

EAGLE EPICHER

Electronics Division

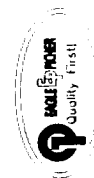
Joplin, MO

ADVANCED SYSTEMS OPERATION

SODIUM-SULFUR GROUP

EPI SODIUM SULFUR PROGRAM

- NaS program initiated in 1986.
- EPI selected by USAF as sole developer for NaS LEO cells.
- Over 200 cells constructed for a variety of applications.
- Developed a β " electrolyte production capability.

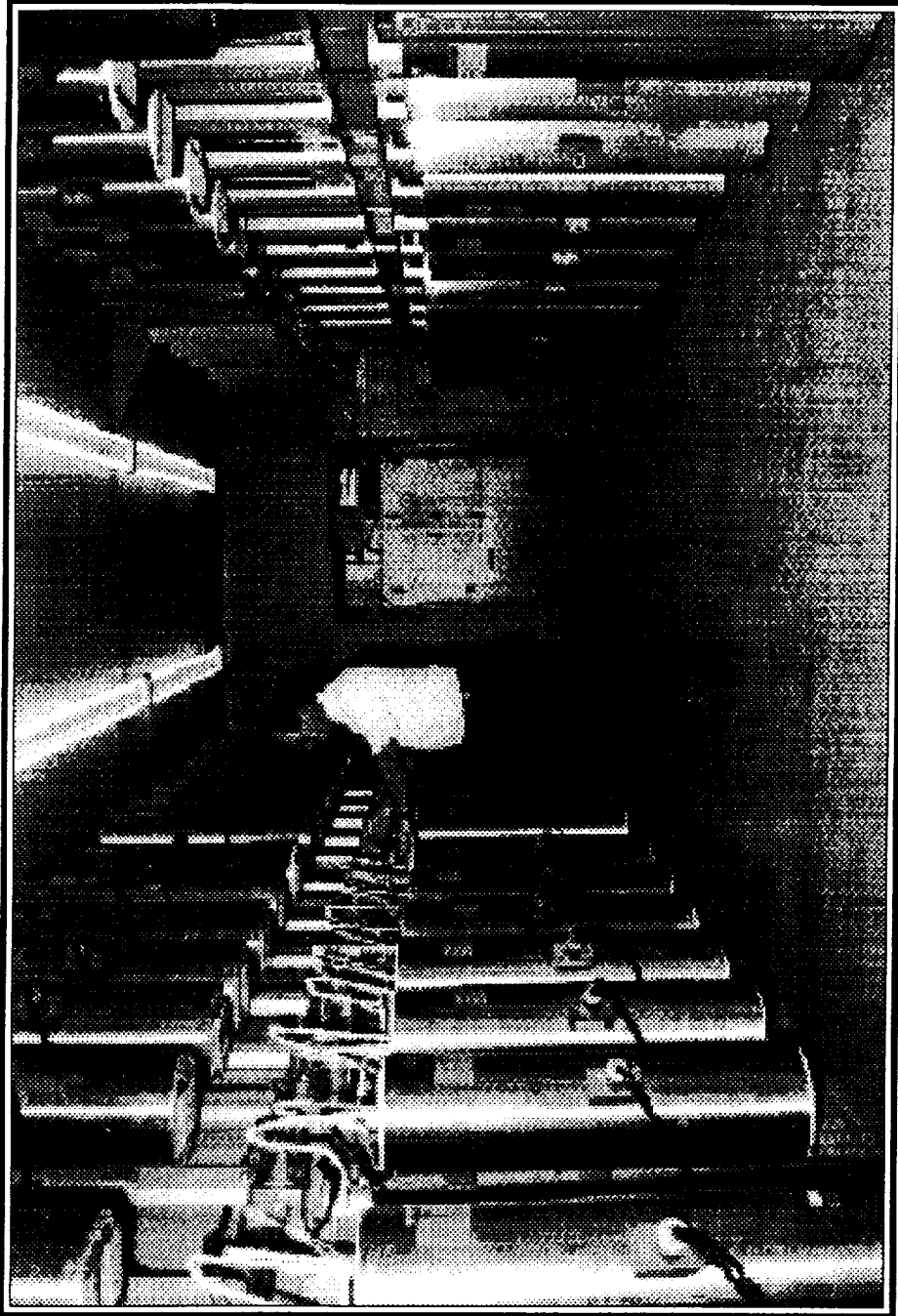


ADVANCED SYSTEMS OPERATION

SODIUM-SULFUR GROUP

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CELL SIZES MANUFACTURED

50 AH

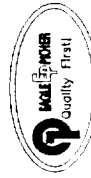
1.4" D X 12.3" L

600 gms (1.31 lbs)

