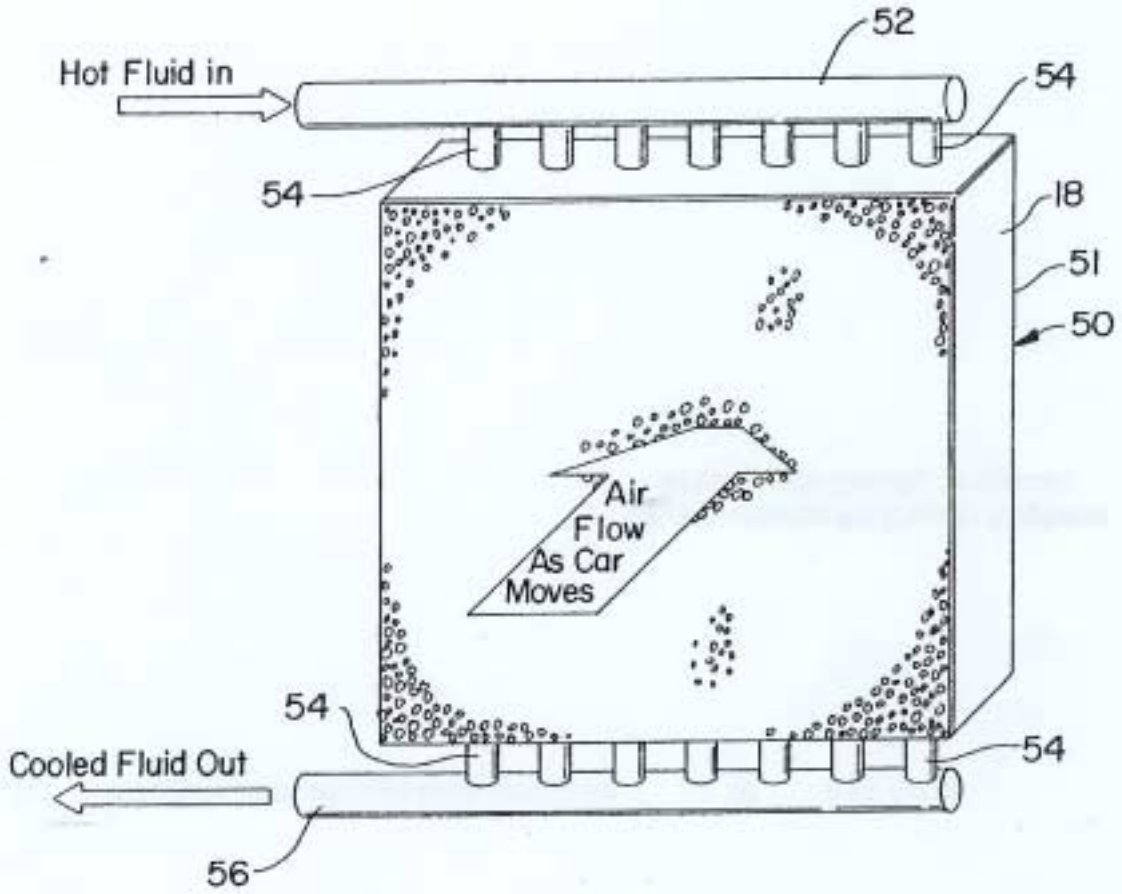

Hot Fluid in
52
54
54
18
51
50
Air
Flow
As Car
Moves
54
54
Cooled Fluid Out
56

FIG. 19

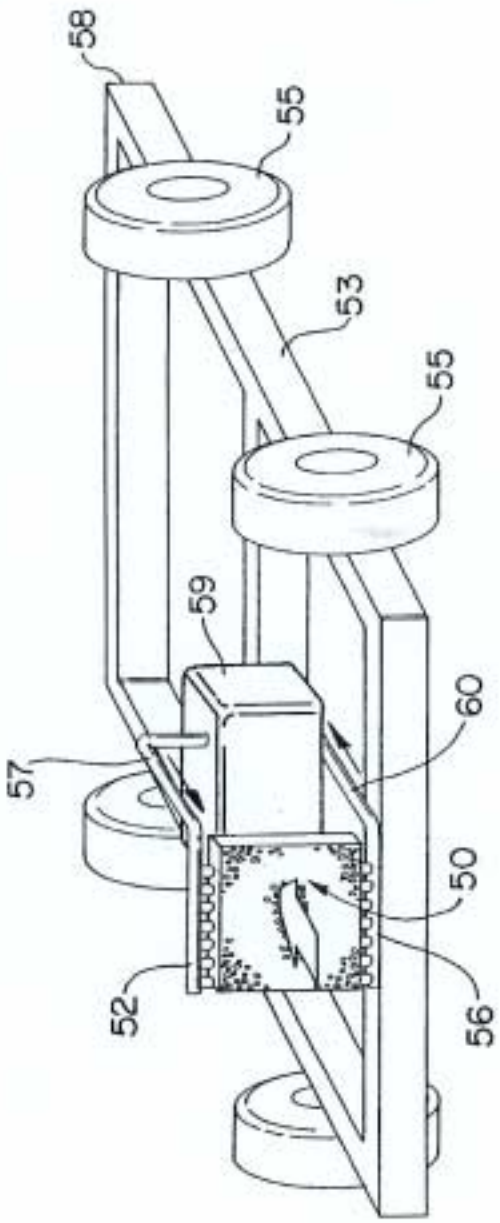


FIG. 20

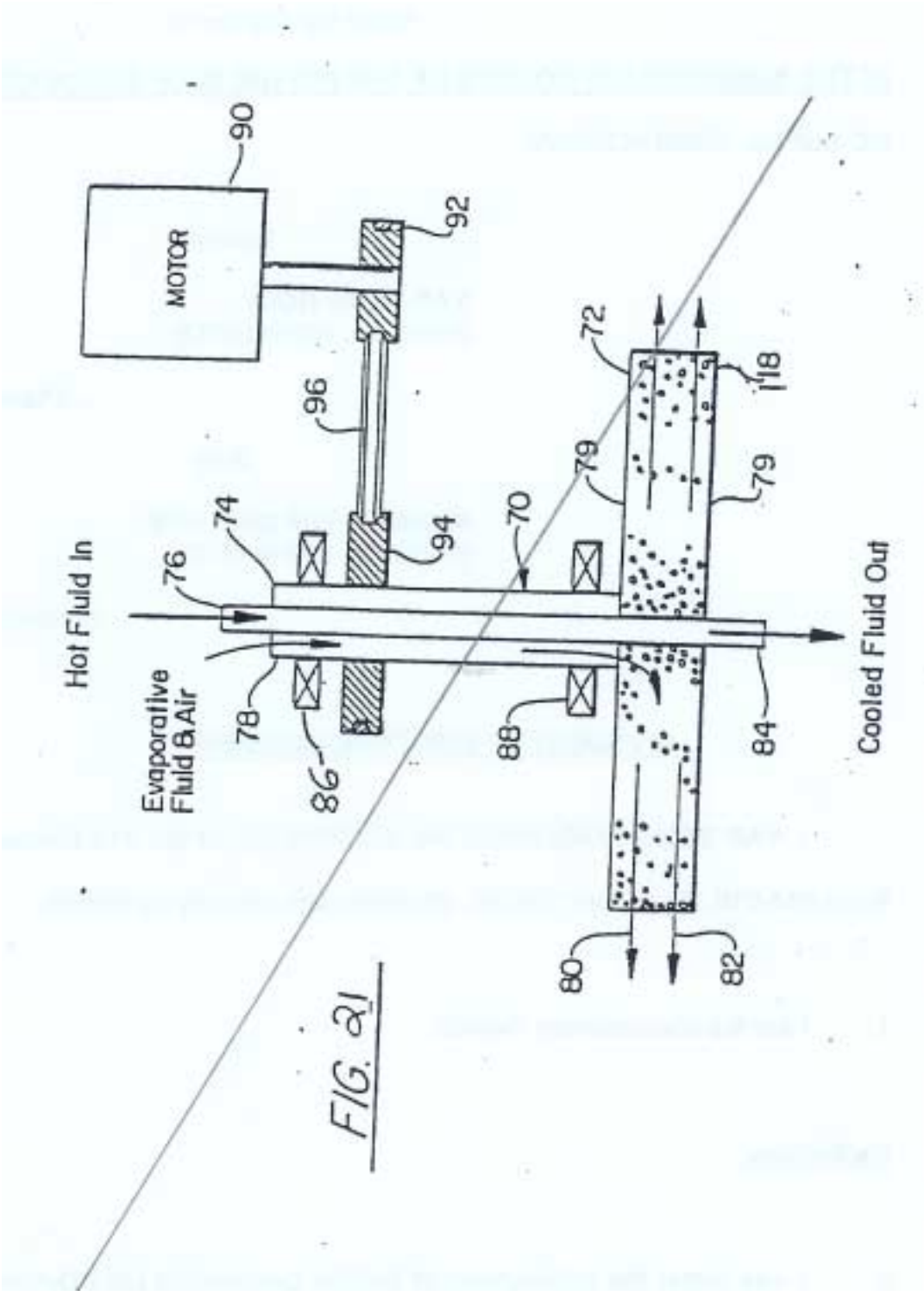

90
MOTOR
92
96
94
74
76
70
