

(10) **Patent No.:** US 6,622,821 B2
(45) **Date of Patent:** Sep. 23, 2003

- | | | | | | |
|-----------|----|---|---------|-------------------------|---------|
| 1,697,839 | A | * | 1/1929 | Goerlich | 181/269 |
| 4,114,715 | A | | 9/1978 | Theron | |
| 4,125,171 | A | | 11/1978 | Morris | |
| 5,152,366 | A | | 10/1992 | Reitz | |
| 5,269,650 | A | | 12/1993 | Benson | |
| 5,304,749 | A | | 4/1994 | Crandell | |
| 5,824,972 | A | * | 10/1998 | Butler | 181/279 |
| 5,868,172 | A | | 2/1999 | Graves | |
| 5,992,470 | A | | 11/1999 | Redman | |
| 6,009,914 | A | | 1/2000 | Castano | |
| 6,283,162 | B1 | | 9/2001 | Butler | |
| 6,308,799 | B1 | * | 10/2001 | Konstantakopoulos | 181/282 |

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

FR	667215	10/1929
----	--------	---------

* cited by examiner

Assistant Examiner—Renata McCloud

(74) *Attorney, Agent, or Firm*—Mallinckrodt & Mallinckrodt; Robert R. Mallinckrodt

(21) Appl. No.: 09/943,819

(22) Filed: **Aug. 31, 2001**

(65) **Prior Publication Data**

US 2003/0042071 A1 Mar. 6, 2003

(51) **Int. Cl.⁷** **F01N 1/08**

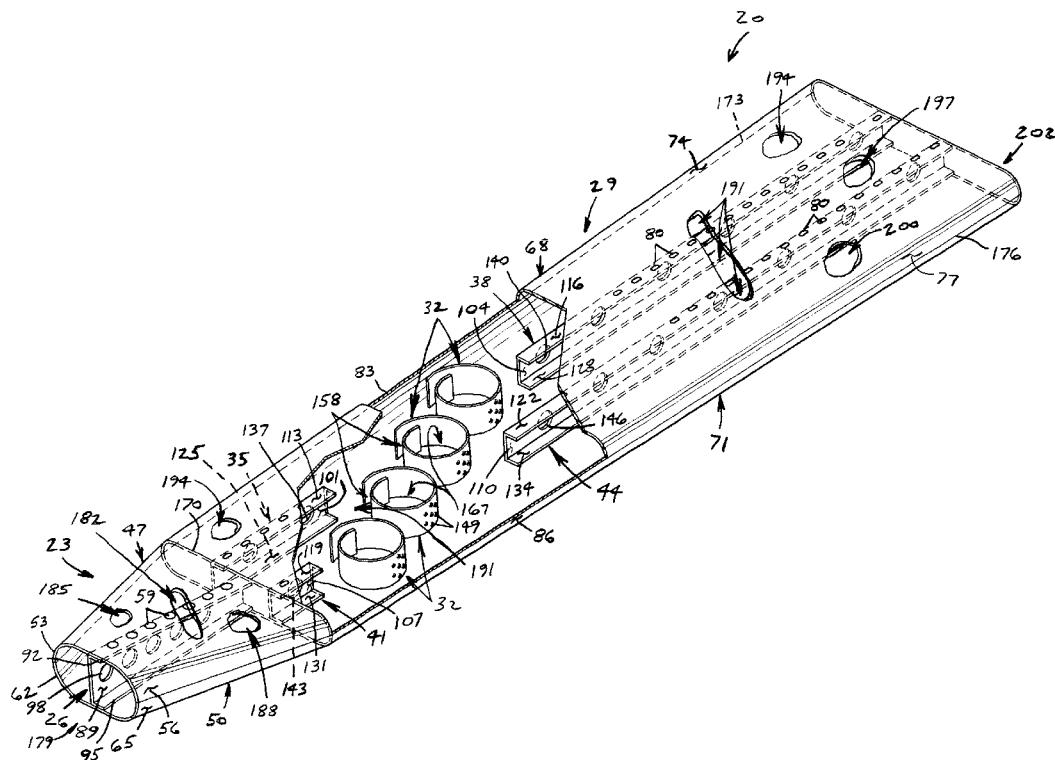
(52) **U.S. Cl.** 181/270; 181/268; 181/269;
181/270; 181/271; 181/272; 138/109; 138/177;
138/128

(58) **Field of Search** 181/270, 272,
181/271, 269, 268; 138/177, 178, 109

(56) **References Cited**

U.S. PATENT DOCUMENTS

981,584	A	1/1911	Miller
1,002,801	A	9/1911	Boeck



45 Claims, 7 Drawing Sheets