



US006139575A

United States Patent [19]

Shu et al.

[11] Patent Number: **6,139,575**

[45] Date of Patent: **Oct. 31, 2000**

[54] **HYBRID MECHANICAL HEART VALVE PROSTHESIS**

5,562,729 10/1996 Purdy et al. 623/2
5,569,463 10/1996 Helmus et al. 424/426

[75] Inventors: **Mark C. S. Shu**, Mission Viego; **Hong S. Shim**, Santa Ana; **Jeffrey M. Gross**, Rancho Santa Margarita, all of Calif.

FOREIGN PATENT DOCUMENTS

WO 99/04731 2/1999 WIPO A61F 2/24

[73] Assignee: **Medtronic, Inc.**, Minneapolis, Minn.

OTHER PUBLICATIONS

The Return of Elastomer Valves (The Society of Thoracic Surgeons 1989;48:S98-9) William J. Kolff et al.

[21] Appl. No.: **09/286,095**

Primary Examiner—David J Isabella
Attorney, Agent, or Firm—Harold R. Patton

[22] Filed: **Apr. 2, 1999**

[51] Int. Cl.⁷ **A61F 2/06**

[52] U.S. Cl. **623/2.12; 623/2.2**

[58] Field of Search 623/2.1, 2.12, 623/2.13, 2.14, 2.15, 2.16, 2.17, 2.19, 2.2

[57] ABSTRACT

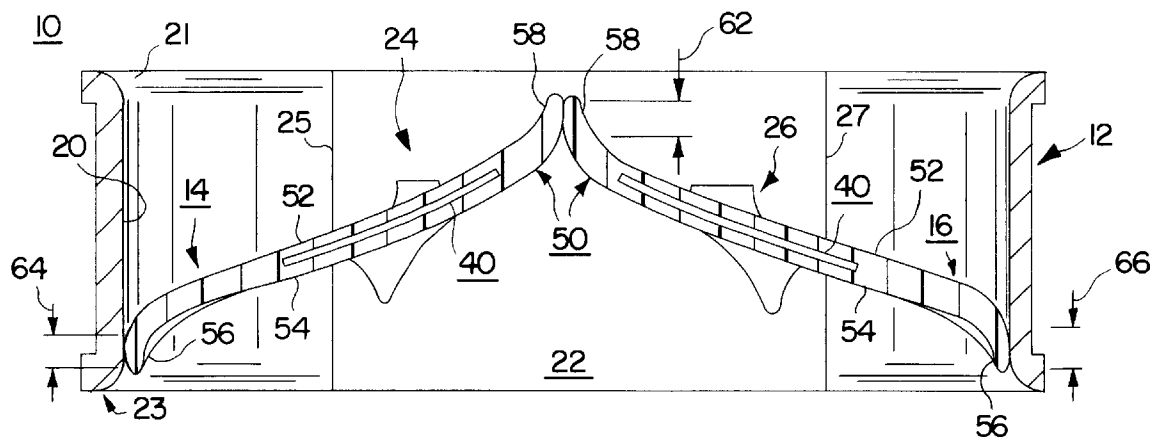
A prosthetic mechanical heart valve, and in particular, a bi-leaflet and/or a trileaflet mechanical valve formed with rigid frame and hinge elements for providing a stable reliable hinge mechanism with flexible leaflets formed of a thin elastomeric material adhering to and extending from the valve frame to form leaflet occluding sections bounded by outer peripheral edges for softening the opening and closing action of the valve leaflets. In one embodiment, the valve leaflet is formed of a rigid pyrolytic carbon frame supporting hinge elements and defining a leaflet pivot axis and a flexible leaflet body attached to the frame and defining a leaflet abutting section extending from one side of the valve frame and an occluding section extending from the other side of the valve frame to an arcuate leaflet seat. In the closing phase of operation, the abutting sections of the leaflet bodies contact one another in an abutting contact band, and the arcuate leaflet seats bear against arcuate seat regions of the valve body. The seat regions of the valve body may also be coated with an elastomeric material.

