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United States Patent [19]

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Moslehi

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[54] **LAMP-HEATED CHUCK FOR UNIFORM WAFER PROCESSING**

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[73] Assignee: **Texas Instruments, Dallas, Tex.**

[21] Appl. No.: **63,110**

[22] Filed: **May 17, 1993**

Related U.S. Application Data

[63] Continuation of Ser. No. 774,677, Oct. 11, 1991, abandoned.

[51] Int. Cl.⁶ **H05B 3/00; H01L 21/027; F27D 11/00**

[52] U.S. Cl. **392/416; 118/724; 118/50.1**

[58] Field of Search **392/416-418; 219/405, 411, 390; 118/724, 725, 728, 730, 50.1; 250/492.1; 427/55, 50, 51, 585, 586, 592, 557, 569**

[56] References Cited

U.S. PATENT DOCUMENTS

3,836,751	9/1974	Anderson	219/405
4,499,354	2/1985	Hill et al.	118/725
4,599,069	7/1986	Murakami et al.	118/725
4,640,224	2/1987	Bunch et al.	118/725
4,682,566	7/1987	Aitken	118/724
4,709,655	12/1987	Van Mastrigt	118/725
4,796,562	1/1989	Brors et al.	118/725
4,891,335	1/1990	McNeilly	219/530
5,073,698	12/1991	Stultz	219/405
5,119,761	6/1992	Nakata	118/725
5,156,461	10/1992	Moslehi et al.	374/121
5,255,286	10/1993	Moslehi et al.	374/121
5,293,216	3/1994	Moslehi	356/371

FOREIGN PATENT DOCUMENTS

60-189924	9/1985	Japan	118/724
60-189927	9/1985	Japan	118/730

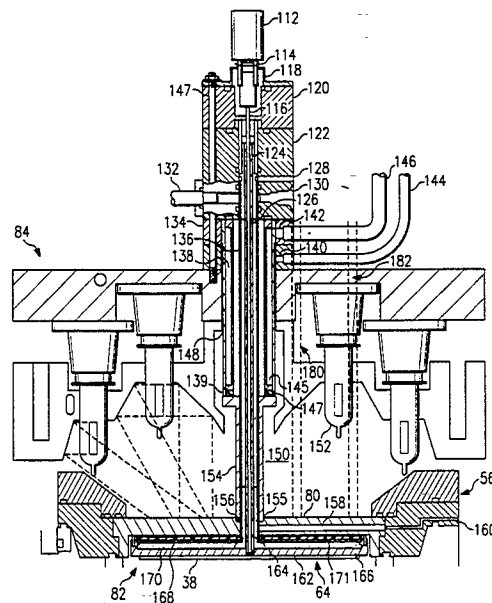
63-58926	3/1988	Japan	.
63-160222	7/1988	Japan	.
64-5014	1/1989	Japan	392/418
3-20464	1/1991	Japan	118/724
3-159224	7/1991	Japan	.
3-256323	11/1991	Japan	.
4-17667	1/1992	Japan	.

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[57] ABSTRACT

A chuck (82) for lamp-heated thermal and plasma semiconductor wafer (38) processing comprises an absorbing surface (171) for absorbing optical energy from an illuminator module (84) that transforms the electrical energy into radiant optical energy. Chuck (82) includes an absorbing surface (171) that absorbs optical energy and distributes the resultant thermal energy. From the absorbing surface, a contact surface (168) conducts the heat energy to semiconductor wafer (38) and uniformly heats the semiconductor wafer (38) with the distributed thermal energy. Chuck (82) not only provides significantly improved process temperature uniformity, but also allows for the generation of RF plasma for plasma-enhanced fabrication processes as well as for in-situ chamber cleaning and etching. Additionally, chuck (82) provides at least two methods of determining semiconductor wafer temperature; a direct reading thermocouple (112) and association with the pyrometry sensor of illuminator module (84). Other features of chuck (82) are that it is thermally decoupled from the thermal mass of fabrication reactor (50) and establishes an environment for purging optical quartz window (80) surface and semiconductor wafer (38) backside in order to prevent deposition on wafer backside and the quartz window.

