



US00D924119S

(12) **United States Design Patent** (10) **Patent No.:** **US D924,119 S**  
**Roman et al.** (45) **Date of Patent:** **\*\* Jul. 6, 2021**

(54) **SPLIT WINGLET**

CPC ..... B64C 2201/146; B64C 2201/027; B64C 2201/104; B64C 25/06; B64C 25/24; B64C 39/04; B64C 5/02; B64C 23/065  
See application file for complete search history.

(71) Applicant: **The Boeing Company**, Chicago, IL (US)

(72) Inventors: **Dino L. Roman**, Lake Forest, CA (US); **John C. Vassberg**, Long Beach, CA (US); **Douglas M. Friedman**, Irvine, CA (US); **Adam P. Malachowski**, Lynnwood, WA (US); **Christopher A. Vegter**, Kirkland, WA (US)

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,466,551 A 7/1923 Thurston  
1,841,921 A 1/1932 Spiegel  
(Continued)

(73) Assignee: **The Boeing Company**, Chicago, IL (US)

FOREIGN PATENT DOCUMENTS

(\*\*) Term: **15 Years**

DE 634884 9/1936  
DE 2149956 4/1973  
(Continued)

(21) Appl. No.: **29/617,368**

OTHER PUBLICATIONS

(22) Filed: **Sep. 13, 2017**

Boeing 737 MAX—Wikipedia. cited as publically announced Aug. 30, 2011. found online [Apr. 3, 2020] [https://en.wikipedia.org/wiki/Boeing\\_737\\_MAX](https://en.wikipedia.org/wiki/Boeing_737_MAX).\*

**Related U.S. Application Data**

(Continued)

(63) Continuation of application No. 15/477,940, filed on Apr. 3, 2017, now abandoned, which is a continuation of application No. 15/259,509, filed on Sep. 8, 2016, now Pat. No. 9,637,226, which is a continuation of application No. 15/134,379, filed on Apr. 20, 2016, now Pat. No. 9,463,871, which is a continuation of application No. 14/942,988, filed on Nov. 16, 2015, now Pat. No. 9,346,537, which is a continuation of application No. 14/566,483, filed on Dec. 10, 2014, now Pat. No. 9,216,817, which is a continuation of  
(Continued)

*Primary Examiner* — Marissa J Cash

(51) **LOC (13) Cl.** ..... **12-07**

(57) **CLAIM**

(52) **U.S. Cl.**

The ornamental design for a split winglet, as shown and described.