72
18
79
79
Hot Fluid In
Evaporative Fluid & Air
78
86
88
84
Cooled Fluid Out
80
82

FIG. 21

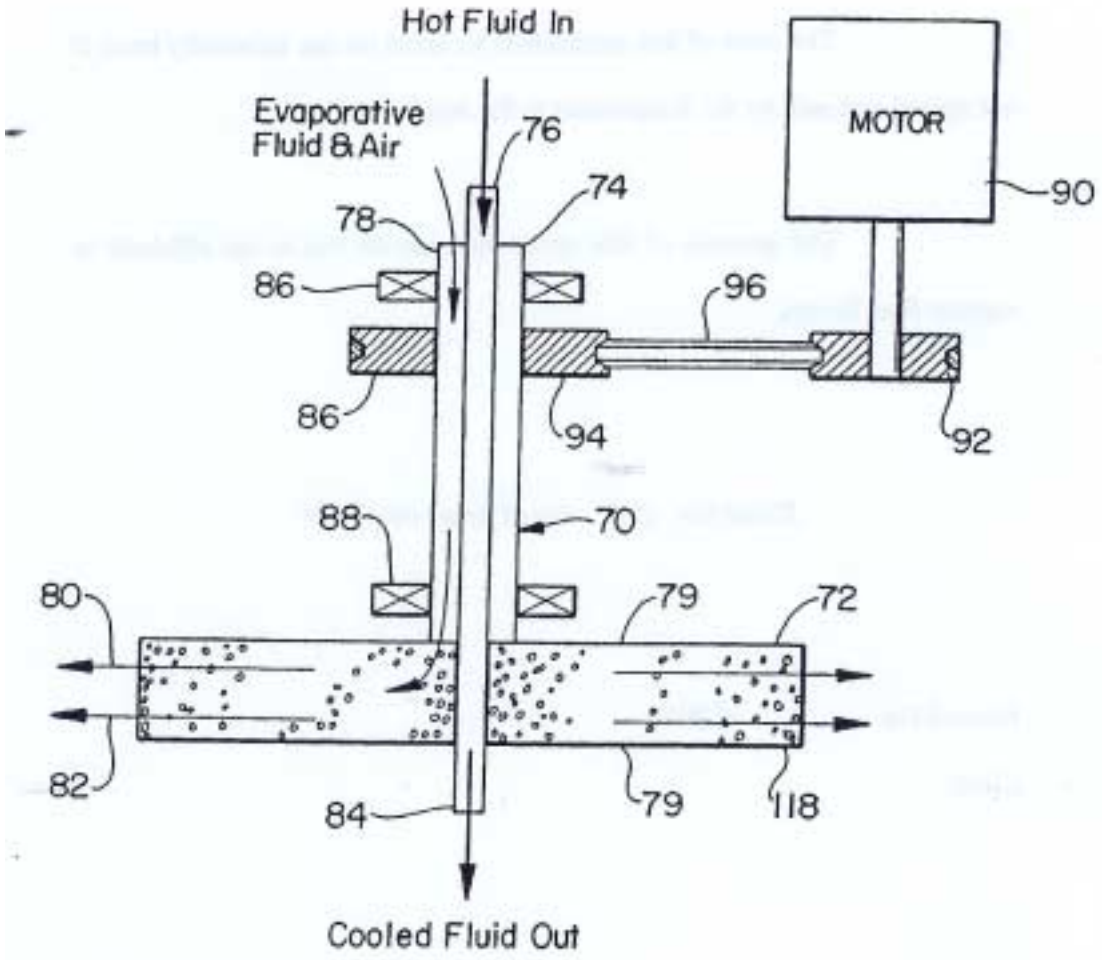

Hot Fluid In
Evaporative
Fluid & Air
76
74
78
MOTOR
90
86
96
86
94
92
88
70
80
79
72
82
84
79
118
Cooled Fluid Out

