US00D440582S

(12) **United States Design Patent**
Gopalraja et al.

(10) **Patent No.: US D440,582 S**
(45) **Date of Patent: ** Apr. 17, 2001**

(54) **SPUTTERING CHAMBER COIL**

(75) Inventors: **Praburam Gopalraja**, San Jose; **Zheng Xu**, Foster City; **Michael Rosenstein**, Sunnyvale; **John C. Forster**, San Francisco; **Peijun Ding**, San Jose, all of CA (US)

(73) Assignee: **Applied Materials, Inc.**, Santa Clara, CA (US)

(**) Term: **14 Years**

(21) Appl. No.: **29/090,631**

(22) Filed: **Jul. 13, 1998**

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/039,695, filed on Mar. 16, 1998.

(51) **LOC (7) Cl.** **15-09**

(52) **U.S. Cl.** **D15/144.2**

(58) **Field of Search** D15/144.2, 199; 204/298, 192.12, 192.13, 298.03, 298.19, 298.2, 298.01, 298.02, 298.05, 298.37, 298.38; 315/111.21, 111.41, 111.51, 111.81

(56) **References Cited**

U.S. PATENT DOCUMENTS

118,252	8/1871	Lewis .
565,698	8/1896	Sparks .
4,154,011	5/1979	Rakestraw et al.
4,361,472	11/1982	Morrison, Jr. .

(List continued on next page.)

FOREIGN PATENT DOCUMENTS

0520519	12/1992	(EP) .
0653776	10/1994	(EP) .
0727923	2/1996	(EP) .
0758148	8/1996	(EP) .

(List continued on next page.)

OTHER PUBLICATIONS

U.S. application No. 08/559,345 filed Nov. 15, 1995.

U.S. application No. 08/730,722 filed Oct. 8, 1996.

U.S. application No. 09/049,276 filed Mar. 27, 1998.

Search report in PCT/US98/10058 issued Nov. 4, 1998.

Applied Materials, Inc., Exhibit A, Dated prior to Jul. 13, 1998, the filing date of the present application.(Exhibit A is a drawing of a prior art coil design which is prior to the design of the present application).

S.M. Rossnagel et al., "Magnetron Sputter Deposition with High Levels of Metal Ionization," *Appl. Phys. Lett.*, vol. 63, pp. 3285–3287, 1993.

J. Hopwood et al., "Mechanisms for Highly Ionized Magnetron Sputtering," *J. Appl. Phys.*, vol. 78, pp. 758–765, 1995.

S.M. Rossnagel, "Directional and Ionized Sputter Deposition for Microelectronics Applications," *Proc. of 3rd ISSP* (Tokyo), pp. 253–260, 1995.

N. Jiwari et al., "Helicon wave plasma reactor employing single–loop antenna," *J. of Vac. Sci. Technol.*, A 12(4), pp. 1322–1327, Jul./Aug. 1994.

(List continued on next page.)

Primary Examiner—Antoine Duval Davis

(74) *Attorney, Agent, or Firm*—Konrad Raynes & Victor

(57) **CLAIM**

The ornamental design for sputtering chamber coil, as shown and described.

DESCRIPTION

FIG. **1** is a front elevational view;

FIG. **2** is a top view;

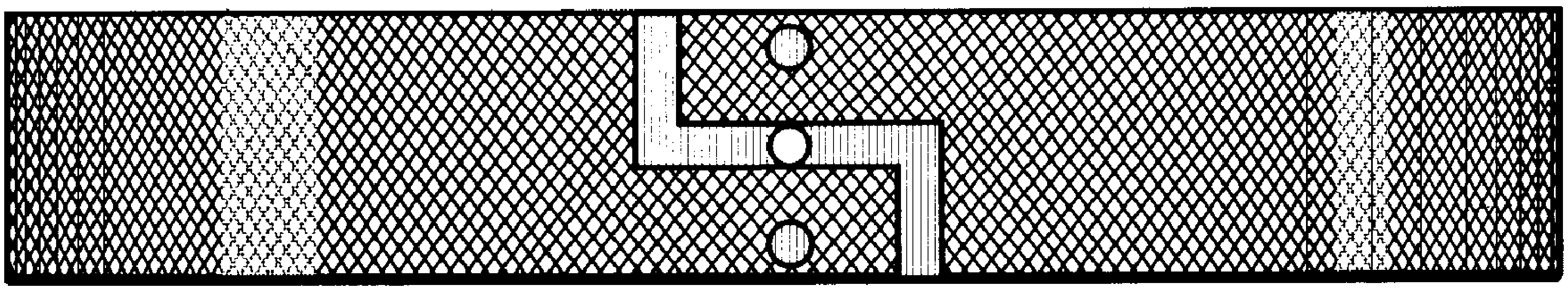
FIG. **3** is a right side elevational view;