USPC ..... **D12/345**

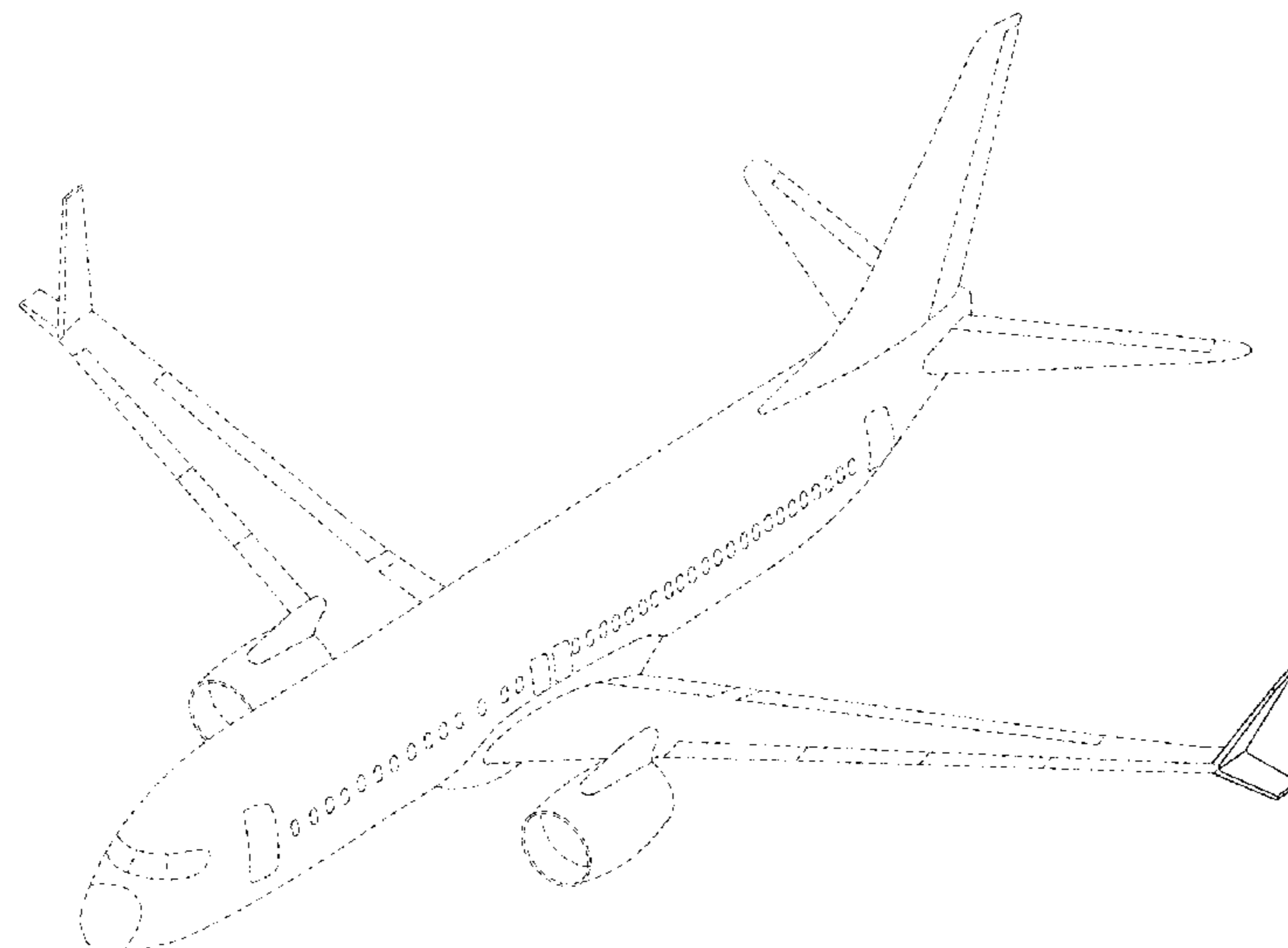
**DESCRIPTION**

(58) **Field of Classification Search**

USPC ..... D12/319–345, 16.1, 1–4, 415, 401; D21/436–455, 769, 771; D15/199; D32/21; D25/4; D6/514, 705.7, 706, D6/675, 675.3, 677.3

FIG. 1 is a perspective view of a split winglet shown in an environment of use.  
FIG. 2 is a front view of the split winglet shown in an alternate environment of use; and,  
FIG. 3 is a front view of the split winglet in an alternate environment of use.  
The broken lines shown in the drawings represent environmental subject matter only and form no part of the claimed design.

**1 Claim, 2 Drawing Sheets**



**Related U.S. Application Data**

application No. 13/436,355, filed on Mar. 30, 2012,  
now Pat. No. 8,936,219.

(56)