FIG. 21

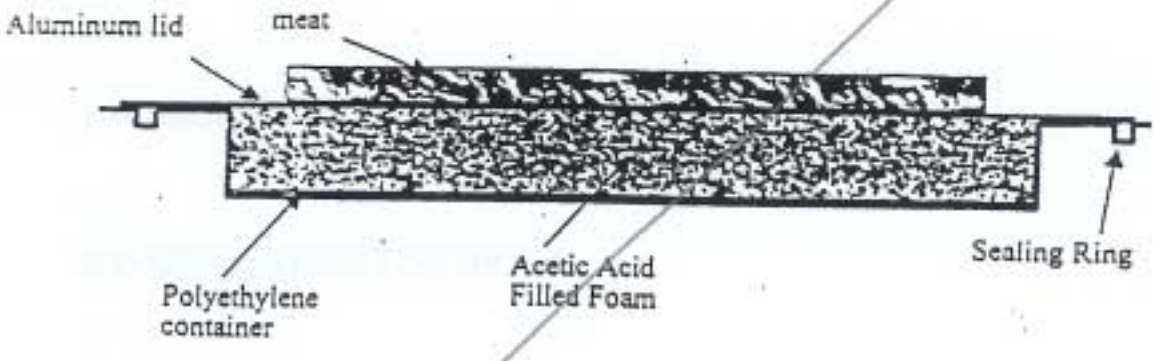

Aluminum lid
meat
Polyethylene container
Acetic Acid Filled Foam
Sealing Ring

FIGURE .22

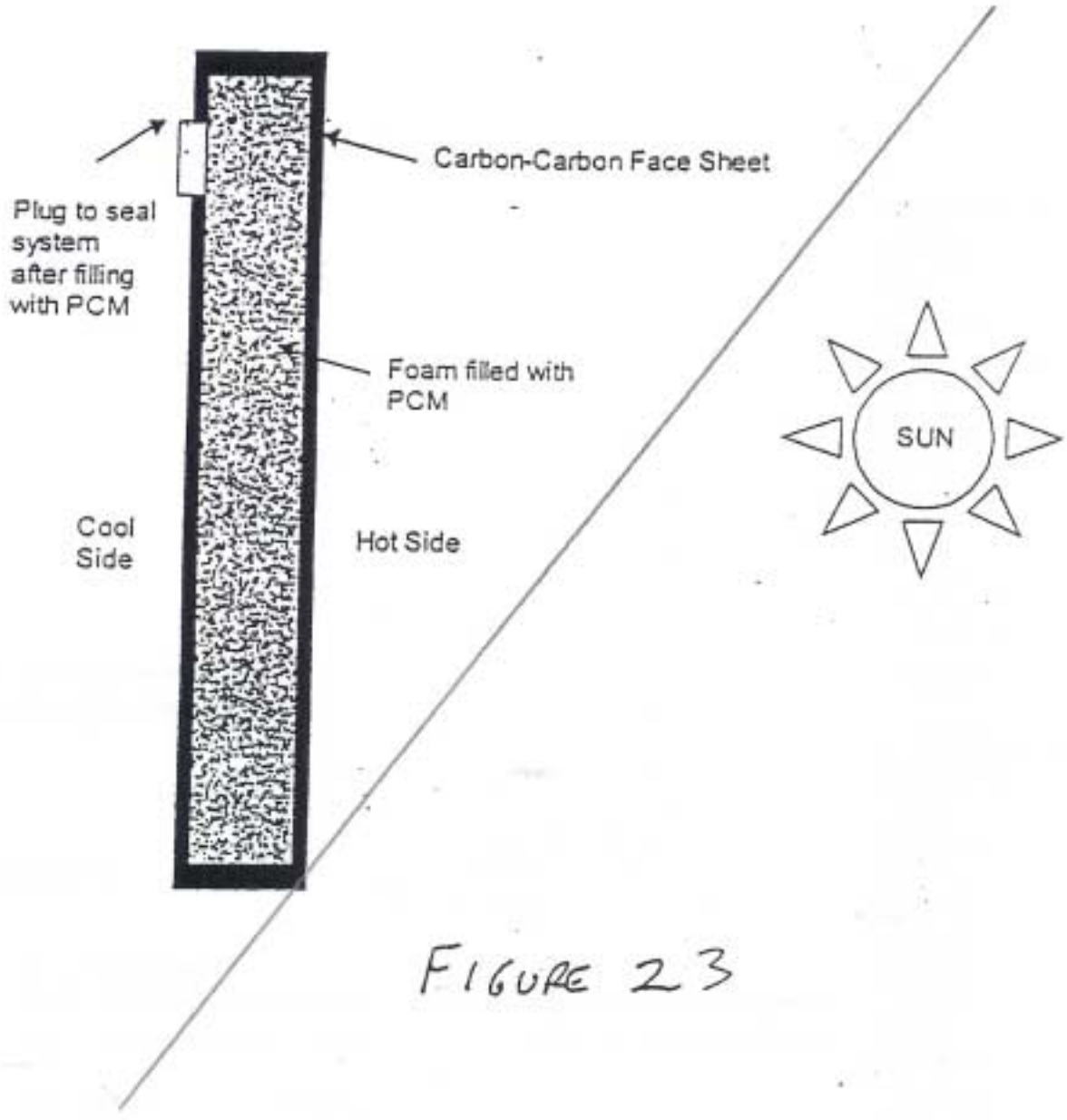

Carbon-Carbon Face Sheet
Plug to seal system after filling with PCM
Foam filled with PCM
SUN
Cool Side
Hot Side