5 Claims, 8 Drawing Sheets



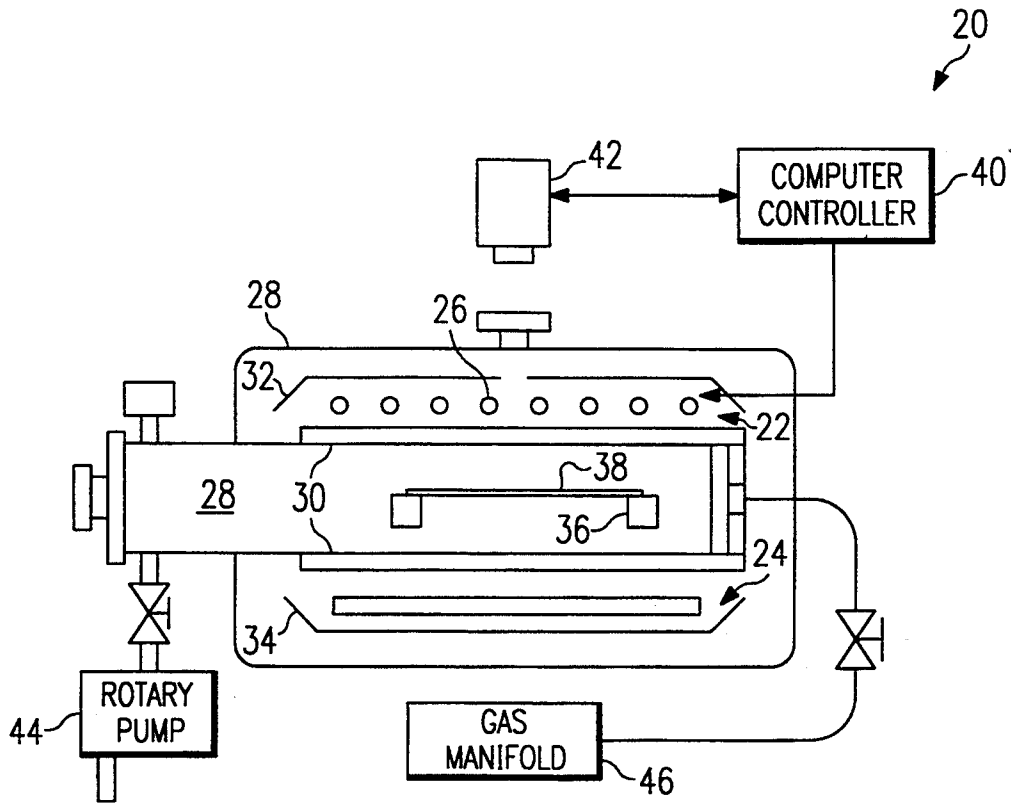


FIG. 1
(PRIOR ART)