40 AH

1.4" D X 9.0" L

500 gms (1.10 lbs)



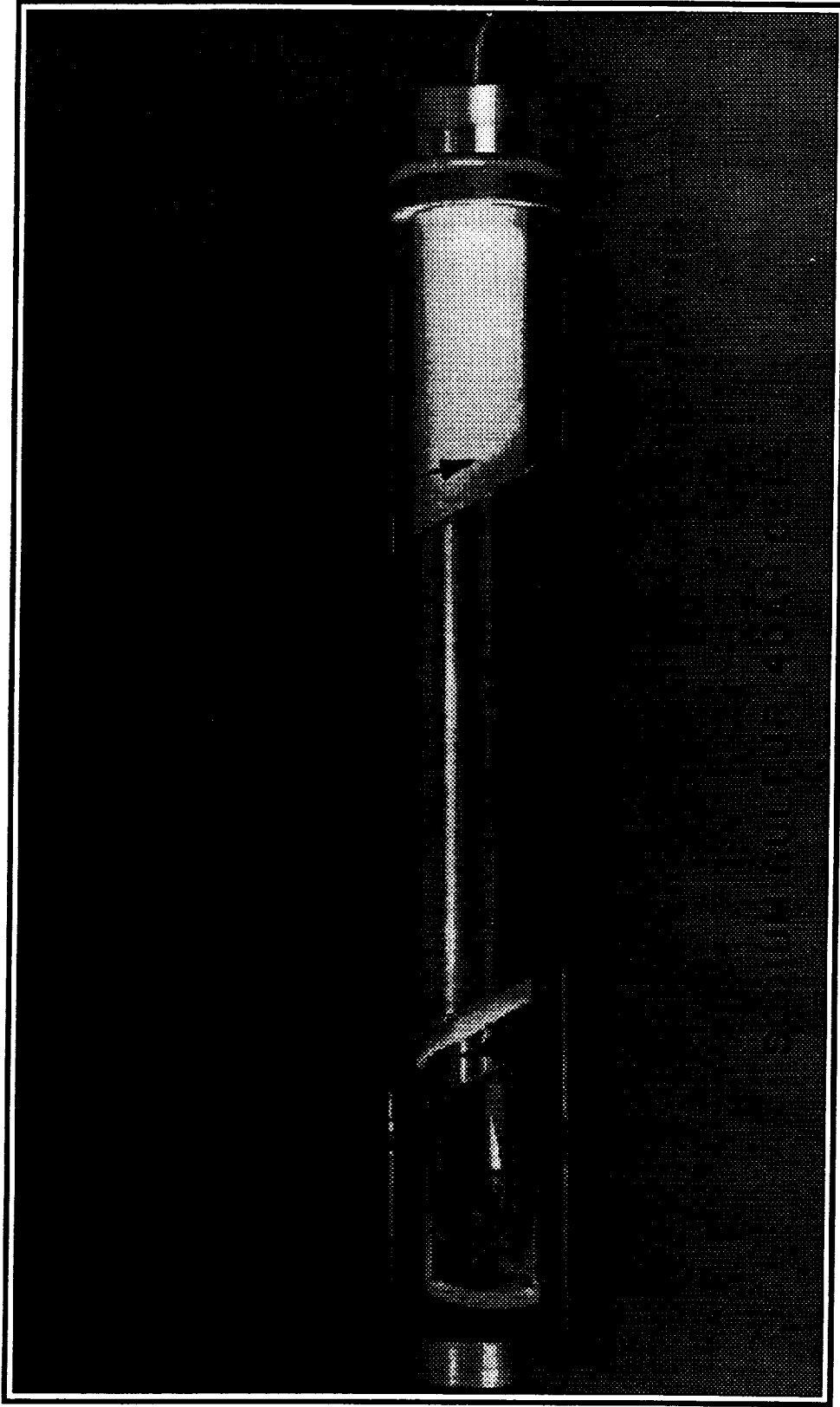
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ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