FIGURE 23

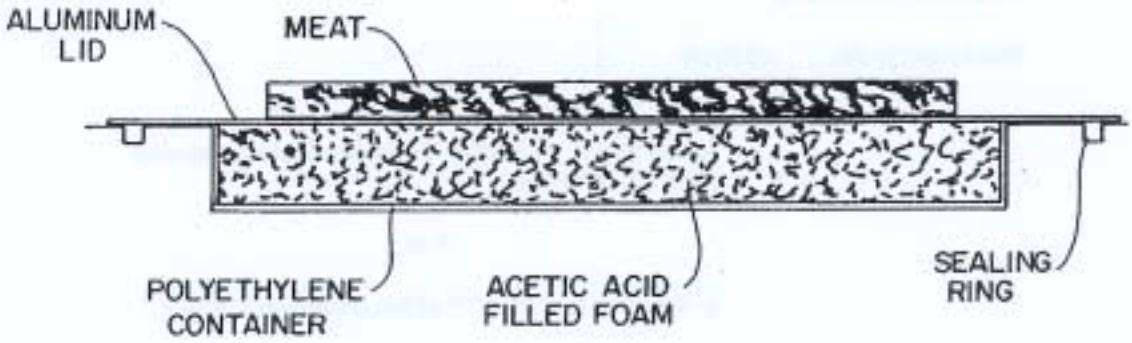

ALUMINUM LID
MEAT
POLYETHYLENE CONTAINER
ACETIC ACID FILLED FOAM
SEALING RING

FIG. 22

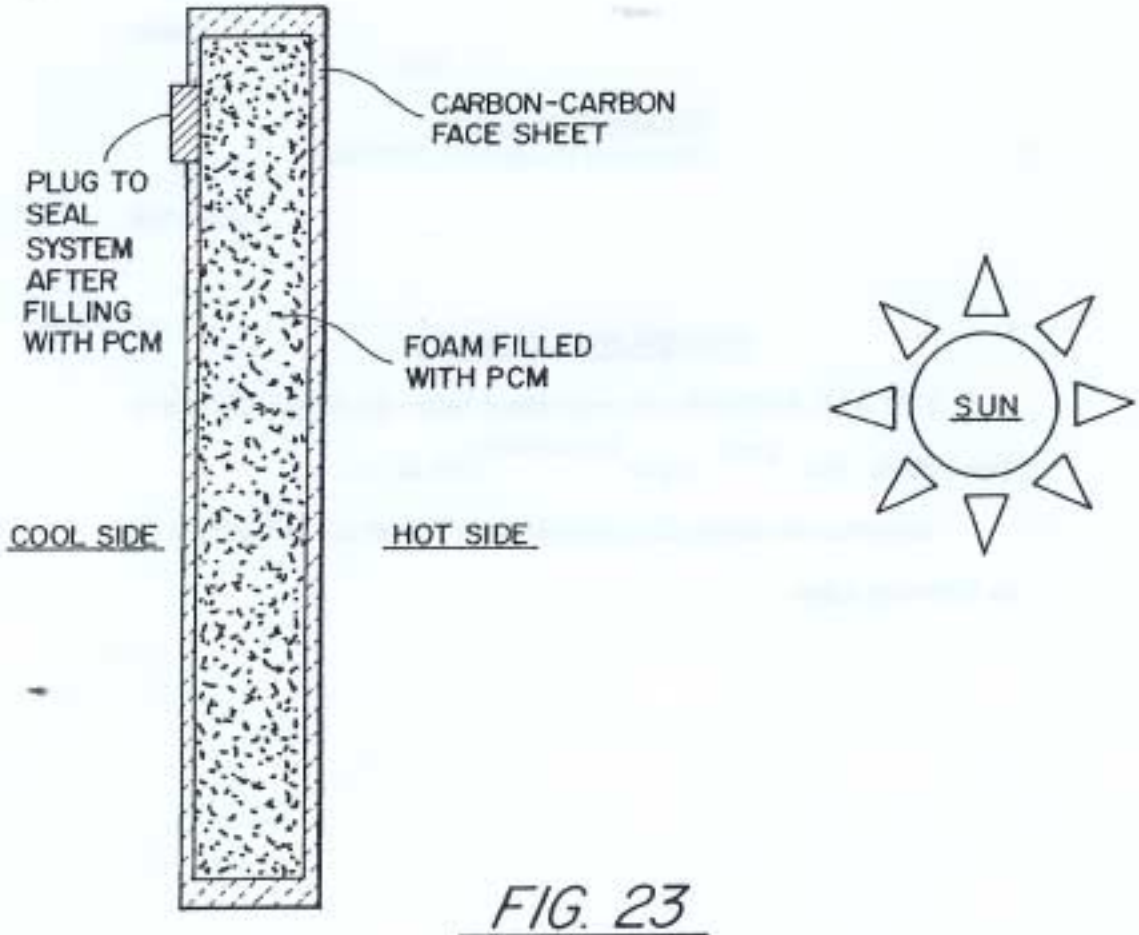

CARBON-CARBON FACE SHEET
PLUG TO SEAL SYSTEM AFTER FILLING WITH PCM
FOAM FILLED WITH PCM
SUN
COOL SIDE
HOT SIDE

FIG. 23

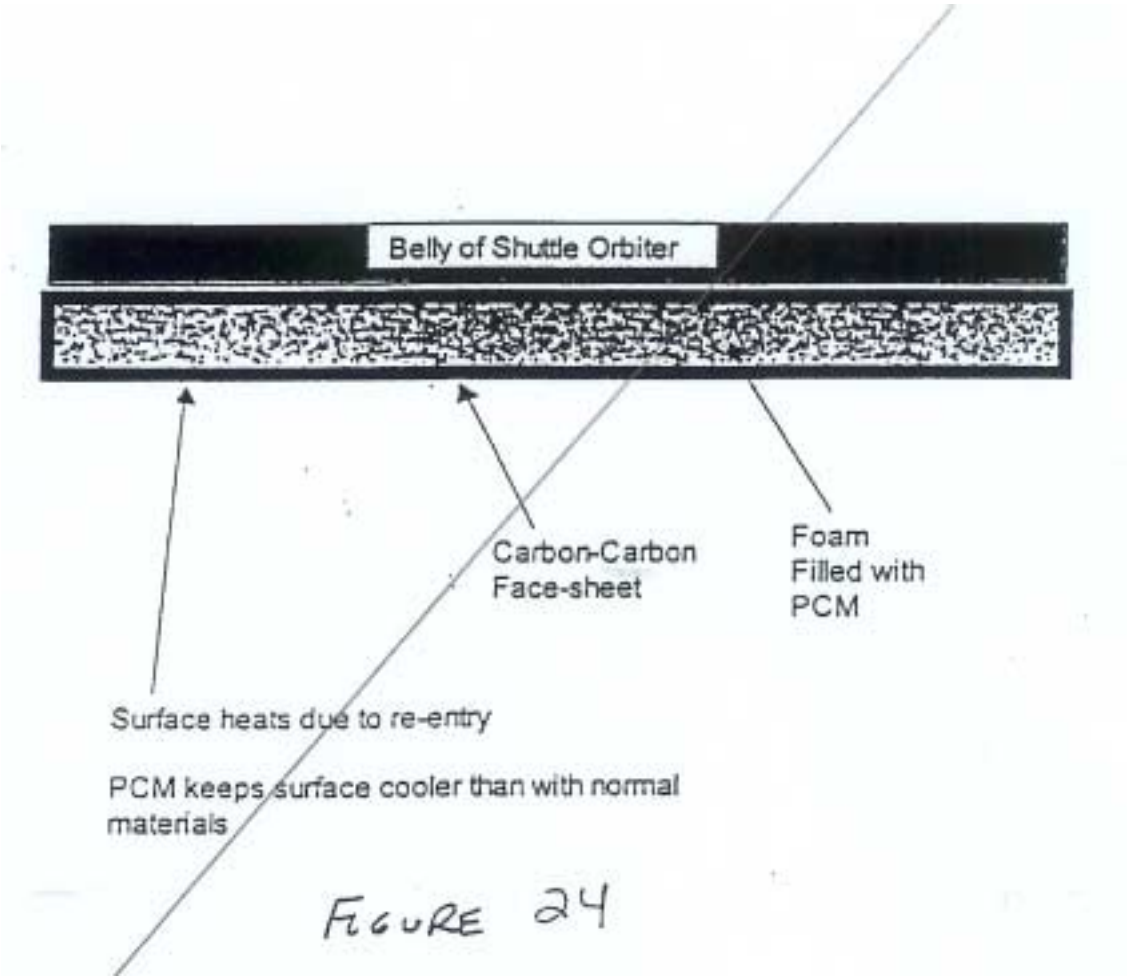

Belly of Shuttle Orbiter
Carbon-Carbon
Face-sheet
Foam
Filled with
PCM
Surface heats due to re-entry
PCM keeps surface cooler than with normal materials

