UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/804,534	07/21/2015	Nathan Snape	81389US01; 67097-3266US1	2324

54549 7590 09/30/2019

CARLSON, GASKEY & OLDS/PRATT & WHITNEY
400 West Maple Road
Suite 350
Birmingham, MI 48009

EXAMINER	
BEBE, JOSHUA R	
ART UNIT	PAPER NUMBER
3745	
NOTIFICATION DATE	DELIVERY MODE
09/30/2019	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

ptodocket@cgolaw.com

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte NATHAN SNAPE, GABRIEL L. SUCIU, BRIAN D. MERRY, and JESSE M. CHANDLER

Appeal 2019-002683
Application 14/804,534
Technology Center 3700

Before CHARLES N. GREENHUT, MICHELLE R. OSINSKI, and LISA M. GUIJT, *Administrative Patent Judges*.

GUIJT, *Administrative Patent Judge*.

DECISION ON APPEAL

Pursuant to 35 U.S.C. § 134(a), Appellant[1] appeals from the Examiner's decision to reject claims 1–14 and 21. We have jurisdiction under 35 U.S.C. § 6(b).

We AFFIRM.

---

[1] We use the word "Appellant" to refer to "applicant" as defined in 37 C.F.R. § 1.42. Appellant identifies the real party in interest as United Technologies Corporation. Appeal Br. 1.

CLAIMED SUBJECT MATTER

Claims 1 and 21 are the independent claims on appeal. Claim 1, reproduced below, is exemplary of the subject matter on appeal.

1. A gas turbine engine comprising:

rotating components including a main compressor section having a high pressure compressor with a downstream discharge, and more upstream locations;

said rotating components also including a turbine section having a high pressure turbine;

a tap tapping air from at least one of said more upstream locations in said compressor section, passing said tapped air through a heat exchanger and then to a cooling compressor, said cooling compressor compressing air downstream of said heat exchanger, and delivering air to at least one of said rotating components;

said heat exchanger also receiving air to be delivered to an aircraft cabin; and

said turbine section also including a fan drive turbine, said fan drive turbine driving a fan rotor, and a bypass ratio being defined as a volume of air delivered into a bypass duct as propulsion air compared to a volume of air delivered into said compressor section, with said bypass ratio being greater then 6.0, and said fan drive turbine driving said fan through a gear reduction.

EVIDENCE

Elovic	US 4,254,618	Mar. 10, 1981
Coffinberry	US 5,392,614	Feb. 28, 1995
Glickstein	US 5,452,573	Sept. 26, 1995
Yoshinaka	US 6,134,880	Oct. 24, 2000
Bruno	US 2007/0213917 A1	Sept. 13, 2007
Jarrell	US 2010/0005810 A1	Jan. 14, 2010
Glahn	US 2011/0247344 A1	Oct. 13, 2011

Sennoun	US 2012/0216545 A1	Aug. 30, 2012
Berryann	US 2013/0000317 A1	Jan. 3, 2013
Kupratis	US 2013/0192258 A1	Aug. 1, 2013
Ress, Jr.	US 2013/0199156 A1	Aug. 8, 2013
Bacic	US 2014/0208768 A1	July 31, 2014
Schwarz	US 2014/0260326 A1	Sept. 18, 2014

REJECTIONS

I. Claim 1 stands rejected under 35 U.S.C. § 103 as unpatentable over Elovic, Glickstein, Kupratis, Yoshinaka, and Sennoun.[2]

II. Claims 2, 4, and 21 are rejected under 35 U.S.C. § 103 as unpatentable over Elovic, Glickstein, Yoshinaka, and Sennoun.

III. Claim 3 stands rejected under 35 U.S.C. § 103 as unpatentable over Elovic, Glickstein, Yoshinaka, Sennoun, and Bacic.

IV. Claims 5 and 11 stand rejected under 35 U.S.C. § 103 as unpatentable over Elovic, Glickstein, Yoshinaka, Sennoun, and "an engineering expedient."

V. Claims 6 and 7 stand rejected under 35 U.S.C. § 103 as unpatentable over Elovic, Glickstein, Yoshinaka, Sennoun, "an engineering expedient," and Bruno.[3]

VI. Claim 8 stands rejected under 35 U.S.C. § 103 as unpatentable over Elovic, Glickstein, Yoshinaka, Sennoun, "an engineering expedient," Bruno,[4] and Jarrell.

---

[2] Coffinberry is cited as evidence. Final Act. 7.

[3] Although Berryann is listed in the Examiner's summary of the rejection, Bruno is relied on as evidence. Final Act. 14–15.