FIG. **4** is a bottom view; and,

FIG. **5** is a rear elevational view of our sputtering chamber coil.

The left side elevation view (not shown) is the same as the right side elevational view (FIG. **3**) because of coil symmetry.

1 Claim, 2 Drawing Sheets



U.S. PATENT DOCUMENTS

4,478,437	10/1984	Skinner .
4,948,458	8/1990	Ogle .
4,990,229	2/1991	Campbell et al. .
4,999,096	3/1991	Nihei et al. .
5,001,816	3/1991	Oetiker .
5,122,251	6/1992	Campbell et al. .
5,146,137	9/1992	Gesche et al. .
5,150,503	9/1992	Müller .
5,178,739	1/1993	Barnes et al. .
5,231,334	7/1993	Paranjpe .
5,234,560	8/1993	Kadlec et al. .
5,241,245	8/1993	Barnes et al. .
5,280,154	1/1994	Cuomo et al. .
5,304,279	4/1994	Coultas et al. .
5,346,578	9/1994	Benzing et al. .
5,397,962	3/1995	Moslehi .
5,401,350	3/1995	Patrick et al. .
5,404,079	4/1995	Ohkuni et al. .
5,418,431	5/1995	Williamson et al. .
5,429,070	7/1995	Campbell et al. .
5,429,995	7/1995	Nishiyama et al. .
5,430,355	7/1995	Paranjpe .
5,556,501	9/1996	Collins et al. .
5,637,961	6/1997	Ishii et al. .
5,669,975	9/1997	Ashtiani .
5,681,393	10/1997	Takagi .
5,683,537	11/1997	Ishii .
5,707,498	1/1998	Ngan .
5,721,021	2/1998	Tobe et al. .
5,770,098	6/1998	Araki et al. .
5,783,492	7/1998	Higuchi et al. .

FOREIGN PATENT DOCUMENTS

0807954	11/1997	(EP) .
0813227	12/1997	(EP) .
0836218	4/1998	(EP) .
0836219	4/1998	(EP) .
0840351	5/1998	(EP) .
0727807	9/1999	(EP) .
2231197	11/1990	(GB) .
59-190363	10/1984	(JP) .
61-190070	8/1986	(JP) .
6-232055	8/1994	(JP) .
6-283470	10/1994	(JP) .
7-176398	7/1995	(JP) .
7-176399	7/1995	(JP) .
8-153712	6/1996	(JP) .
8-288259	11/1996	(JP) .
8606923	11/1986	(WO) .

OTHER PUBLICATIONS

U.S. application No. 08/856,335, filed May 14, 1997.
U.S. application No. 08/857,719, filed May 16, 1997.
U.S. application No. 08/857,944, filed May 16, 1997.
U.S. application No. 09/039,695, filed Mar. 16, 1998.
U.S. application No. 09/064,355, filed Apr. 22, 1998.
U.S. application No. 09/113,577, filed Jul. 10, 1998.
U.S. application No. 29/090,618, filed Jul. 13, 1998.
U.S. application No. 29/109,892.
U.S. application No. 29/109,870.
U.S. application No. 29/109,893.