C-8

AREAS OF IMPROVEMENT

- **Resistance**
- **Cathode Performance**
- **Parts Count**
- **Weight**
- **Seals**



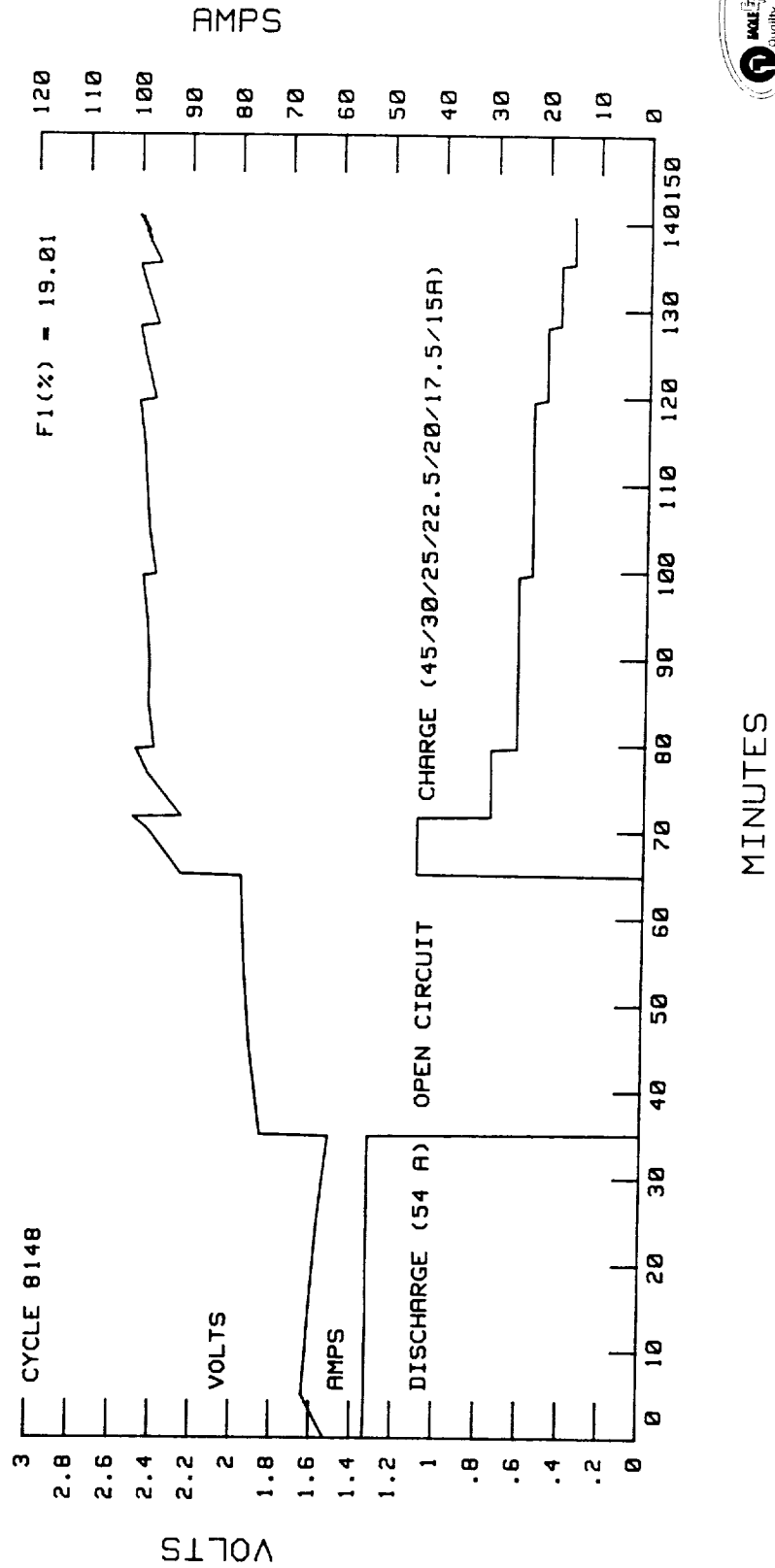
SODIUM-SULFUR GROUP**Performance Improvement Demonstrated
(16 Amp Discharge)**