FIGURE 24

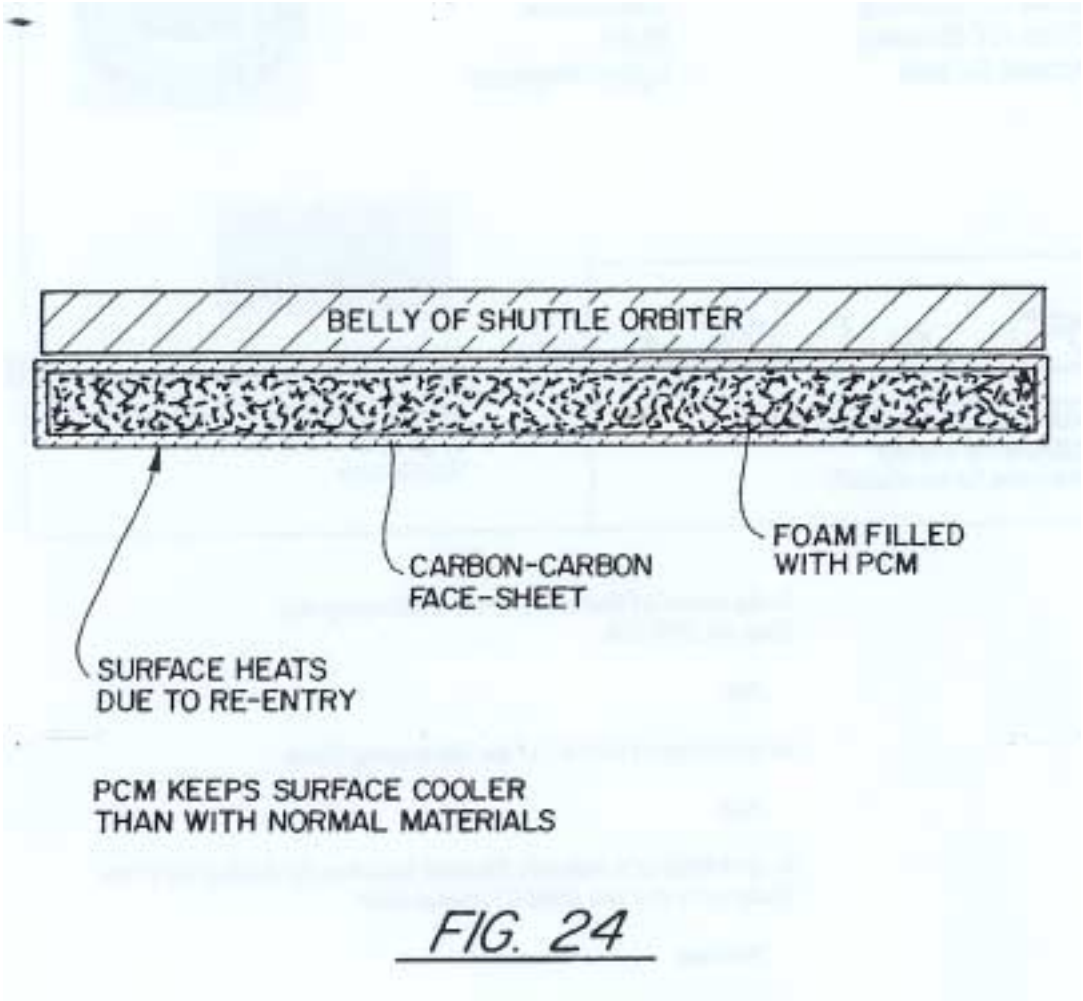

BELLY OF SHUTTLE ORBITER
FOAM FILLED WITH PCM
CARBON-CARBON FACE-SHEET
SURFACE HEATS DUE TO RE-ENTRY
PCM KEEPS SURFACE COOLER THAN WITH NORMAL MATERIALS

FIG. 24

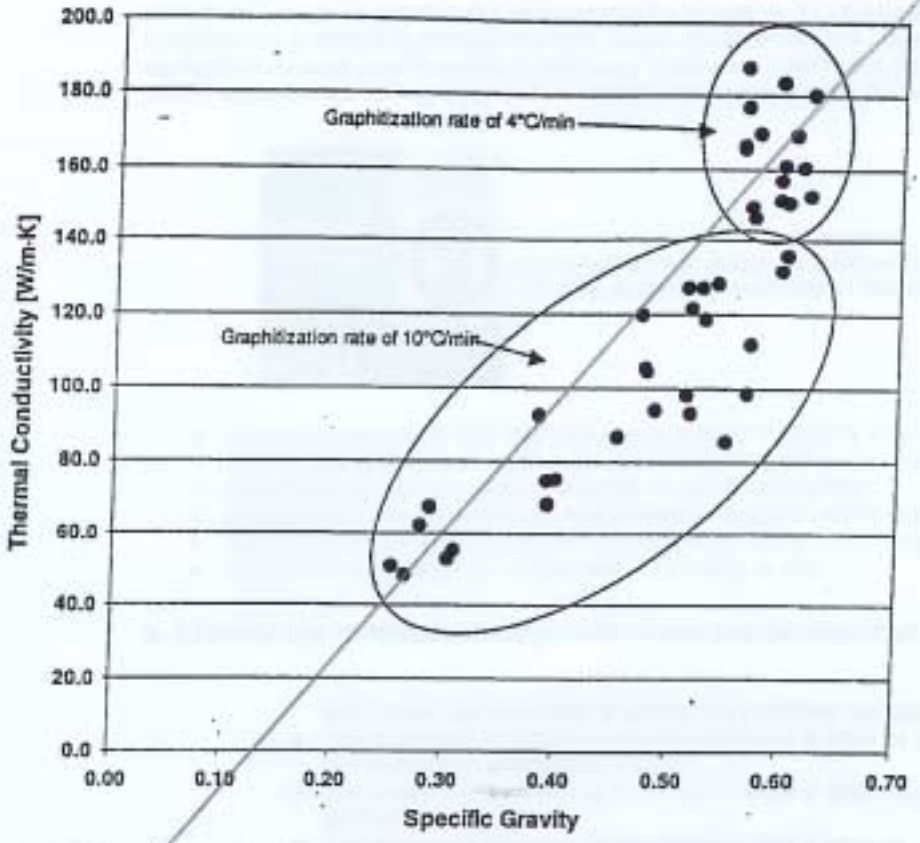


Figure 1. Thermal conductivity as a function of density for ARA24 mesophase derived graphite foam graphitized at 4°C/min and 10°C/min.