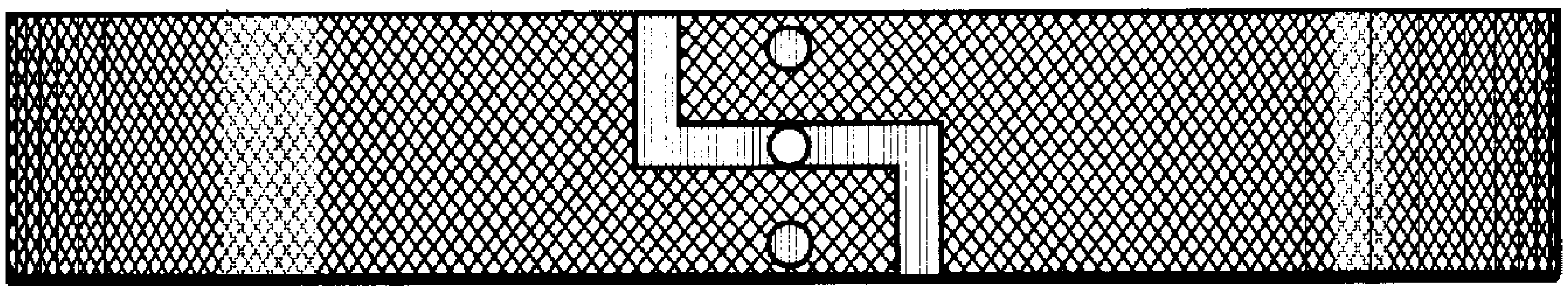


Fig. 1

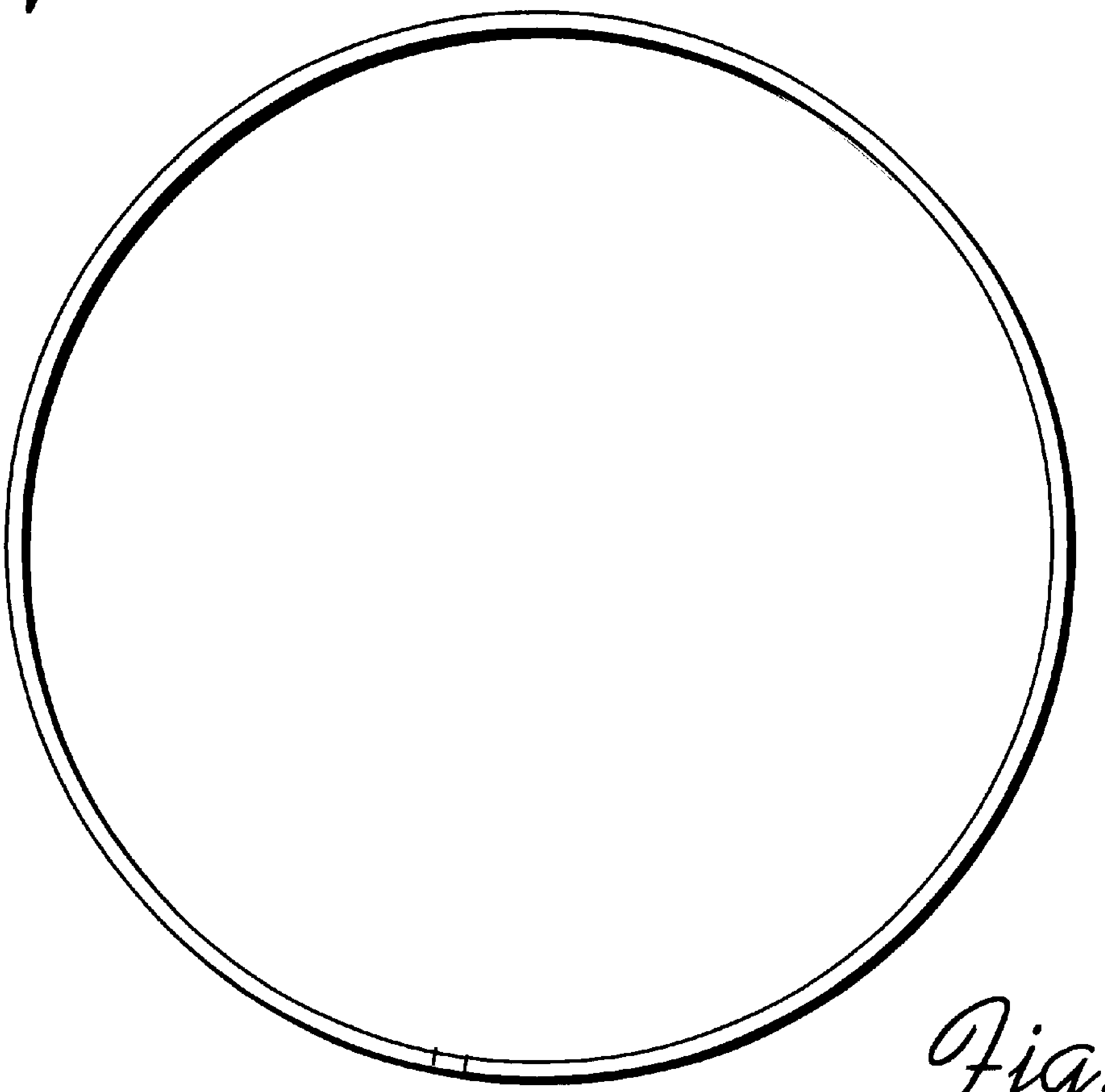


