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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL
AND APPEAL BOARD

Ex parte BROOKS A CHILDERS, CHRISTOPHER J FAZIO,
and ROGER GLEN DUNCAN

Appeal 2017-010616
Application 14/138,972
Technology Center 2800

Before MICHAEL P. COLAIANNI, AVELYN M. ROSS, and
MERRELL C. CASHION, JR., *Administrative Patent Judges*.

COLAIANNI, *Administrative Patent Judge*.

DECISION ON APPEAL

Appellants[1] appeal under 35 U.S.C. § 134(a) the non-final rejection of claims 1–18. We have jurisdiction over the appeal pursuant to 35 U.S.C. § 6(b).

We AFFIRM.

Appellants' invention is directed to an apparatus and method for estimating an environmental parameter such as temperature, pressure, strain, and vibrations. (Spec. ¶ 1, claims 1 and 12).

Claim 1 is illustrative:

> 1. An apparatus for estimating an environmental parameter, the apparatus comprising:
>
> an optical fiber including at least one core configured to be optically coupled to a light source and transmit an interrogation signal, the at least one core including a plurality of fiber Bragg gratings (FBGs) distributed along a measurement length of the optical fiber and configured to reflect light;
>
> a detector configured to receive a reflected return signal including light reflected from one or more of the plurality of sensing locations; and
>
> a processor, the processor configured to:
>
> receive data describing the reflected return signal;
>
> compare the received data to expected data for a reflected return signal for the optical fiber;
>
> determine a shift in wavelength of light reflected for one or more of the plurality of FBGs based on the comparison;
>
> determine a change in a length of a dead zone of the optical fiber based on the comparison;
>
> estimate locations of two or more of the plurality of FBG' s based on the shift in wavelength and the change in length of the dead zone; and
>
> based on the estimates, estimate the environmental parameter.

[1] Appellants name Baker Hughes Incorporated as the real party in interest. (App. Br. 1.)

Appellants appeal the following rejections:

1. Claims 1–18 are rejected under 35 U.S.C. § 101 as directed to a judicial exception (i.e., an abstract idea) without significantly more.
2. Claims 1–7 and 10–17 are rejected under 35 U.S.C. § 103 as unpatentable over Sapack (US 6,072,567; June 6, 2000) in view of Duncan (US 2012/0237205 Al; Sept. 20, 2012).
3. Claims 8, 9, and 18 are rejected under 35 U.S.C. § 103 as unpatentable over Sapack in view of Duncan and Willner (US 6,915,040 B2; July 5, 2005).

FINDINGS OF FACT & ANALYSIS

35 U.S.C. § 101 Rejection

The Examiner finds that the claims are directed to an abstract idea because "the steps performed by the processor are calculations based on received data." (Non-Final Act. 5). The Examiner finds that the claims do not include additional elements that are sufficient to amount to significantly more than the judicial exception because the additional limitations (i.e., the optical fiber, Fiber Bragg gratings, and detector) are well known in the art as shown by Sapack. (Non-Final Act. 5). The Examiner finds that the claims use a generic computer to collect and analyze the data, which does not transform the abstract idea into patent-eligible subject matter. (Non-Final Act. 5). The Examiner finds that even though the calculated value may have real world applications, such real world applications, by themselves, are not sufficient to remove the computed "value from the realm of being abstract as simply a value." (Ans. 5).

Appellants argue that the claims are not directed to an abstract idea because the apparatus and method use Fiber Bragg gratings (FBGs) and an optical fiber to estimate a real world value (e.g., temperature). (App. Br. 6). Appellants contend that the apparatus and method are used while drilling for and producing underground fluids such as oil and water. (App. Br. 6). Appellants contend that "the claims here are not directed solely to applying "math" to a system but, rather, to form a result by considering changes to the system (e.g., changes to the dead zone) not previously considered in the prior art." (Reply Br. 4). Appellants cite to *Thales Visionix Inc. v. U.S.*, 850 F.3d 1343 (Fed. Cir. 2017) to support the argument that the claims are not directed to an abstract idea. (Reply Br. 4).

The facts in *Thales* are distinguishable from the present case. *Thales* involved a system for tracking motion of an object comprising a first inertial sensor on a moving object, a second inertial sensor on a moving reference frame, and an element adapted to receive signals from the first and second sensors and configured to determine an orientation of the object relative to the moving reference frame based on the signals received from the two sensors. *Thales*, 850 F.3d at 1345. The court in *Thales* found that the claims used the inertial sensors in a non-conventional manner to determine the relative position and orientation of a moving object on a moving reference frame. *Thales*, 850 F.3d at 1348–49.