[4] Although Berryann is listed in the Examiner's summary of the rejection, Bruno is relied on as evidence. Final Act. 17.

VII. Claims 9 and 10 stand rejected under 35 U.S.C. § 103 as unpatentable over Elovic, Glickstein, Yoshinaka, Sennoun, "an engineering expedient," Bruno,[5] Jarrell, and Ress, Jr.

VIII. Claims 12 and 13 stand rejected under 35 U.S.C. § 103 as unpatentable over Elovic, Glickstein, Yoshinaka, Sennoun, and Bruno.[6]

IX. Claim 14 stand rejected under 35 U.S.C. § 103 as unpatentable over Elovic, Glickstein, Yoshinaka, Sennoun, Bruno, and Jarrell.

ANALYSIS

Rejections I and II

Appellant argues independent claims 1 and 21 as a group, and does not present separate arguments for the patentability of dependent claims 2 and 4. Appeal Br. 2–4. We select claim 1 as representative, and claims 2, 4, and 21 fall therewith. *See* 37 C.F.R. § 41.37(c)(1)(iv) (2015).

Regarding independent claim 1, the Examiner finds that Elovic discloses, *inter alia*, a main compressor section (i.e., compressor 20) having a high pressure compressor with a downstream discharge and also upstream locations, a turbine section having a high pressure turbine (i.e., high pressure turbine 36), a tap tapping air from the main compressor section, wherein the tapped air is passed through a heat exchanger (i.e., heat exchanger 54) and

[5] Although Berryann is listed in the Examiner's summary of the rejection, Bruno is relied on as evidence. Final Act. 19.

[6] Although Berryann is listed in the Examiner's summary of the rejection, Bruno is relied on as evidence. Final Act. 15–16.

delivered to the turbine section (i.e., rotating components), as claimed. Final Act. 6 (citing Elovic 3:45–64, 5:5–25, Fig. 2). The Examiner relies on Elovic for disclosing to a person of ordinary skill in the art that the tap may be from one of the upstream locations of the high pressure compressor, because Elovic teaches that it may be desirable to extract the cooling air from the compressor at a location other than the compressor discharge. *Id.* (citing Elovic 6:30–40); *see* Elovic 6:30–32 ("it may be desirable to extract the cooling air from the compressor 20 at a location other than the compressor discharge").

The Examiner determines that Elovic fails to disclose a cooling compressor downstream from the heat exchanger, as claimed, and the Examiner relies on Glickstein for disclosing tapping air from high pressure compressor 84 and passing the air to a cooling compressor (i.e., auxiliary compressor 50), which is downstream from heat exchanger 42. Final Act. 6–7 (citing, *e.g.*, Glickstein 6:15–35, Fig. 2).

The Examiner also relies on Glickstein for generally teaching that "[i]t is desirable to provide high pressure cooled air, *over a wide range of pressures for engine needs*." Final Act. 6 (citing Glickstein 1:15–20, 45–51, 2:30–37) (emphasis added); *see also id.* at 6:19–22 ("selector valve 250 is used to divert a portion of compressed air from the high compressor 84 through either the interstage bleed 101 or the exit stage bleed 100, *depending on the current requirements for cool air on the vehicle* 10") (emphasis added). Notably, Glickstein discloses that it is known to tap air from multiple locations of a compressor section 18 of a turbine engine 12 having a low pressure compressor 82 and a high pressure compressor 84, including, for example, (i) at "an exit stage bleed 100" at the downstream end of the high pressure compressor 84 (Glickstein 2:49–51); (ii) at "an interstage bleed 101," as depicted in Figure 2 of Glickstein as located upstream of the downstream end of high pressure compressor 84 (*id.* at 5:29–31); and (iii) at the downstream end of low pressure compressor 82, as depicted in Figures 1 and 2 of Glickstein as tapping compressed air 22, and as described in Glickstein as exiting the low pressure compressor for use as a coolant for heat exchangers 40, 41 (*id.* at 3:9–14, 17–20). Glickstein discloses that air tapped from exit stage bleed 100 has a higher pressure (i.e., a second pressure) than air tapped from interstage bleed 101 (i.e., a third pressure), which has a higher pressure than air tapped from the downstream end of low pressure compressor 82 (i.e., a first pressure). *See, e.g.*, *id.* at 2:46–51, 6:25–37.

The Examiner reasons that it would have been obvious to have modified Elovic's cooling air system to include an auxiliary cooling compressor downstream of the heat exchanger, as taught by Glickstein, to provide "improved pressure of cooling from lower stage, (colder) air, but still meeting the high pressure cooling needs of the turbine." Final Act. 7.