**References Cited**

U.S. PATENT DOCUMENTS

1,888,418	A	11/1932	Adams	
2,576,981	A	2/1951	Vogt	
2,743,888	A	5/1956	Lippisch	
3,027,118	A	1/1960	Wilcox	
3,027,098	A	9/1966	Cone	
3,270,988	A	9/1966	Cone	
3,684,217	A	8/1972	Kukon	
3,712,564	A	1/1973	Rethorst	
3,840,199	A	10/1974	Tibbs	
4,046,336	A	9/1977	Tangier	
4,108,403	A	8/1978	Finch	
4,172,574	A	10/1979	Spillman	
4,190,219	A	2/1980	Hackett	
4,205,810	A	6/1980	Ishimitsu	
4,245,804	A	1/1981	Ishimitsu	
4,382,569	A	5/1983	Boppe	
4,455,004	A	6/1984	Whitaker	
4,457,479	A	7/1984	Daude	
4,541,593	A	9/1985	Cabral	
4,545,552	A	10/1985	Welles	
4,595,160	A	6/1986	Santos	
4,667,906	A	5/1987	Suarez	
4,671,473	A	6/1987	Goodson	
4,674,709	A	6/1987	Welles	
4,700,911	A	10/1987	Zimmer	
4,714,215	A	12/1987	Jupp	
4,722,499	A	2/1988	Klug	
4,776,542	A	10/1988	Van Dam	
5,039,032	A	8/1991	Rudolph	
5,082,204	A	1/1992	Croston	
5,102,068	A	4/1992	Gratzer	
5,156,358	A	10/1992	Gerhardt	
5,275,358	A	1/1994	Goldhammer	
5,348,253	A	9/1994	Gratzer	
5,407,153	A	4/1995	Kirk	
5,414,215	A	5/1995	Dunand et al.	
5,435,504	A	7/1995	Inoue	
5,634,613	A	6/1997	McCarthy	
5,778,191	A	8/1998	Wake	
5,909,858	A	6/1999	Hawley	
5,975,464	A	11/1999	Rutan	
5,992,793	A	11/1999	Perry	
6,089,502	A	7/2000	Herrick	
6,161,797	A	12/2000	Kirk	
6,345,790	B1	2/2002	Brix	
6,484,968	B2	11/2002	Felker	
6,547,181	B1	4/2003	Hoisinaton	
6,578,798	B1	6/2003	Dizdarevic	
6,726,149	B2	4/2004	Wojciechowski	
6,827,314	B2	12/2004	Barriety	
6,886,778	B2	5/2005	McLean	
6,929,219	B2	8/2005	Wojciechowski	
7,048,228	B2	5/2006	Vassberg	
7,275,722	B2	10/2007	Irving	
7,316,371	B2	1/2008	Wyrembek	
D587,799	S *	3/2009	Oleson	F04D 29/384 D23/411
7,900,876	B2 *	3/2011	Eberhardt	B64C 23/069 244/199.4
7,988,100	B2	8/2011	Mann	
8,876,044	B2 *	11/2014	Cazals	B64C 23/076 244/87
8,936,219	B2 *	1/2015	Roman	B64C 3/58 244/199.4
8,944,386	B2 *	2/2015	Gratzer	B64C 23/065 244/199.4
D731,395	S *	6/2015	Ivans	D12/345
D733,029	S *	6/2015	Dutertre	D12/319
9,452,825	B2 *	9/2016	Witte	B64C 23/069

D795,784	S *	8/2017	Guo	D12/328
D830,896	S *	10/2018	Lutterodt	D12/16.1
D858,421	S *	9/2019	Von Holzhausen	D12/345
D862,361	S *	10/2019	Corning	D12/330
10,597,138	B2 *	3/2020	Bishop	B64C 23/072
2004/0155146	A1	8/2004	Wyrembek	
2005/0184196	A1	8/2005	Shmilovich	
2006/0027703	A1	2/2006	Bussom	
2007/0018049	A1	1/2007	Stuhr	
2008/0191099	A1	8/2008	Werthmann	
2009/0039204	A1	2/2009	Eberhardt	
2009/0084904	A1	4/2009	Detert	
2009/0224107	A1	9/2009	McLean	
2009/0256029	A1	10/2009	Malachowski	
2011/0272530	A1	11/2011	Mann	
2012/0112005	A1	5/2012	Chaussee et al.	
2012/0312928	A1	12/2012	Gratzer	
2019/0235090	A1 *	8/2019	Lott	G01S 19/36

FOREIGN PATENT DOCUMENTS

DE	19926832	1/2001
EP	0094064	11/1983
EP	0113466	7/1984
EP	1493660	1/2005
FR	2541231	8/1984
FR	2780700	1/2000
JP	2009507719	2/2009
JP	2010540342	12/2010
WO	WO2007031732	3/2007
WO	WO 2012/007358	1/2012