	Weight (grams)	Avg. Volts (Discharge)	Resistance (mOhms)	Spec. Energy (Whr/Kg)	Energy Dens. (Whr/L)
Baseline	509	1.64	17.6	119.1	266.9
Intermediate	506	1.74	10.6	127.3	283.6
Improved	500	1.89	6.7	139.8	307.8
State-of-the-Art	455	1.95	5.8	158.5	334.0



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IMPROVED CELL PERFORMANCE (LEO 60% DOD)



ADVANCED SYSTEMS OPERATION

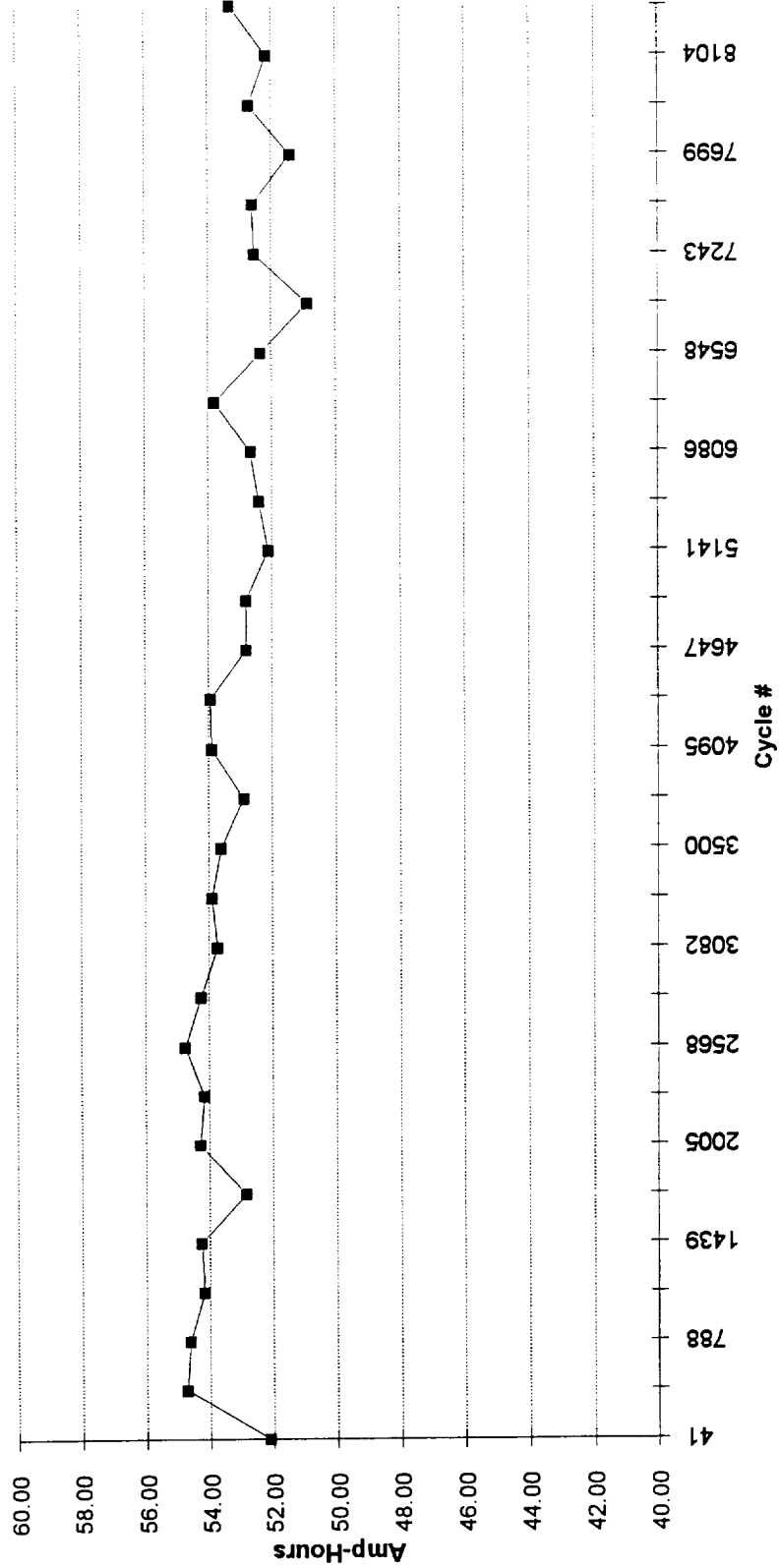
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Capacity - 50Ahr "Improved" Cell