The Examiner determines that Elovic also fails to disclose that the heat exchanger also receives air to be delivered to an aircraft cabin, as claimed, and the Examiner relies on Yoshinaka for disclosing that "[i]t is known that bleed air extracted from core air and then delivered to a heat exchanging intercooler elements, can be utilized for multiple things such as cooling a turbine and environmental control system aircraft cabin air supply." Final Act. 6–7 (citing Yoshinaka 2:18–25, 6:25–45). The

Examiner further relies on Sennoun for teaching that "[i]t is well-known in the [environmental control systems (ECS)] cooling arts to utilize engine bleed air ducted through heat exchangers," and that "decreasing the overall weight of the pre-cooler and ECS systems (heat exchanger being a partial step in such systems) should be desirable to reduce fuel cost and improve engine efficiency." *Id.* at 7–8 (citing Sennoun ¶¶ 9, 12, 13). The Examiner specifically relies on Sennoun for expressly disclosing that "some of that heat exchanging bypass air should instead be sent through the heat exchanger as desired to improve control of temperature of the air supplied to the ECS." Ans. 6. The Examiner reasons that it would have been obvious, in view of Yoshinaka and Sennoun, to modify Elovic's cooling air system, as modified by Glickstein, to use a portion of the cooling air from the auxiliary cooling compressor for aircraft cabin cooling, in addition to delivering a portion of the cooling air to rotating components, for example, of the turbine engine, such that the number of bleed ports and heat exchangers are reduced and thereby improving weight and costs associated with the cooling system. Final Act. 8.

Finally, the Examiner determines that Elovic is silent regarding the bypass ratio for the turbine engine, and relies on Kupratis for disclosing that a fan bypass ratio of "6:1 or 10:1" is "desirable," and that "[such] fans are operable under a gear reduction ratio between [the] driving turbine shaft and [the] fan." Final Act. 8 (citing Kupratis ¶¶ 49, 50). The Examiner also finds that Kupratis teaches that "gear reduction provides for a range of different rotational speeds of the fan drive turbine, and the fan," and thus, "permits the low pressure compressor and low spool to operate at a higher speed." *Id.*

(citing Kupratis ¶ 82). The Examiner reasons that it would have been obvious to modify Elovic, "which does not specify a particular bypass ratio" or "gear reduction," as modified by the teachings of Glickstein, Yoshinaka, and Sennoun *supra*, "[to] improv[e] fan drive turbine efficiency, and bypass thrust, [and to] reduc[e] fuel consumption of the engine." *Id.* at 8–9.

As an initial matter, Appellant argues that the Examiner's reliance on a large number of prior art references in the statement of the rejection weighs against the obviousness of the claimed invention. Appeal Br. 2–3; Reply Br. 1. However, while we note that the Examiner cited as many as six references to support the conclusion of prima facie obvious, it is well settled that the number of references required to show obviousness does not, by itself, demonstrate that the claimed subject matter would have been unobvious to an ordinary artisan. *See In re Gorman*, 933 F.2d 982, 986 (Fed. Cir. 1991) (affirming obviousness rejection over thirteen references) ("The criterion . . . is not the number of references, but what they would have meant to a person of ordinary skill in the field of the invention."). Here, as discussed *infra*, the Examiner applies the teachings of the prior art references properly, such that the Examiner's conclusion of obviousness has sufficient rational underpinning, notwithstanding the number of references relied on in the rejection. *See In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006) (requiring an obviousness conclusion to be based on explicit articulated reasoning with rational underpinning) *cited with approval in KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 418 (2007).

Appellant argues that "[t]here is no showing as to why 'it may be desirable' to tap the air from any other location," in Elovic, such that "[t]he only teaching on this record as to a reason for tapping the air from such a location is Appellant's disclosure." Appeal Br. 3. Appellant submits that neither the Examiner nor Elovic provide a reason why it is desirable to tap air from any position other than the exit location of Elovic's high pressure compressor section. Reply Br. 1. Appellant concludes that the Examiner improperly relied on hindsight. Appeal Br. 3.