OTHER PUBLICATIONS

McDonnell Douglas MD-11—Wikipedia. cited as introduced Dec. 20, 1990. found online [Apr. 3, 2020] [https://en.wikipedia.org/wiki/McDonnell\\_Douglas\\_MD-11](https://en.wikipedia.org/wiki/McDonnell_Douglas_MD-11).\*

McDonnell Douglas MD-11 by Wikimedia Commons. dated Oct. 7, 2004. found online [Apr. 3, 2020] [https://commons.wikimedia.org/wiki/File:Alitalia\\_McDonnell\\_Douglas\\_MD-11\\_Bidini.jpg](https://commons.wikimedia.org/wiki/File:Alitalia_McDonnell_Douglas_MD-11_Bidini.jpg).\*

Wingtip device. by Wikipedia. many dates included in references depending on citation. found online [Apr. 3, 2020] [https://en.wikipedia.org/wiki/Wingtip\\_device#Winglet](https://en.wikipedia.org/wiki/Wingtip_device#Winglet).\*

737MAX and the MD12. by jur3k. dated Dec. 9, 2013. found online [Jan. 2, 2020] <https://avtales.wordpress.com/2013/12/09/737max-and-the-md-12/>.\*

European Patent Office, European Examination Report for Appl. No. 17162402.6 dated Dec. 10, 2019.

Canadian Patent Office, Canadian Office Action for Appl. No. 2,800,627 dated Jul. 11, 2018.

Canadian Patent Office, Canadian Office Action for Appl. No. 2,800,627 dated Sep. 6, 2017.

PCT International Search Report for PCT/US2008/076055 U.S. Appl. No. 11/866,209; dated Jun. 8 2006, European Patent Office. Pfenninger et al., “About the Design Philosophy of Long Range LFC Transports with Advanced Supercritical LFC Airfoils,” AIM 19th Fluid Dynamics, Plasma Dynamics and Laser Conference, AIAA 87. Jun. 8-10, 1987.

Whitcomb, Richard T., “A Design Approach and Selected Wind-Tunnel Results at High Subsonic Speeds for Wing-Tip Mounted Winglets,” NASA Technical Note 8260—National Aeronautics and Space Administration—Washington D.C., Jul. 1976.

Wilcox et al. Simultaneous Optimization of a Multiple-Aircraft Family: Journal of Aircraft, Jul. 2003 pp. 616-622.

DESKTOPAERO, Wing Design Parameters (4 pages) <http://www.desktopaero.com/appliedaero/wingdesignwingparams.html>.

Boeing AERO, From AERO No. 17, Blended Winglets, accessed Jun. 19, 2012.

Cone, “The Theory of Induced Lift and Minimum Induced Drag of Non-Planar Lifting Systems,” NASA Technical Report R-139 National Aeronautics and Space Administration, Issued Aug. 16, 1963.

Craig et al., “Spanload Optimization for Strength Designed Lifting Surfaces,” AIM 6th Applied Aerodynamics Conference, The Boeing Company, Jul. 6-8, 1988.

(56)

**References Cited**

## OTHER PUBLICATIONS

Design and Analysis of Winglets for Military Aircraft. Technical Report AFFDL-TR-76-3, Feb. 1976.

Kroo, I., Non-Planar Wing Concepts for Increased Aircraft Efficiency, Lecture series on Innovative Configurations and Advanced Concepts for Future Civil Aircraft, Jun. 6-10, 2005, 29 pages.

La Roche et al., "Wing-Grid, a Novel Device for Reduction of Induced Drag on Wings," La Roche Consulting presented at ICAS 96 in Sorrento, Italy.

McLean, Doug, "Wingtip Devices: What They Do and How They Do it." Boeing Aerodynamics—Article 4, 2005. 20 pages.

EP 14160595, European Search Report, dated Aug. 22, 2014.

European Search Report for EP13161307, dated Dec. 12, 2013.