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SINGLE CELL TEST MILESTONES

- Over 11,000 cycles to date
- 43 month calendar life
- 3,130 AHr/cm² in cell testing
- 5,900 AHr/cm² in sodium-sodium testing
- Discharge resistance < 5 milliohms
- F1 of less than 5 (low rate charge)





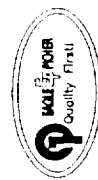
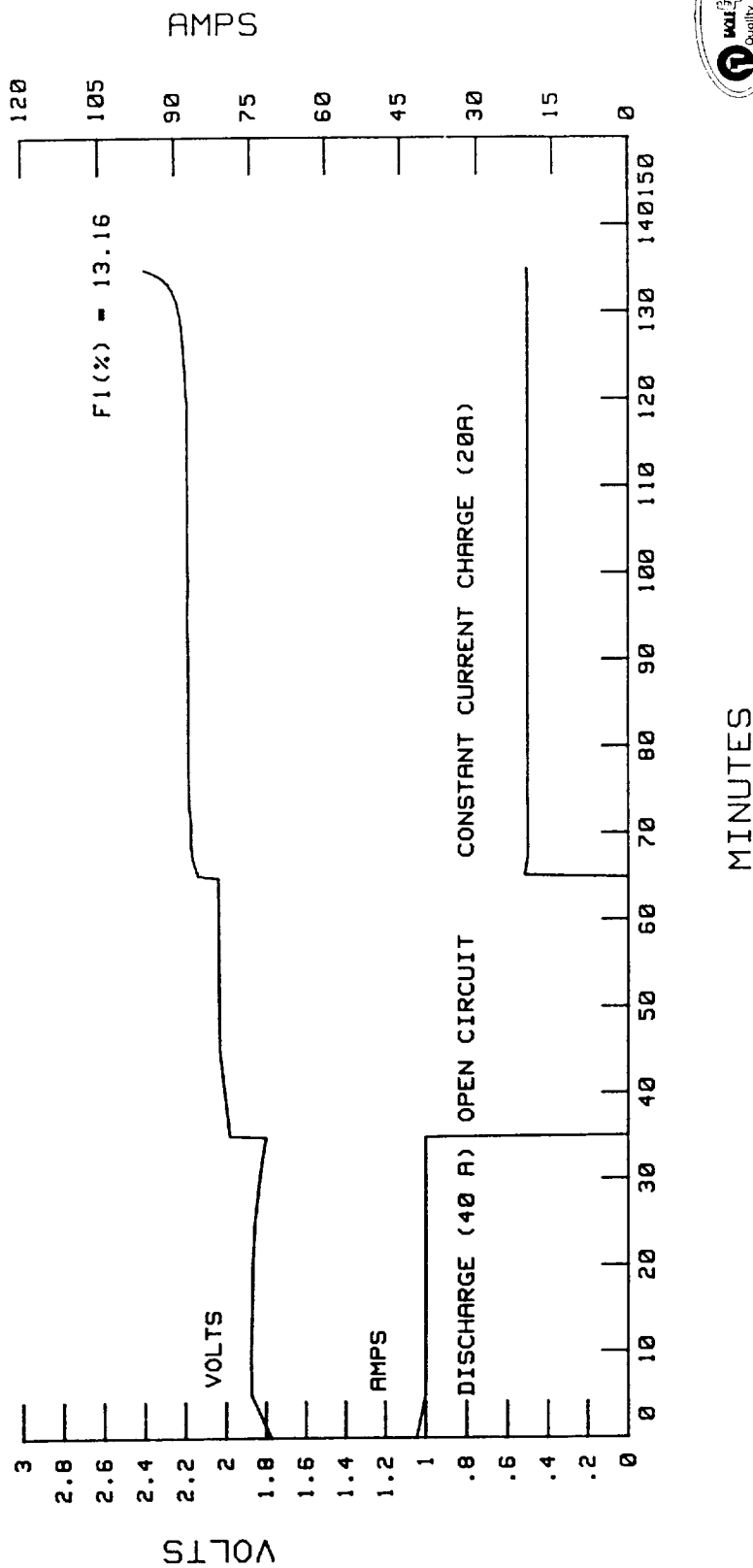
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ADVANCED SYSTEMS OPERATION