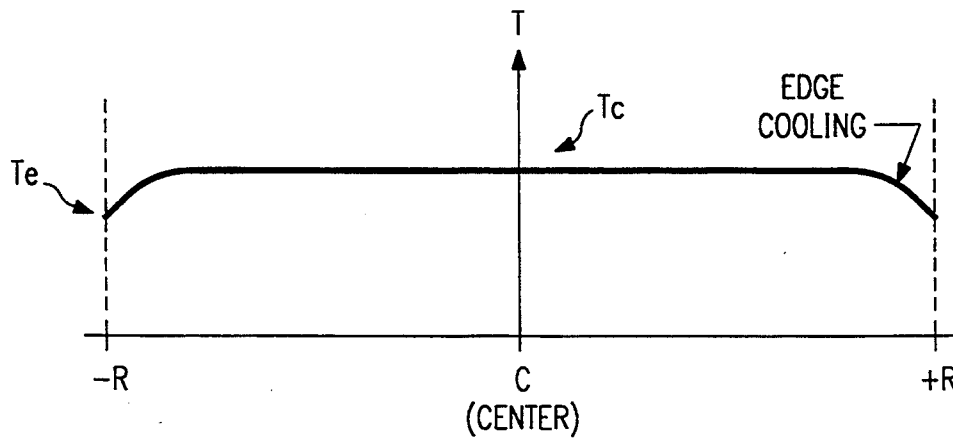


FIG. 2

FIG. 3

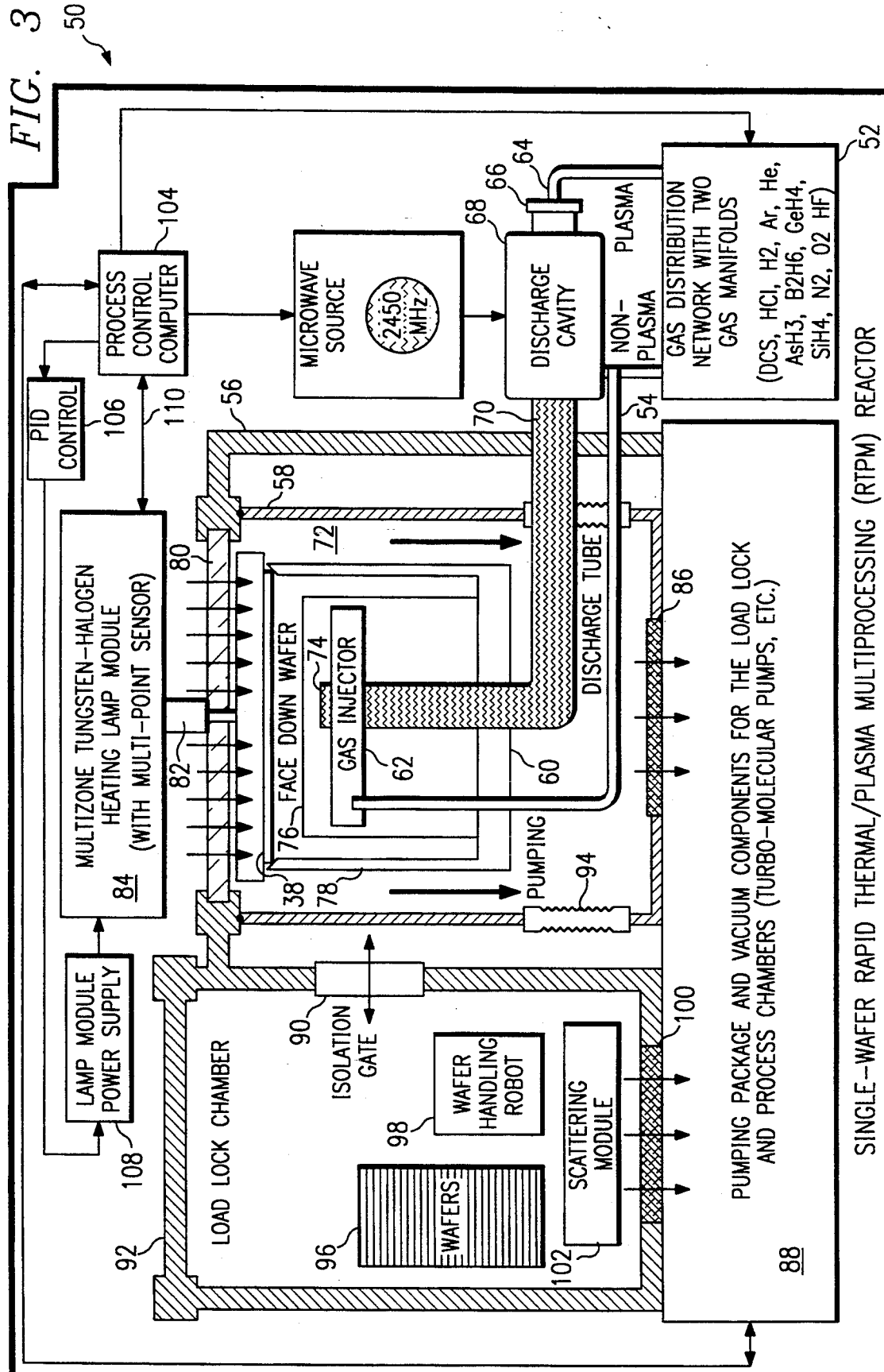


FIG. 3

50

PID CONTROL

106

110

MULTIZONE TUNGSTEN-HALOGEN HEATING LAMP MODULE (WITH MULTI-POINT SENSOR)

84

82

80

LAMP MODULE POWER SUPPLY

108

LOAD LOCK CHAMBER

92

ISOLATION GATE

90

WAFER HANDLING ROBOT

98

WAFERS

96

SCATTERING MODULE

102

FACE DOWN WAFER

76

GAS INJECTOR

74

DISCHARGE TUBE

60

PUMPING

94

NON-PLASMA

PLASMA

DISCHARGE CAVITY

64

MICROWAVE SOURCE

2450 MHz

68

GAS DISTRIBUTION NETWORK WITH TWO GAS MANIFOLDS

(DCS, HCl, H₂, Ar, He, AsH₃, B₂H₆, GeH₄, SiH₄, N₂, O₂, HF)

52

PUMPING PACKAGE AND VACUUM COMPONENTS FOR THE LOAD LOCK AND PROCESS CHAMBERS (TURBO-MOLECULAR PUMPS, ETC.)