We are not persuaded by Appellant's argument. First, as correctly stated by the Examiner, Elovic indeed teaches tapping air from any desirable location along the compressor section, and not solely from the compressor discharge. Ans. 3 ("it is clear that Elovic does in fact teach the disputed feature"); *see In re Mouttet*, 686 F.3d 1322, 1331 (Fed. Cir. 2012), citing *KSR*, 550 U.S. at 418–421 ("[a] reference may be read for all that it teaches, including uses beyond its primary purpose"). Second, Glickstein expressly discloses tapping at interstage 101 of high compressor section 84, as set forth *supra*, as well as providing a reason for tapping at various locations along the compressor, as set forth *supra*: air tapped at the exit end of low pressure compressor 82 has a first pressure lower than a third pressure of air tapped at interstage 101 within high pressure compressor 84, which has a pressure lower than a second pressure of air tapped at the exit end of high pressure compressor 84, because it is desirable to provide high pressure cooled air over a wide range of pressures for engine needs. *See also* Glickstein 6:18–22 (disclosing that "a portion of compressed air from the high [pressure] compressor 84 [is tapped] through either the interstage bleed 101 or the exit stage bleed 100 *depending on the current requirements for cool air on the vehicle 10*") (emphasis added). Thus, Appellant's argument does not apprise us of error in the Examiner's findings or reasoning, and Appellant's hindsight argument is of no moment where, as here, the Examiner provided a sufficient, non-hindsight reason to combine the references. *See In re Cree*, 818 F.3d 694, 702, n.3 (Fed. Cir. 2016).

Appellant also argues that Yoshinaka fails to disclose "a single heat exchanger being utilized for both cooling air for a rotating component, and for the cabin air system," as claimed, and that "[although] there are a number of alternative applications, . . . [n]o dual applications are mentioned." Appeal Br. 3; *see also* Reply Br. 3.

Again, we are not persuaded by Appellant's argument. Glickstein expressly discloses that, in operation and with respect to air tapped from interstage bleed 101 of high pressure compressor 84, the tapped air flows through heat exchanger 40 to auxiliary compressor 50 where the air exits at a fourth pressure and is delivered to second heat exchanger 41, where the flow is further cooled and sent to the components 301 of the vehicle, while a portion of the flow is delivered, via heat exchanger 41, to auxiliary turbine 52, "[wherein] the portion bled from the high pressure compressor 84 is expanded through the auxiliary turbine 52, thereby producing cooled, relatively low pressure air for cooling components of the vehicle." Glickstein 4:16–21; *id.* at Glickstein 6:14–60, Fig. 2. In other words, Glickstein discloses using heat exchanger 40, wherein heat exchanger 40 is employed in a system that produces multiple cooling air streams for different aircraft needs. Thus, in view of these teachings of Glickstein, and Yoshinaka's further disclosure of using "mass bleed flow" for an "environmental control system . . . or for aircraft cabin air supply"

(Yoshinaka 6:29–37), and Sennoun's further disclosure of connecting a "bleed air outlet line [to] the heat exchanger cooling circuit to the environmental control system," (Sennoun ¶ 12), we determine that the Examiner's reasoning that it would have been obvious to use a portion of the cooling air stream from Elovic's cooling air system to cool the turbine blades, while also using a portion of the cooling air stream to cool the cabin air, is sufficiently supported by factual underpinning.

Appellant further argues that although Kupratis "may disclose a bypass ratio and a gear reduction, . . . this does not provide any incentive to modify Elovic in an manner." Appeal Br. 4. Appellant submits that, with respect to the claimed invention, "the use of the gear reduction and the high bypass ratio provides synergistic benefits in combination with the cooling system." *Id.*

Appellant does not dispute the Examiner's findings with respect to Kupratis. Appeal Br. 4; Reply Br. 1–2. Appellant's argument also does not apprise us of error in the Examiner's reasoning, as set forth *supra*, that using Kupratis' bypass ratio and gear reduction would improve fan drive turbine efficiency, and bypass thrust, and reduce fuel consumption of the engine, as taught in Kupratis. "The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results." *KSR*, 550 U.S. at 416.

Accordingly, we sustain the Examiner's rejection of independent claim 1, and claims 2, 4, and 21 fall therewith.

Rejection III

Claim 3, which depends from claim 2, which depends from independent claim 21, recites, in relevant part, "wherein a mixer is provided downstream of said cooling compressor to receive air from the high pressure compressor to mix with the air downstream of the cooling compressor." Appeal Br. 6 (Claims App.). The Examiner relies on Bacic for teaching mixing an air flow with a portion of high pressure compressor air before passing the air to a high pressure turbine. Final Act. 12 (citing Bacic ¶ 46). The Examiner reasons that it would have been obvious to modify Elovic, as modified *supra*, "such that [the air exiting the cooling compressor] was then delivered to mixing nozzles, mixers and combined with [high pressure compressor] discharge air, as taught by Bacic, for improved effectiveness of the cooling air and mixing, which prevents excessive and uneven cooling." *Id.* The Examiner further reasons that "[o]ne of ordinary skill would understand that Bacic's desire to modulate the cooling air with [high pressure compressor] air prior to introducing to the turbine would be applicable with the cooling air of [Elovic], and one of ordinary skill would be able to apply this with some reasonable expectation of success given the similar treatments of the air[] [flows]." Ans. 7–8.