Japanese Patent Office, Japanese Office Action for Appl. No. 2013-072603 dated Feb. 14, 2017.

Canadian Patent Office, Canadian Office Action for Appl. No. 2,800,627 dated Nov. 16, 2016.

Chinese Patent Office, Chinese Office Action for Appl. No. 2013101049773 dated Dec. 13, 2016.

Russian Patent Office, Russian Office Action for Appl. No. 2013113631/11(020118) dated Dec. 29, 2016.

Chinese Patent Office, Fourth Office Action for Appl. No. 2013101049773 dated May 2, 2017.

European Patent Office, Extended European Search Report for Appl. No. 17162402.6, dated Jul. 10, 2017.

EPO, Examination Report for Appl. No. 19196564.9 dated Nov. 25, 2020.

Brazilian Patent Office, Preliminary Office Action for Appl. No. BR102013007856-5 dated Feb. 18, 2020.

Darel, I., "Winglets Development at Israel Aircraft Industries," ICAS paper 80-12.5, Oct. 1980.

AERO "Blended Winglets Improve Performance," Mar. 2009.

AERO "Blended Winglets for Improved Airplane Performance," Jan. 2002.

Unroad Warrior "Wing Tips: Boeing vs. Airbus," Mar. 28, 2011. smartcockpit.com, "Understanding Winglets Technology," retrieved on Mar. 23, 2012.

Flight Global—Flight Blogger, "Blended scimitar-tipped split winglet," Oct. 17, 2011, available at <<http://www.flightglobal.com/blogs/flightblogger/2011/10/split-scimitar-winglet-next-on.html>>.

Flight Global, "NBAA: Aviation Partners splits winglets," Oct. 11, 2011, available at <<http://www.flightglobal.com/news/articles/nbaa-aviation-partners-splits-winglets-for-performance-boost-363281/>>.

Tourism and Aviation, "Airbus sues Aviatin Partners," Mar. 23, 2012.

European Patent Office, European Examination Report for Appl. No. 17162402.6 dated Jun. 6, 2018.

Canadian Patent Office, Canadian Office Action for Appl. No. 3,061,569 dated Jan. 11, 2021.