Fig. 2

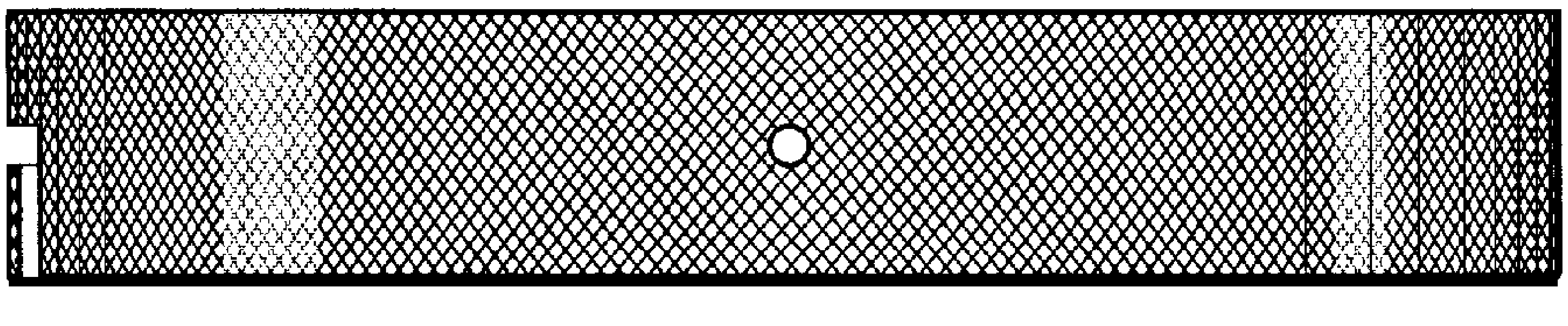


Fig. 3