[56] References Cited

U.S. PATENT DOCUMENTS

3,396,409	8/1968	Melrose .	
3,722,004	3/1973	Cromie .	
3,911,502	10/1975	Boretos	3/1.5
4,204,283	5/1980	Bellhouse et al.	623/2.2
4,222,126	9/1980	Boretos	3/1.5
4,276,658	7/1981	Hanson et al.	3/13.5
4,364,127	12/1982	Pierce et al.	3/1.5
4,473,423	9/1984	Kolff	156/245
4,510,628	4/1985	Kolff	3/1.5
4,556,996	12/1985	Wallace	623/2
4,643,732	2/1987	Pietsch et al.	623/2.2
4,731,075	3/1988	Gallo et al.	623/2
5,133,845	7/1992	Vallana	204/192.5
5,178,632	1/1993	Hanson	632/2
5,370,684	12/1994	Vallana et al.	623/1
5,447,724	9/1995	Helmus et al.	424/426
5,500,016	3/1996	Fisher	623/2

23 Claims, 11 Drawing Sheets



NORRED EXHIBIT 2114 - Page 1
Medtronic, Inc., Medtronic Vascular, Inc.,
& Medtronic Corevalve, LLC
v. Troy R. Norred, M.D.

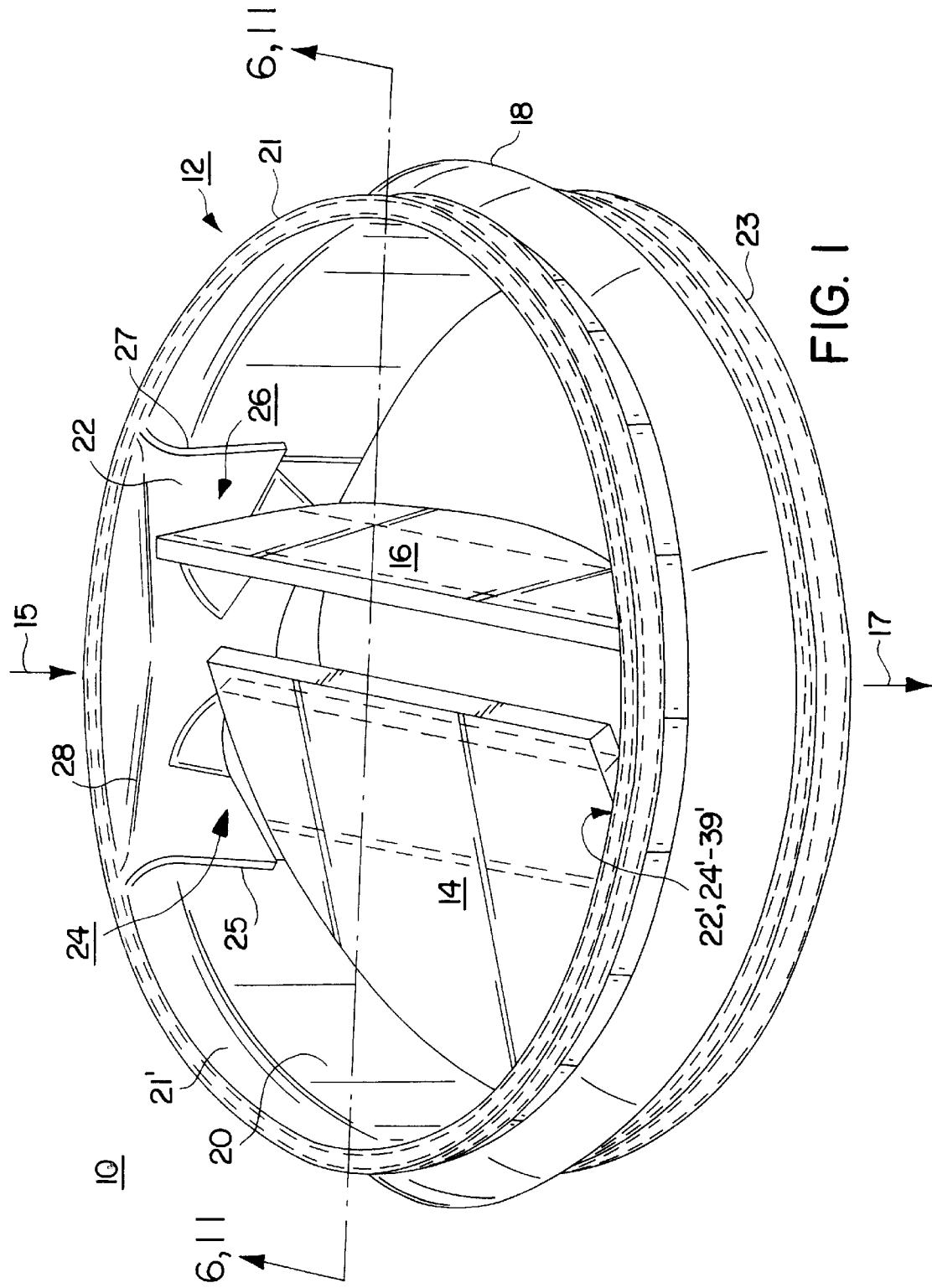


FIG. 1

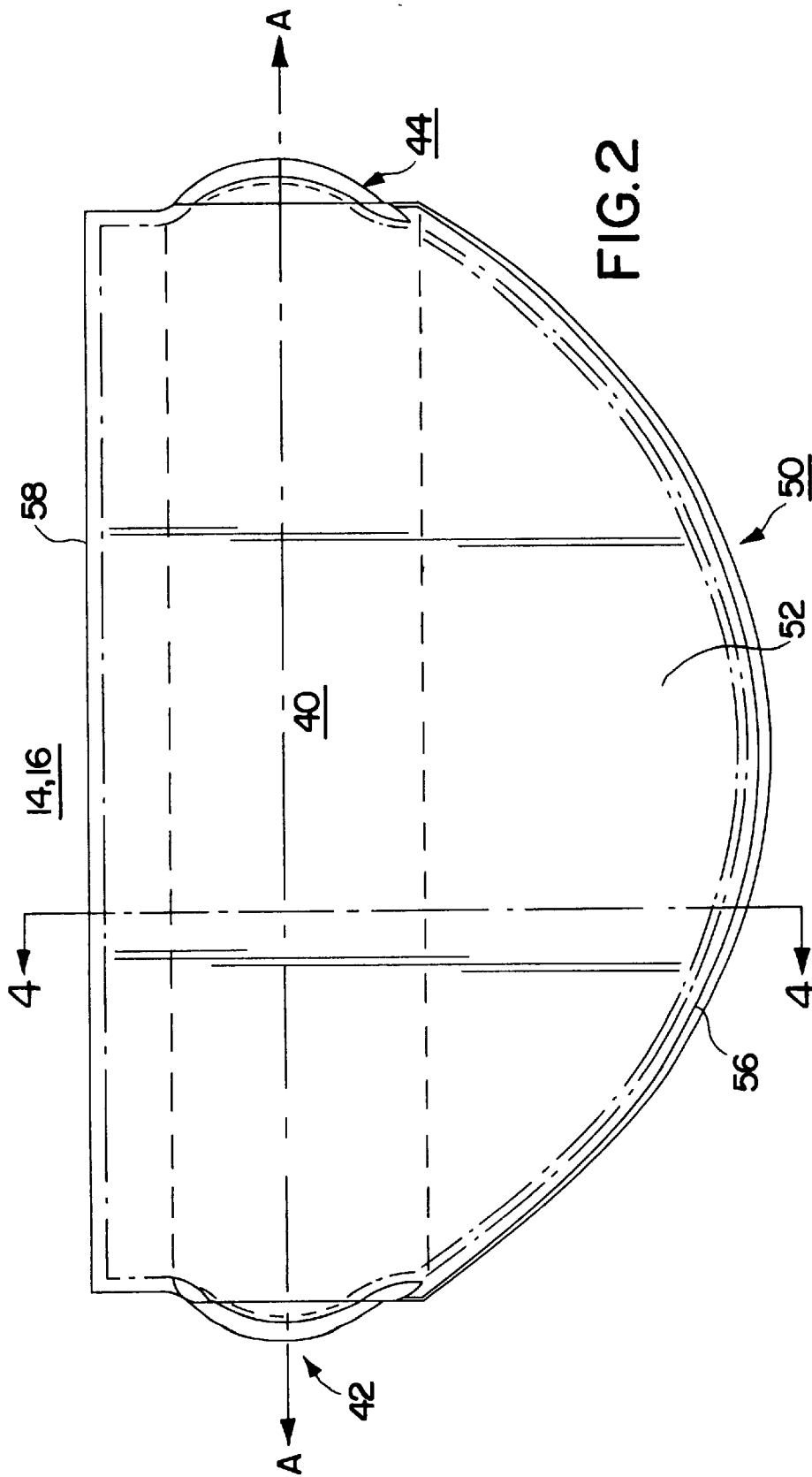
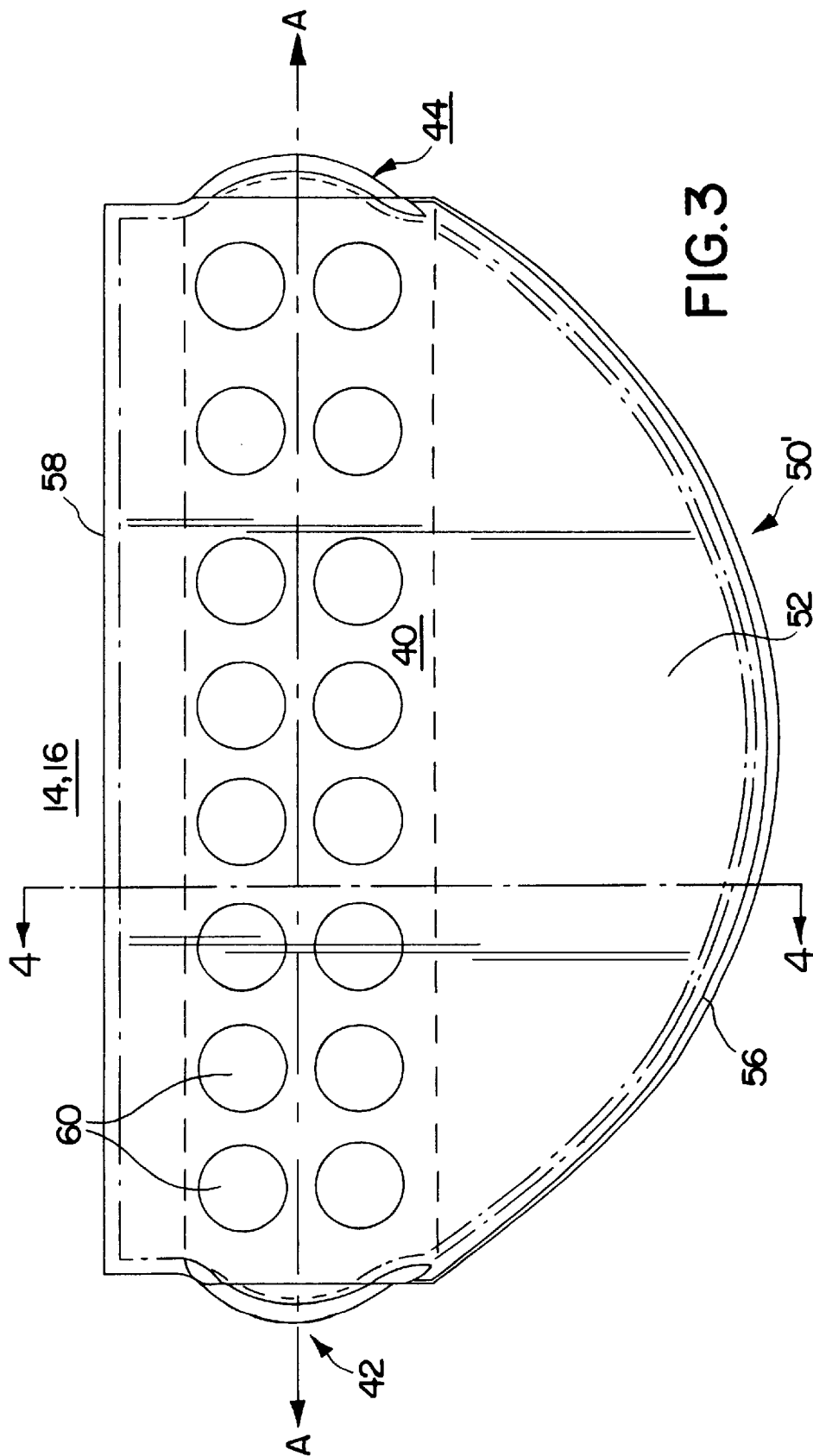
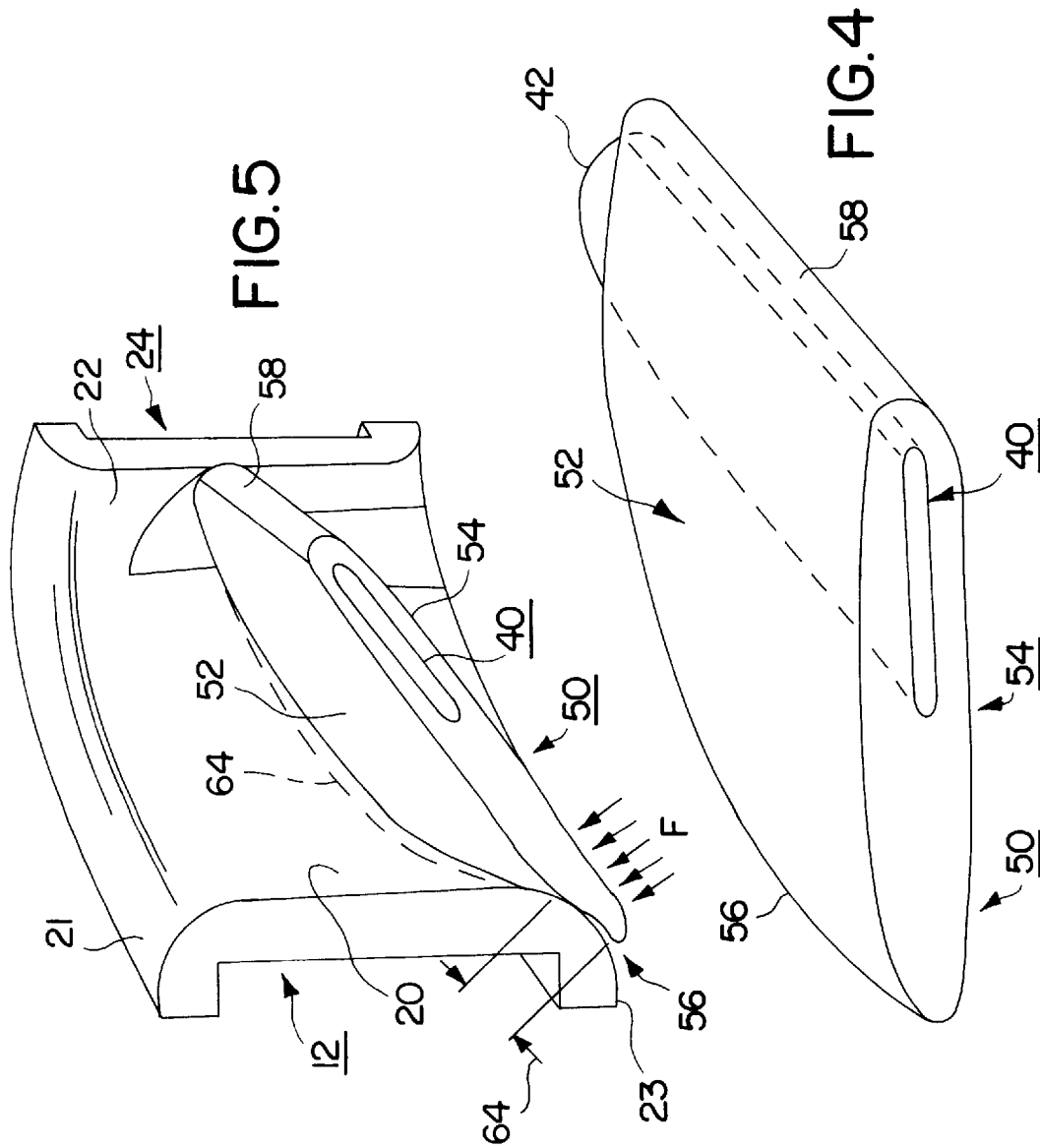


FIG. 2





Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.