Fig. 25

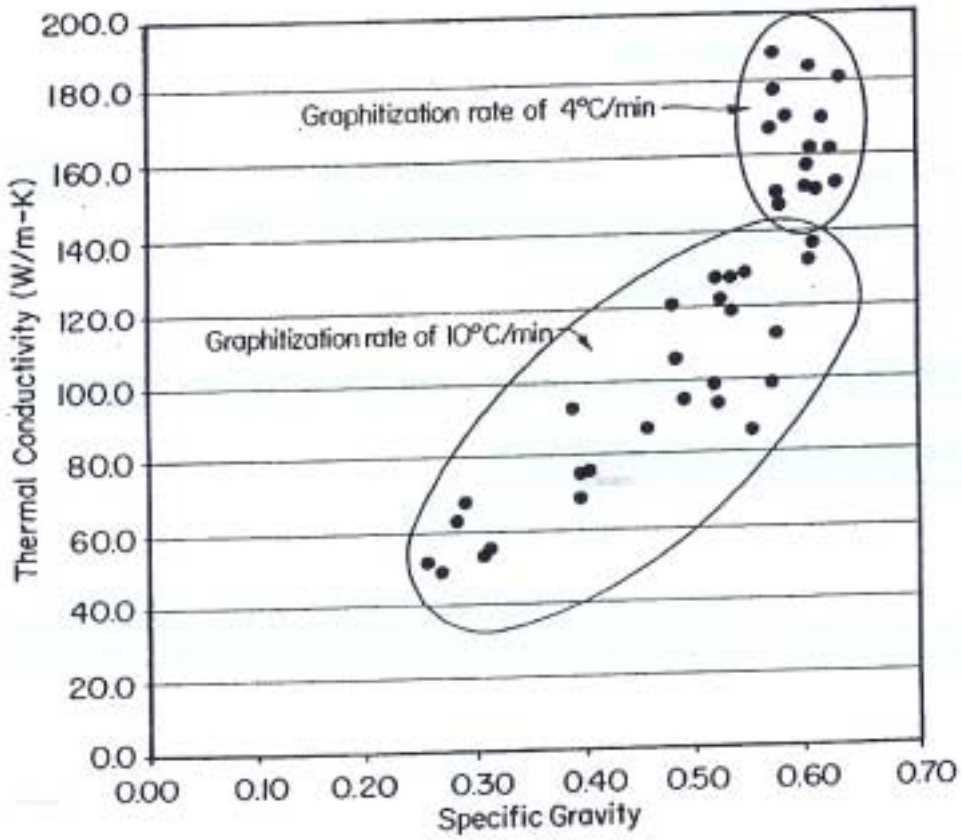

200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
Thermal Conductivity (W/m-K)
Graphitization rate of 4°C/min
Graphitization rate of 10°C/min
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
Specific Gravity

FIG. 25

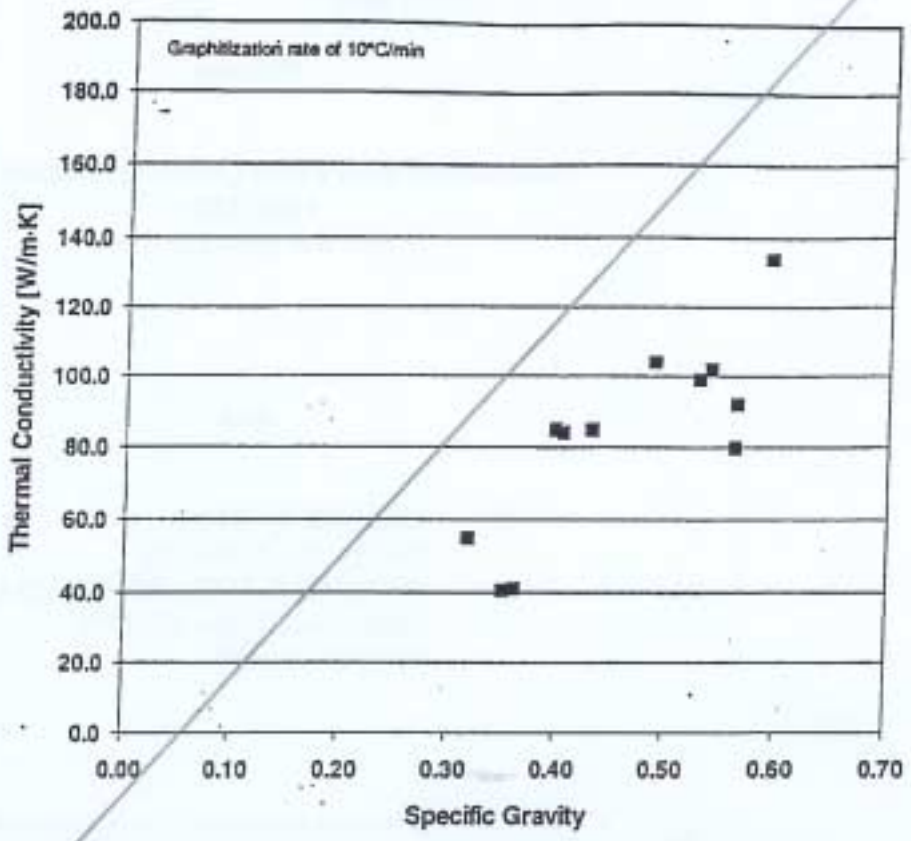


Figure 2. Thermal conductivity as a function of density for Conoco mesophase derived graphite foam graphitized at 10°C/min.