\* cited by examiner

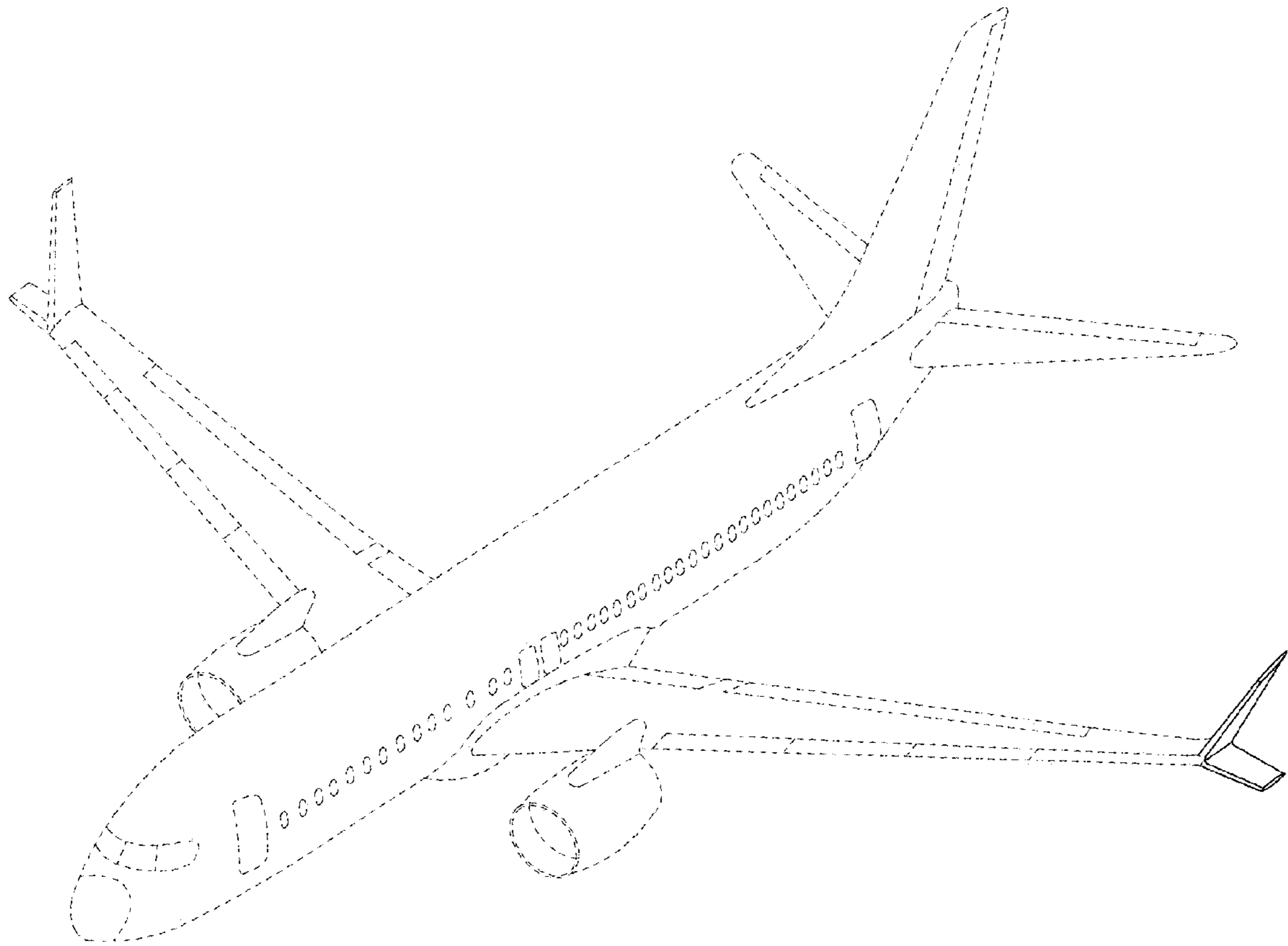


FIG. 1