88

SINGLE-WAFER RAPID THERMAL/PLASMA MULTIPROCESSOR (RTPM) REACTOR

50

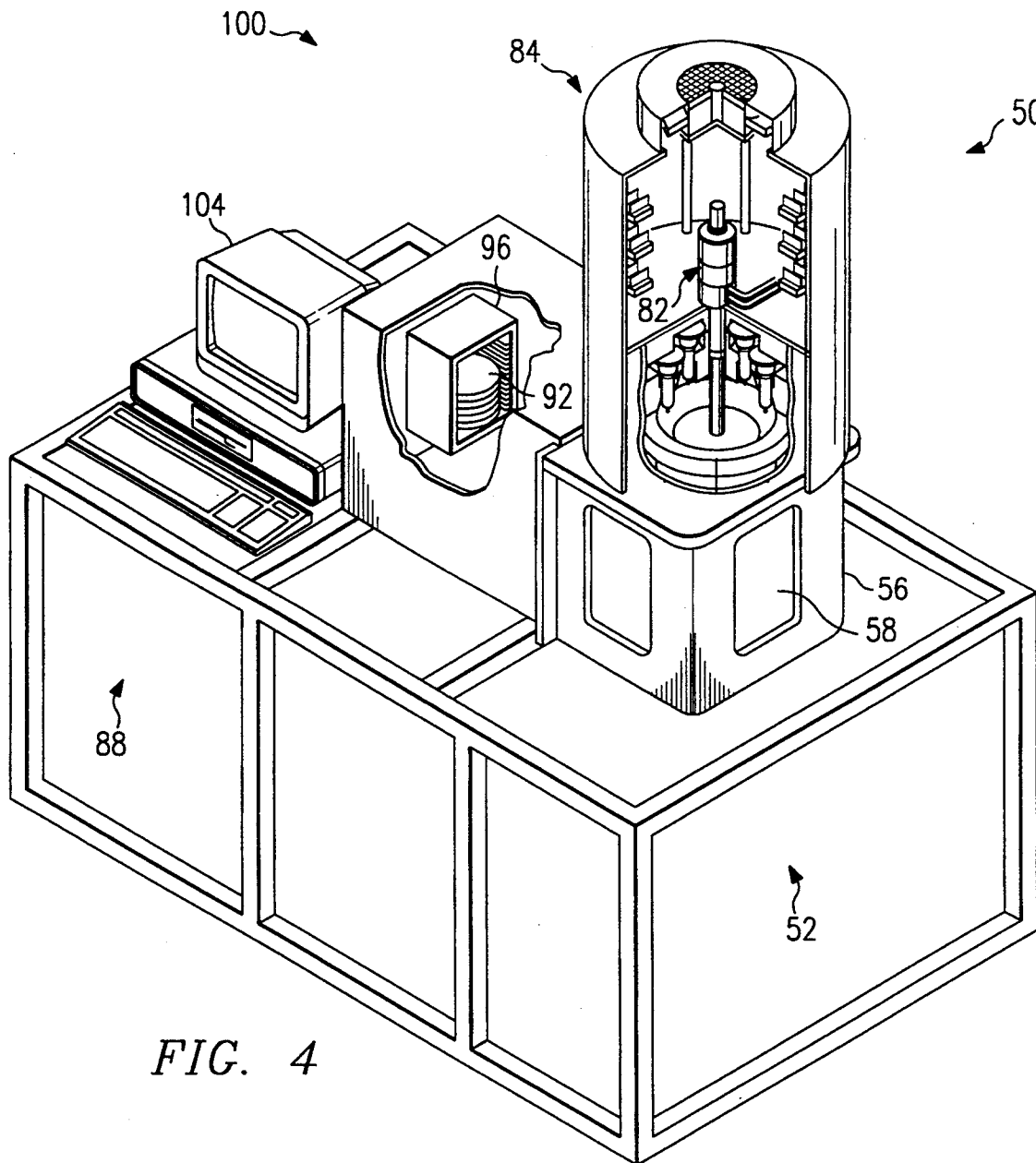