Fig. 26

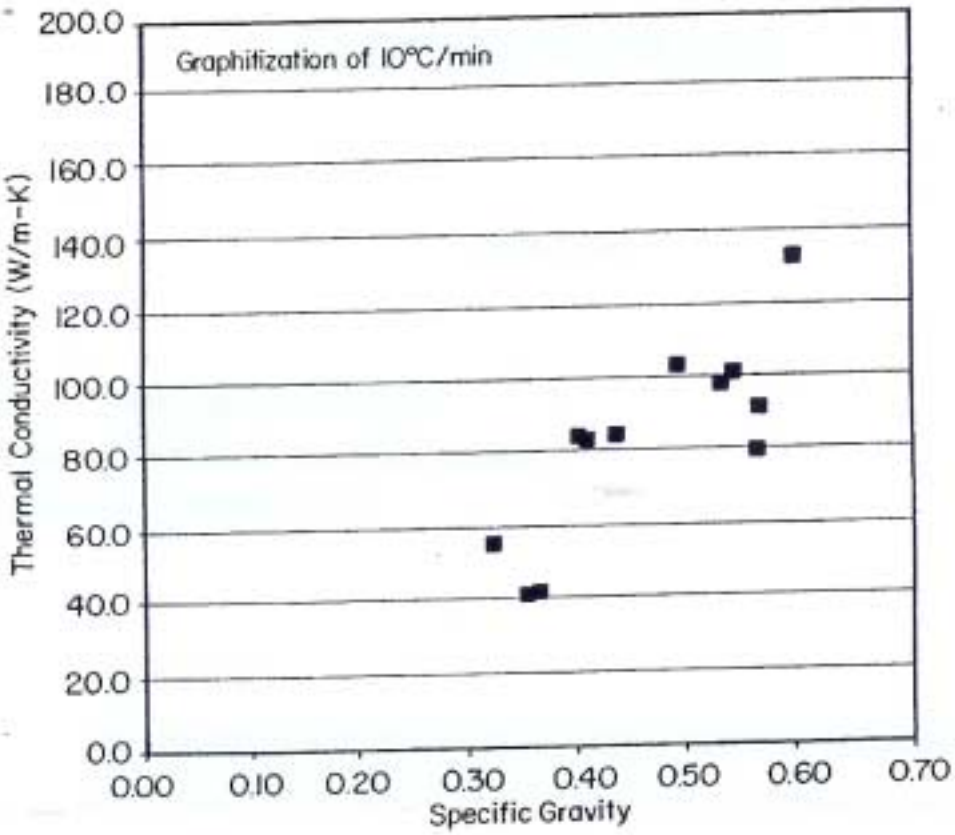

Graphitization of 10°C/min
Thermal Conductivity (W/m-K)
200.0
180.0
160.0
140.0
120.0
100.0
80.0
60.0
40.0
20.0
0.0
0.00
0.10
0.20
0.30
0.40
0.50
0.60
0.70
Specific Gravity