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STATE-OF-THE-ART CELL

TYPICAL CELL PERFORMANCE (LEO 60% DOD)

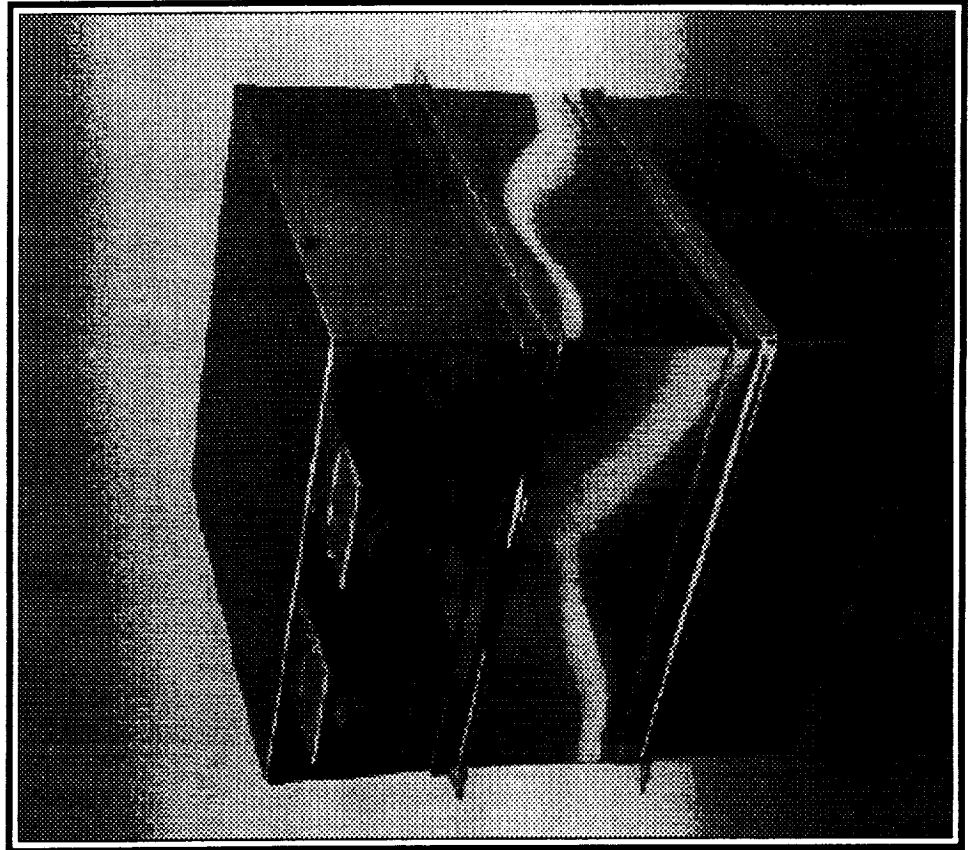


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SODIUM-SULFUR GROUP**NEXT GENERATION BATTERY
PERFORMANCE PROJECTIONS**

- 35 Amp-Hour cells
- 20 cell series string
- Battery OCV: 42 Volts
- Battery working volts: 38 Volts
- Weight: 13.5 Kg
- Volume: 30 L
- Energy Density: 100 Whr/Kg, 45 Whr/L