FIG. 4

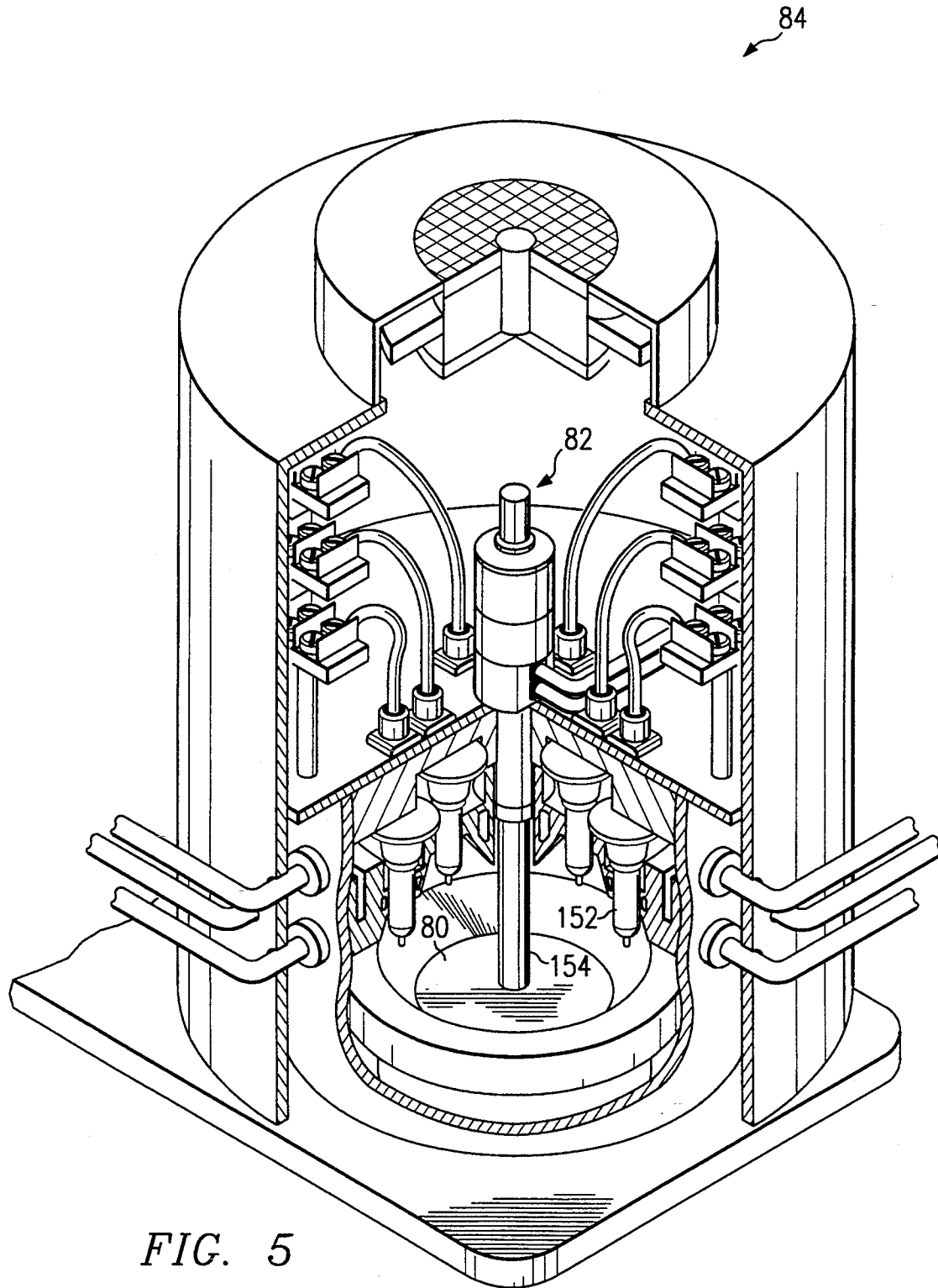


FIG. 5

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