In the present appeal, the optical fiber with the fiber Bragg gratings, light source, detector and processor are all used in a conventional manner. The Examiner finds that Sapack teaches using these elements to determine an environmental parameter in a bore hole. (Non-Final Act. 5). Though Appellants contend that adjusting measurements based on changes in the "dead zone"[2] of the optical fiber is non-conventional, we note that Duncan teaches adjusting measurements based on signals adjusted for the lead-in fiber length (i.e., the dead zone). (*See e.g.*, Duncan ¶¶ 3, 6, 30, 37). The delay of the reference modulation signal to compensate for lead-in lengths is determined by the time of flight of the signal from the optical source to the sensing region (i.e., the region with the fiber Bragg gratings). (Duncan ¶ 30). In other words, Duncan teaches that the lead-in fiber length affects the measurement range of the fiber-optic distributed system (DSS) and how to address these problems by adjusting the reference modulation signal based upon the lead-in length. (Duncan ¶¶ 3, 30). The lead-in length will change by virtue of the fiber being exposed to conditions in the borehole as suggested by Sapack's teaching that fiber Bragg gratings work by the shift in wavelength caused by movement of the gratings due to stretching of the fibers at conditions in the borehole. (Sapack col. 7, ll. 60–65). As the Examiner explains, the lead-in length will undergo some stretching due to the conditions in light of Sapack's and Duncan's teachings about the effect of borehole conditions on the fiber. (Non-Final Act. 7–8). In other words, the prior art includes taking into account a change in lead-in length of the fiber by adjusting the reference modulation signal accordingly. Thus, contrary to Appellants' allegation, taking into account a change in the length of the dead zone (i.e., lead-in length) appears to be conventional in the art.

The Examiner correctly finds that the output of the apparatus is merely a value without any claim recitation of what is done with that

[2] Dead-zone is described in the Specification as the length of optical fiber having no fiber Bragg gratings (FBGs) that extends from the optical light source to the first FBG. (Spec. ¶ 20).

"value." (Ans. 5). In other words, claim 1 recites that an environmental parameter is determined as an output of the processor, but nothing more is done with that "value" and the mere collection of data by measuring the environmental parameter constitutes insignificant extra-solution activity. *See Mayo Collaborative Servs v. Prometheus Labs. Inc.*, 566 US 66, 79 (2012).

On this record, we affirm the Examiner's § 101 rejection of claims 1–18.

REJECTIONS (2) AND (3): § 103

Appellants argue the claims as a group. (App. Br. 4–5). We select claim 1 as representative of the group. Any claim not argued separately will stand or fall with our analysis of the rejection of claim 1.

The Examiner finds, in relevant part, that Sapack discloses the subject matter of claim 1, including that environmental factors cause expansion or compression of the Bragg grating sensors. (Non-Final Act. 7). The Examiner finds that the expansion or compression of the length of fiber where the fiber Bragg gratings are located would cause a change between a given end of the optical fiber and a Bragg grating (i.e., the dead zone). (Non-Final Act. 7). The Examiner further finds that Duncan teaches that compression and expansion of the fiber, due to external forces, occurs due to a change in the length of the fiber, thereby resulting in a change in reflected light from the sensors, such as Bragg gratings, along the fiber. (Non-Final Act. 7–8). The Examiner finds that determining the locations of the Bragg grating sensor regions would therefore include measuring the dead zone and any changes in its length due to environmental parameters such as temperature or strain. (Non-Final Act. 8).

Appellants argue that Duncan does not teach determining the change in length of the dead zone as recited in claim 1. (App. Br. 4). Appellants contend that paragraphs 19, 20, 30, and 34 of Duncan relied upon by the Examiner do not teach that the location of the fiber Bragg gratings change with respect to a starting location (i.e., a change in length of a dead zone). (App. Br. 4). Appellants contend that the there is no discussion in Sapack about changes in length of the fiber. (Reply Br. 3).

Contrary to Appellants' arguments, the Examiner reasonably finds that the combined teachings of Sapack and Duncan would have suggested the claimed subject matter including the step of determining a change in length of the "dead zone" as part of the processor used to determine an environmental parameter. Duncan teaches basing the reference modulation signal delay on the lead-in fiber (i.e., dead zone) length (¶ 30). Sapack teaches that the fiber stretches and changes the distance between fiber Bragg gratings which provides a change in reflected wavelength and indicates a particular environmental parameter (col. 7, ll. 60–65). The location of the Bragg gratings are moved due to static, dynamic or temperature induced strain on the fiber. (Sapack col. 7, ll. 62–65). The Examiner reasonably finds that the strain that causes a stretching of the fiber portion having the Bragg gratings would also cause a change in the size of the lead-in portion of the fiber or dead zone. Duncan teaches adjusting the reference modulation signal based on the lead-in fiber length (time of flight of the optical signal) (¶ 30). In other words, the combined teachings of Sapack and Duncan would have suggested determining an environmental parameter by taking into account the change in length of the dead-zone (i.e., the lead-in length) of the optical fiber.

Appellants' arguments do not convince us of reversible error in the Examiner's obviousness determination. On this record, we affirm the Examiner's § 103 rejections.

DECISION

The Examiner's decision 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)(1)(iv).

AFFIRMED