FIG. 26

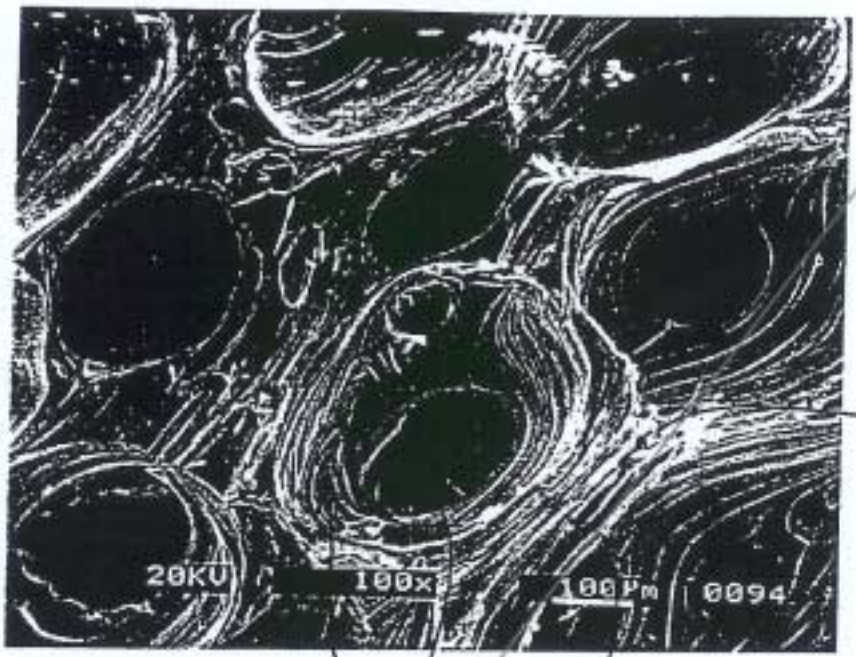


FIGURE 27

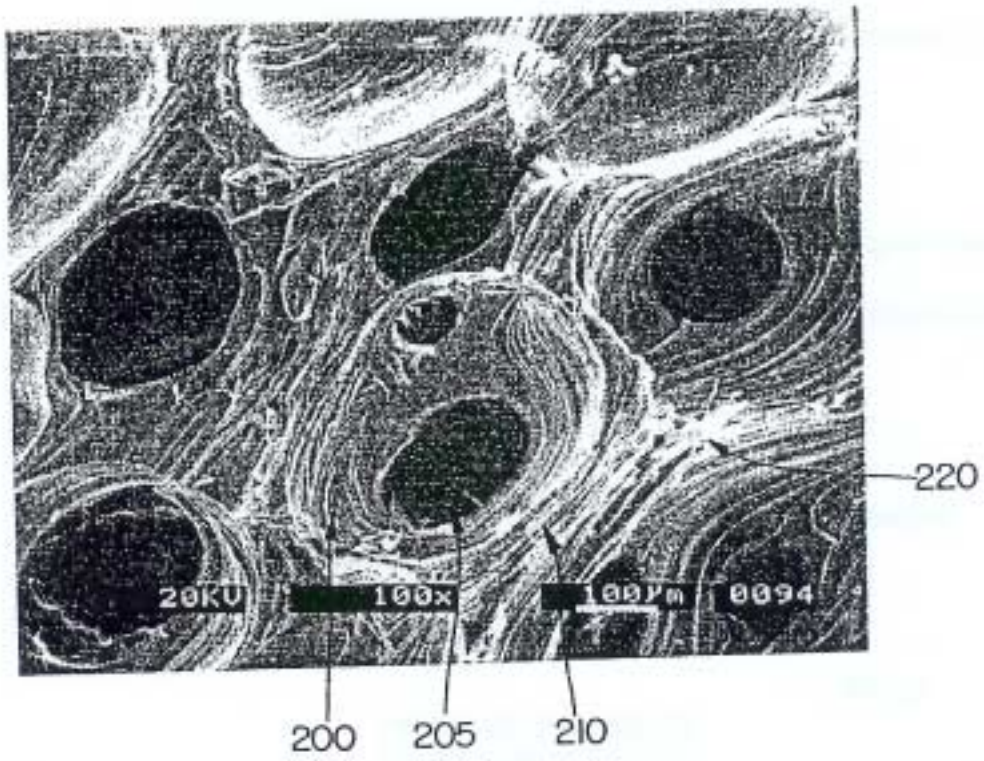


FIG. 27

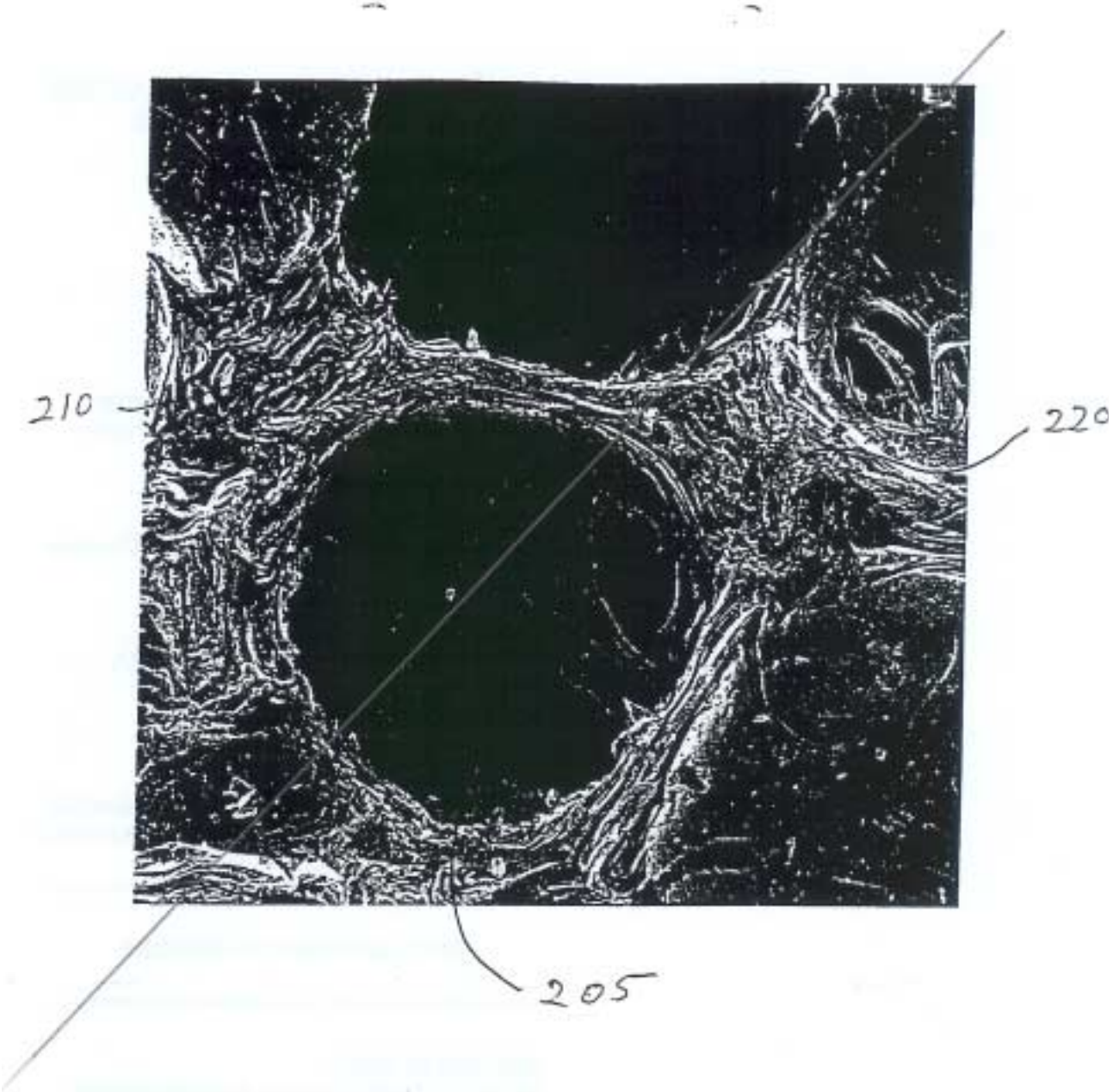


FIGURE 28

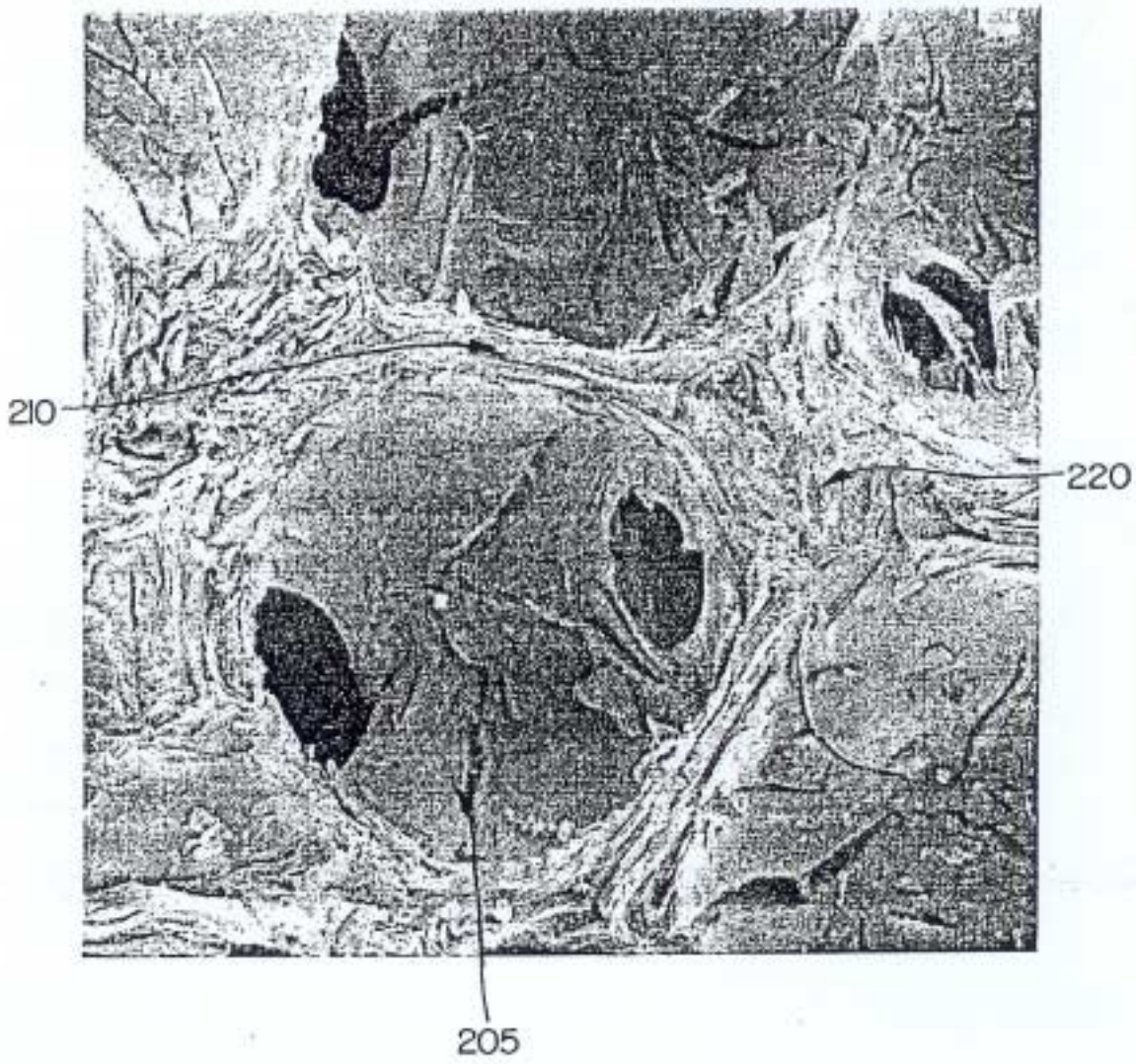


FIG. 28