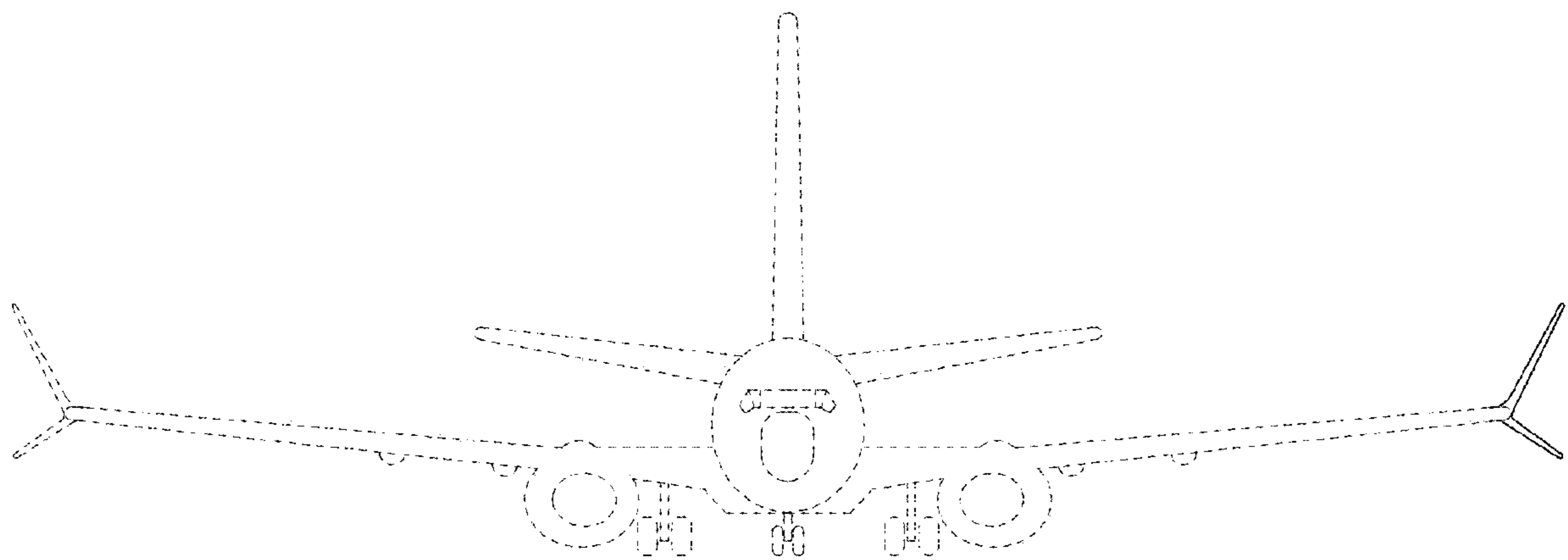
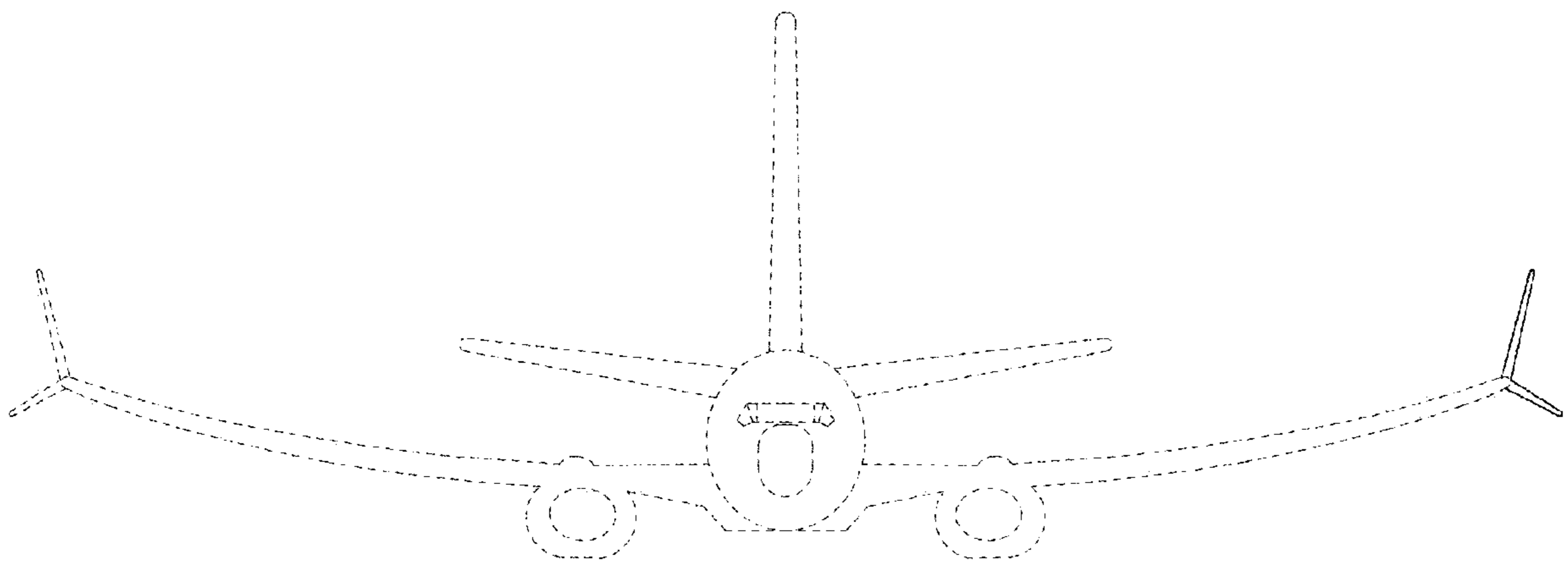


FIG. 2



**FIG. 3**