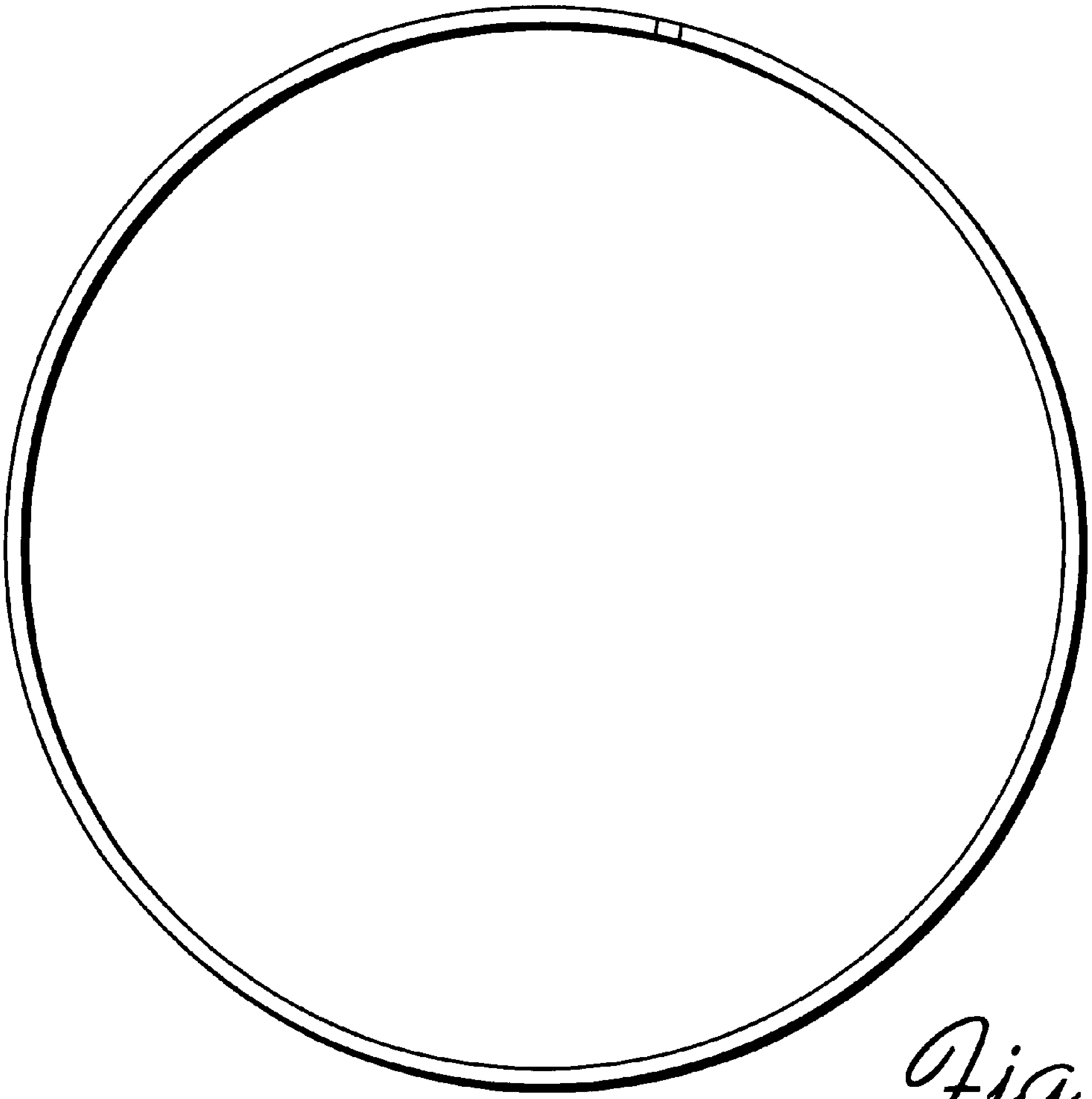


Fig. 4

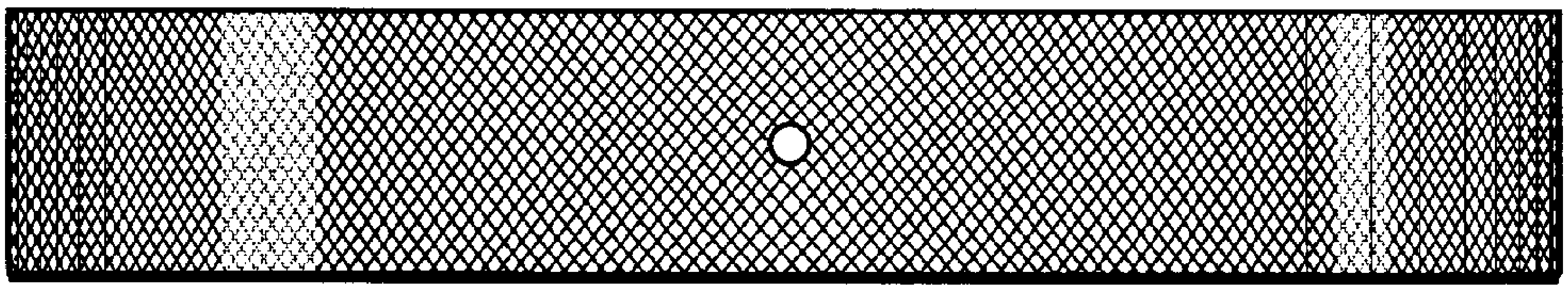


Fig. 5