Appellant argues that "Bacic does not mix a lower pressure tap with a higher pressure tap," but rather, "both pressure taps heading into the mixing chamber of Bacic come from the compressor discharge," wherein "[o]ne is cooled, one is not, however, that is not what is being delivered to the mixing chamber of claim 3." Appeal Br. 4.

Appellant's argument does not apprise us of error in the Examiner's reliance on Bacic for disclosing the use of high pressure compressor bleed air as a mixing ingredient in a turbine engine coolant supply system, neither does Appellant's argument apprise us of error in the Examiner's reasoning that it would be within the knowledge of one skilled in the art to apply Bacic's teaching to Elovic's product stream of cooling air prior to delivery to aircraft components or the cabin itself.

Accordingly, we sustain the Examiner's rejection of claim 3.

Rejections IV, VI, and IX

Appellant argues that the Examiner's reliance on "an 'engineering expedient'" and Jarrell does not cure the deficiencies in the Examiner's rejection of the independent claims, as presented in Rejection I *supra*. Appeal Br. 4. Because we do not agree that the Examiner's rejection has deficiencies, we sustain the Examiner's rejection of claims 5, 8, 11, and 14 for essentially the same reasons as stated in Rejection I *supra*.

Rejections V, VII, and VIII

Regarding claims 6, 7, 9, 10, 12, and 13, the Examiner relies on, *inter alia*, Bruno for disclosing that

> [i]t is known to utilize a tower shaft[](62) to power several auxiliary devices needed by an engine through an accessory gear box. . . . "[I]it is well-known and obvious that among the items driven by accessory gear boxes are pumps, i.e.[,] compressors)][.] This is achieved by utilizing a bull gear[](68) attached to the low spool shaft (therefore driven by the low pressure turbine, therefore the turbine section is driving the tower shaft through the bull gear. This improves over driving said

> gearbox and accessories from a high power shaft, as on the low spool, a larger inertia may be provided and therefore the spool is more tolerant to power extraction, which further improves the high spool operating margins, by removing the need for a surge margin to accommodate power extraction on the high speed spool.

Final Act. 15–17 (citing Bruno ¶¶ 6, 7, 12, 14, 17–20). The Examiner reasons that it would have been obvious

> to modify the auxiliary cooling compressor and additional elements of the engine of [Elovic] to be powered by a tower shaft and auxiliary gear box powered by a bull gear as taught by Bruno, for the purpose o[f] providing additional elements powered by the engine such as generators, etc[.], as well as power the pump of [Elovic] and [Glickstein], as a known in the art alternative method for powering said pump and with advantages in engine operation over powering them from the high spool shaft as they are typical powered.

Id. at 15.

Regarding claims 9 and 10, the Examiner relies on, *inter alia*, Ress, Jr. for disclosing that

> [i]t can be desirable to include auxiliary fans[](32) operated at variable speeds downstream of primary fans[](30) but upstream of the bypass duct[](36) and the elements within it. . . . The system variable speed rotating loads may be utilized to operate in a variable cycle, with varying high thrust low bypass modes when desirable, reducing a need to operate over a wide range of engine spool speeds, to improve the transient characteristics of the engine.

Id. at 19 (citing Ress, Jr. ¶¶ 5, 12, 17–21, 28). The Examiner reasons that it would have been obvious

> to modify the engine of [Elovic] to include an auxiliary fan downstream of the primary fan and upstream of the bypass flow,

> said fan capable of operating at variable speed, as taught by [Ress, Jr.], for the purpose of improving the engine[’]s transient operating conditions and its ability to operate in variable thrust and bypass modes as desired.

Id.

Appellant argues that “adding all of this structure to drive the cooling compressor takes away drive from the remainder of the engine,” such that “the combination of Glickstein/Coffinberry with Elovic [is] even more costly, and even less ‘undesirable.’” Appeal Br. 4.

Appellant does not dispute the Examiner’s findings. We are also not persuaded that the Examiner’s proposed modification of Elovic would not have been obvious, in view of the Examiner’s reasoning as set forth *supra*. Again, “[t]he fact that the motivating benefit comes at the expense of another benefit, however, should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another. Instead, the benefits, both lost and gained, should be weighed against one another.” *Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000).

Accordingly, we sustain the Examiner’s rejection of claims 6, 7, 9, 10, 12, and 13.

DECISION

The Examiner’s decision rejecting claims 1–14 and 21 is AFFIRMED.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a). *See* 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED