

**UNITED STATES COURT OF APPEALS FOR THE FEDERAL CIRCUIT**

00-1349

TURBOCARE DIVISION OF  
DEMAG DELAVAL TURBOMACHINERY CORPORATION,

Plaintiff-Appellant,

v.

GENERAL ELECTRIC COMPANY,

Defendant-Appellee.

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Appealed from: U. S. District Court for the District of Massachusetts

Judge Michael A. Ponsor

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DECIDED: August 29, 2001

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Before BRYSON, GAJARSA, and LINN, Circuit Judges.

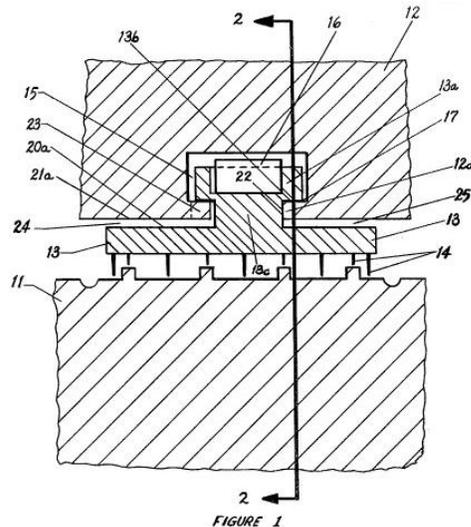
BRYSON, Circuit Judge.

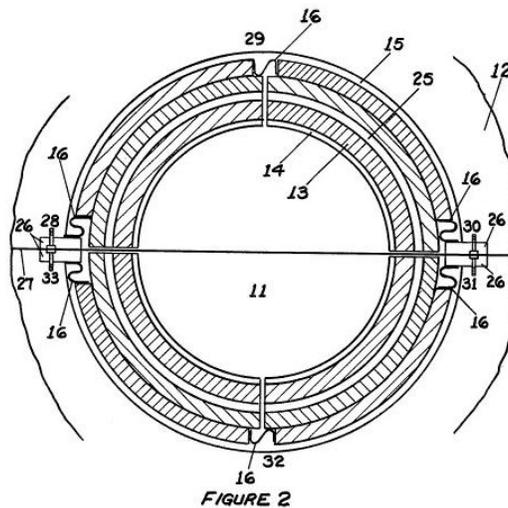
The TurboCare Division of Demag Delaval Turbomachinery Corp. ("TurboCare") is the owner of U.S. Patent No. 4,436,311 ("the '311 patent"), which is directed to a shaft sealing system for fluid turbines. TurboCare brought suit against General Electric Co. ("GE") in the United States District Court for the District of Massachusetts, asserting infringement of the '311 patent. The district court granted summary judgment of noninfringement as to claims 1, 5, 6, and 7 and invalidity as to claim 2. TurboCare appealed. We affirm the district court's judgment of invalidity as to claim 2, and we affirm-in-part and vacate-in-part the district court's judgment of noninfringement as to claims 1, 5, 6, and 7. We remand for further consideration of the infringement issues and consideration of the validity of claims 1, 5, 6, and 7 in light of our claim construction.

I

The '311 patent describes an improved labyrinth-type shaft seal for use in fluid-driven devices such as steam turbines. Steam turbines are typically divided into stages that are separated by internal walls known as diaphragms. The diaphragms include nozzles for steam passage and central openings for the rotating shaft. The nozzles are designed to direct the steam at the working surfaces of the blades in the next stage; it is therefore preferable to channel all available steam through the nozzles. Steam may, however, leak through the central opening in the diaphragm along the rotating shaft, thereby reducing the efficiency of the turbine. Labyrinth-type shaft seals (also known as packing rings) are used to reduce leakage along the shaft.

The seals reduce leakage along the shaft by minimizing the clearance between the rotating shaft and the stationary turbine casing or diaphragm. Figure 1 is a cross-section of the claimed seal ring, and Figure 2 is a cross-section of the turbine:





In the figures, the seal ring 13 is supported by a groove in the casing 12 and forms a segmented ring surrounding the shaft 11. A number of seal ring teeth 14 extend toward the shaft, thereby reducing the clearance between the shaft and the casing. Because of the small clearance between the rotating shaft and the seal ring teeth, labyrinth-type shaft seals are vulnerable to rubbing damage caused by turbine misalignment, vibration, and thermal distortion during low load conditions, starting, and shutdown. Prior art sealing systems attempted to limit rubbing damage while still minimizing leakage along the shaft by various means, including using specialized materials, modifying the seal teeth geometry, spring-loading the seal, and restricting the seal's movement.

Ronald E. Brandon, the inventor of the '311 patent, conceived of a two-position labyrinth-type seal to resolve the rubbing damage problem. During low load conditions, starting, and shutdown, the claimed seal maintains a large clearance position, thereby minimizing contact between the seal ring teeth and the turbine shaft during those periods of shaft instability. During normal operating conditions, the claimed seal maintains a small clearance position, thereby preventing or reducing leakage along the shaft. Figure 1 shows Brandon's seal segment in the small clearance position.

Brandon's preferred embodiment employs compressed S-shaped springs 16 interposed between the ends of the seal ring segments. Those springs apply a circumferential force, biasing the ring segments toward the large clearance position. As the turbine accelerates, the steam pressure on the seal ring increases so that the bias of the springs is overcome and the seal ring segments move radially inward to the small clearance position. In Figure 1, the steam flows from left to right between the casing 12 and the shaft 11. The relevant steam path runs through annular spaces 24 and 15 via one or more local openings 23. The space at the top of the seal segment does not communicate with annular space 25, because a leak-resistant contact pressure seal is formed between the neck of the seal segment and the casing shoulder at 12a. That pressure seal forms when the seal ring segment is pushed sideways as a result of the axial steam pressure on the high pressure side of the seal segment.

As the radial steam pressure at the top of the seal segment builds, it overcomes both the force of the compressed spring and the friction created by the leak-resistant contact pressure seal and moves the seal to the small clearance position. In that position, the seal reduces the

leakage of steam through the central opening of the diaphragm and therefore increases the passage of steam through the nozzle.

In the preferred embodiment, the movement of the seal is restricted by contact between certain surfaces. Figure 1 shows the seal ring segment in the small clearance position. In that position, the inward facing surface of the outer ring portion of the seal ring segment 13b is in contact with the casing shoulders 17. When the seal ring segment is in the large clearance position, the outward facing surface of the inner ring portion of the seal ring segment 20a is in contact with the inward facing surface of the casing 21a.

The '311 patent claims, in pertinent part:

1. In an elastic fluid turbine employing seals to minimize leakage between rotating and stationary components, an improvement in the seal arrangement utilizing the combination of:

a segmented seal ring supported by and at least partially contained in an annular groove formed in a stationary casing to permit motion of said seal ring between a large diameter position and a small diameter position corresponding respectively to large and small clearance of said seal ring with regard to the rotating shaft, said seal ring groove being partially defined by a pair of opposing, spaced apart shoulders on said casing which form an opening of said groove extending radially into the clearance area between said casing and said rotating shaft;

each segment of said seal ring including an inner arcuate portion having seal teeth extending therefrom in the direction of and adjacent to said rotating shaft, a radially outwardly facing arcuate surface on said seal ring segment which is located opposite to a radially inward facing arcuate surface of said casing for limiting said large clearance position by contact between said opposing surfaces, an outer ring portion disposed within said seal ring groove for both axial and radial movement therein and having a pair of shoulders, extending axially in opposite directions for making radial contact respectively with said pair of spaced apart shoulders on said casing and thereby limiting said small clearance position, and a neck portion connected between said inner arcuate portion and said outer ring portion and extending between said casing shoulders, said neck portion having an axial thickness which is less than the distance between said opposing casing shoulders to thereby axially locate said seal ring segment against one of said casing shoulders and provide a contact pressure seal at the said neck portion which is subject to lower turbine fluid pressure; and

a radial positioning means comprising a compressed spring means biased against said ring segments to forcibly cause said segments to move to said large clearance position, while working fluid which is freely admitted to the annular space between said casing and said ring

segments will urge said segments toward said small clearance position, whereby at low speed and small turbine loads the spring forces will predominate, while at high flows and high working fluid pressure the pressure forces will predominate.

2. A fluid turbine seal arrangement as recited in claim 1, wherein said spring means include a flat spring interposed between said casing shoulders and an inner surface of said outer ring portion of said ring segment.

TurboCare has also asserted dependent claims 5, 6, and 7. On appeal, however, TurboCare has not made separate legal arguments with respect to those claims.

Four GE products are accused of infringement. The parties refer to them as (1) the Original Version, (2) the 1992 N-2 Version, (3) the 1992 Diaphragm Version, and (4) the 1995 Version. The structure of those devices is undisputed in several key respects. Each employs flat springs interposed between the casing shoulders and the inner surface of the outer ring portion of the ring segments. Those springs apply a radial rather than circumferential force. Like the S-shaped springs of the preferred embodiment, however, the flat springs bias the ring segments toward the large clearance position. As the steam load on a GE turbine rises, the pressure on the seal ring increases until the bias of the springs is overcome and the seal ring segments move radially inward to the small clearance position.

The steam path in the GE products is somewhat different than in the preferred embodiment. Two accused products (the Original Version and the 1992 N-2 Version) have drilled holes in the casing above the seal segment to admit steam. One accused product (the 1992 Diaphragm Version) has a drilled hole in the seal segment itself. And the final product (the 1995 Version) has a drilled hole in the casing below the seal segment, but not in the casing shoulder.

The small and large clearance positions are also defined somewhat differently in the various accused products. The Original Version includes separate sealing structures (referred to as "side seals") between the inward facing surface of the outer ring portion of the seal ring segment and the casing shoulders. Thus, the small clearance position is defined by contact between the side seals and the seal ring segment. The 1992 N-2 Version includes similar side seal structures as well as dowels that allow the seal to be adjusted to accommodate non-standard and out-of-round conditions of the casing. The small clearance position is therefore defined by contact between the side seals and the dowels. The 1992 Diaphragm Version and the 1995 Version both include dowels but not side seals. The small clearance position in those devices is therefore defined by contact between the dowels and the casing shoulders. In addition, while the 1992 Diaphragm Version and the 1995 Version define the large clearance position by contact between the outward facing surface of the inner ring portion of the seal ring segment and the inward facing surface of the casing, the Original Version and the 1992 N-2 Version define the large clearance position by contact between the top of the seal ring segment and the casing groove.

On GE's motion for summary judgment, the district court held claim 2 invalid for lack of an

adequate written description. During prosecution, Brandon amended his specification to refer to flat springs and also added a new claim, claim 2, which was directed to a shaft seal with a flat spring interposed between the casing shoulder and the inner surface of the outer ring portion of the ring segment. The district court found that the amendment to the specification did not merely clarify what was already reasonably disclosed in the application, but rather constituted new matter. Consequently, the court held claim 2 invalid as not supported by the original specification.

In construing the term "radial positioning means" in claim 1, the district court refused to consider the new matter that was added to the specification. That new matter included the explicit reference to flat springs, the disclosure of an alternative location for those springs and the words "for example," which were added to the statement: "The openings 23[ ] may, for example, be made by local cutouts in the high pressure side of shoulder 12a." The district court therefore concluded that claim 1 and the dependent claims did not cover a shaft seal with flat springs interposed between the casing shoulder and the inner surface of the outer ring portion of the ring segment. Specifically, the district court interpreted the term "radial positioning means" as including structures containing the following features: (1) S-shaped springs or their equivalent; (2) located at each end of each seal segment and exerting a circumferential force against the segments to cause the seal to be positioned in a large clearance position; and (3) cutouts or their equivalents that admit steam to the top of the segments through the area between the neck of the seal and the casing shoulder, thereby causing the seal to move to the small clearance position. The district court also interpreted the terms "small clearance position" and "large clearance position" to require contact between the relevant surfaces shown in Figure 1 of the patent.

Based on its claim construction, the district court granted summary judgment of noninfringement, holding that none of the accused GE devices literally infringed claims 1, 5, 6, or 7. With respect to the doctrine of equivalents, the court held that Brandon had distinguished his invention from prior art devices that employed leaf (or flat) springs and drilled holes in the casing, and that TurboCare therefore could not establish that GE's accused devices infringed the '311 patent under the doctrine of equivalents.

## II

TurboCare first challenges the district court's conclusion that new matter was added to the specification of the '311 patent and that claim 2 is therefore invalid for failing to satisfy the written description requirement of section 112, paragraph 1. The written description requirement and its corollary, the new matter prohibition of 35 U.S.C. § 132, both serve to ensure that the patent applicant was in full possession of the claimed subject matter on the application filing date. When the applicant adds a claim or otherwise amends his specification after the original filing date, as Brandon did in this case, the new claims or other added material must find support in the original specification. Schering Corp. v. Amgen Inc., 222 F.3d 1347, 1352, 55 USPQ2d 1650, 1653 (Fed. Cir. 2000) ("The fundamental inquiry is whether the material added by amendment was inherently contained in the original application."); Vas-Cath Inc. v. Mahurkar, 935 F.2d 1555, 1563, 19 USPQ2d 1111, 1116 (Fed. Cir. 1991) ("[T]he test for sufficiency of support . . . is whether the disclosure of the application relied upon 'reasonably conveys to the artisan that the inventor had possession at that time of the later claimed subject matter.'") (quoting Ralston Purina Co. v. Far-Mar-Co, Inc., 772 F.2d 1570, 1575, 227 USPQ 177, 179 (Fed. Cir. 1985)).

Claim 2 is directed to a "fluid turbine seal arrangement as recited in claim 1, wherein said spring means include a flat spring interposed between said casing shoulders and an inner surface of said outer ring portion of said ring segment." GE asserts that claim 2 is unsupported by the original disclosure in two respects—the type of spring to be used and its location.

Brandon's original disclosure stated that a "considerable variety of springs 16 can be employed. They must be selected to have long life and stable characteristics while exposed to high temperatures, vibration and possible corrosive conditions. Flat, S-shaped springs are illustrated, but others can be employed." The last sentence was amended during prosecution to read: "S-shaped springs are illustrated, but flat springs and others can be employed." GE asserts that this amendment introduced new matter, namely flat springs. TurboCare counters that the amendment constituted a mere clarification of the original disclosure, since flat springs were not illustrated, but were among those that the specification indicated could be used. TurboCare adds that one of ordinary skill in the art would readily understand that flat springs could be used to perform the required function of pushing the ring segments away from the shaft.

While Brandon's original disclosure is not a model of clarity, neither is it so obscure that no reasonable juror could conclude that flat springs were sufficiently disclosed. Brandon stated that a "considerable variety of springs" could be employed, and he used the general term "spring" when describing his invention. Moreover, it is at least plausible that the amendment served merely to clarify that flat springs were not illustrated. After reviewing the evidence of record on this issue, we conclude that there is an issue of fact as to whether Brandon's amendment, which explicitly discloses flat springs, added new matter to the specification. Consequently, we cannot uphold the district court's summary judgment of invalidity as to claim 2 based on the asserted inadequacy of the original disclosure as to the type of spring used in the seal.

With respect to the location of the springs, Brandon's original written description identified only one location—"s]prings 16, are located at each end of each seal ring segment in a compressed condition." However, one of Brandon's original claims provided that "the positioning means . . . is a spring located between seal ring segments or adjacent to said rings." The examiner rejected that claim as indefinite because "the terms 'located between' and ('or') 'adjacent to' do not describe the same condition." In response, Brandon amended his claims to describe generally a "radial positioning means comprising a compressed spring means biased against said ring segments." New dependent claims were added, specifying that "said spring means include a flat spring interposed between said casing shoulders and an inner surface of said outer ring portion of said ring segment" (claim 2) and that, alternatively, "said spring means include a compressed spring interposed between the ends of said ring segments to bias said ring segments to move to said large clearance position" (claim 4). TurboCare admits that the only support in the original disclosure for the location of the spring in claim 2 is the "spring located . . . adjacent to said rings" language from one of the original, rejected claims.

TurboCare contends that one of ordinary skill in the art would recognize that the only viable location for mounting a spring "adjacent to said rings" would be between the casing shoulders and the shoulders of the outer ring portion of the segment, and therefore that the claimed subject matter was inherent in the original disclosure. To support its contention, TurboCare offers the conclusory statements of its expert witness, Mr. Shifler, to that effect.

In order for a disclosure to be inherent, "the missing descriptive matter must necessarily be present in the [original] application's specification such that one skilled in the art would recognize such a disclosure." Tronzo v. Biomet, Inc., 156 F.3d 1154, 1159, 47 USPQ2d 1829, 1834 (Fed. Cir. 1998). Brandon's original disclosure is completely lacking in any description of an embodiment in which the spring is located between the casing shoulders and the inner surface of the outer ring portion of the ring segment. Such an embodiment may have been obvious from Brandon's vague reference to a "spring located . . . adjacent to said rings." As we held in Lockwood v. American Airlines, Inc., 107 F.3d 1565, 41 USPQ2d 1961 (Fed. Cir. 1997), however, that is not enough to satisfy the written description requirement:

While the meaning of terms, phrases, or diagrams in a disclosure is to be explained or interpreted from the vantage point of one skilled in the art, all the limitations must appear in the specification. The question is not whether a claimed invention is an obvious variant of that which is disclosed in the specification. Rather, a prior application itself must describe an invention, and do so in sufficient detail that one skilled in the art can clearly conclude that the inventor invented the claimed invention as of the filing date sought.

Id. at 1572, 41 USPQ2d at 1966. No reasonable juror could find that Brandon's original disclosure was sufficiently detailed to enable one of skill in the art to recognize that Brandon invented what is claimed.

Because Brandon did not file a continuation-in-part application, he cannot rely on any alternative filing date for his newly added claim 2. See Augustine Med., Inc. v. Gaymar Indus., 181 F.3d 1291, 1302, 50 USPQ2d 1900, 1908 (Fed. Cir. 1999) ("A CIP application contains subject matter from a prior application and may also contain additional matter not disclosed in the prior application. . . . Different claims of such an application may therefore receive different effective filing dates."); see also 35 U.S.C. § 120. Consequently, claim 2 is invalid for an inadequate written description. See Reiffin v. Microsoft Corp., 214 F.3d 1342, 1346, 54 USPQ2d 1915, 1917 (Fed. Cir. 2000) (compliance with the written description requirement requires that the original application considered as a whole describe the invention claimed in the patent resulting from that application); Gentry Gallery, Inc. v. Berklene Corp., 134 F.3d 1473, 1479-80, 45 USPQ2d 1498, 1502-04 (Fed. Cir. 1998) (invalidating amended claims not supported by the original application). We therefore uphold the district court's ruling that claim 2 is invalid for failing to satisfy the written description requirement.

### III

TurboCare also challenges the district court's conclusion on summary judgment that none of the accused GE devices infringes claims 1, 5, 6, or 7, either literally or equivalently.

#### A

The first step in the infringement analysis is to determine the meaning and scope of the patent claims asserted to be infringed. TurboCare contests the district court's construction of three terms used in the claims: (1) radial positioning means; (2) large clearance position; and (3) small clearance position.

## Radial Positioning Means

Brandon's independent claim 1 provides in relevant part:

a radial positioning means comprising a compressed spring means biased against said ring segments to forcibly cause said segments to move to said large clearance position, while working fluid which is freely admitted to the annular space between said casing and said ring segments will urge said segments toward said small clearance position, whereby at low speed and small turbine loads the spring forces will predominate, while at high flows and high working fluid pressure the pressure forces will predominate.

Because the term "radial positioning means" uses the word "means," it is presumptively subject to section 112, paragraph 6. Sage Prods., Inc. v. Devon Indus., Inc., 126 F.3d 1420, 1427, 44 USPQ2d 1103, 1109 (Fed. Cir. 1997). However, the claim recites sufficient structure to overcome that presumption.

The claim states that the function of the "radial positioning means" is to position the ring segments "whereby at low speed and small turbine loads the spring forces will predominate, while at high flows and high working fluid pressure the pressure forces will predominate." The claim recites two structures for achieving that function: (1) a compressed spring means and (2) working fluid. The claim also describes how those structures act to achieve the claimed function—the compressed spring means is biased against the ring segment while the working fluid is freely admitted to the space between the casing and the ring segment. As the court explained in the Sage Products case, "where a claim recites a function, but then goes on to elaborate sufficient structure, material, or acts within the claim itself to perform entirely the recited function, the claim is not in means-plus-function format." 126 F.3d at 1427-28, 44 USPQ2d at 1109.

While it is true that the "compressed spring means," which is one of the elements of the "radial positioning means" also uses the term "means," we conclude that it, too, does not invoke section 112, paragraph 6. The claim states that the function of the compressed spring means is "to forcibly cause said segments to move to said large clearance position." The claim then recites structure to achieve that function—a compressed spring biased against the seal ring segment. Although the term "spring" has a functional connotation, a "compressed spring" denotes a type of device with a generally understood meaning in the mechanical arts. See Greenberg v. Ethicon Endo-Surgery, Inc., 91 F.3d 1580, 1583, 39 USPQ2d 1783, 1786 (Fed. Cir. 1996) (construing the term "detent mechanism" as not invoking section 112, paragraph 6, because it is generally understood in the mechanical arts to describe structure). There is nothing in the specification or the prosecution history suggesting that the patentee used the term "compressed spring means" generally to refer to any structure that can perform a biasing function; on the contrary, both the specification and the prosecution history disclose only a type of device denoted as a "spring" or a "compressed spring." In these circumstances, the term "compressed spring means" is not subject to section 112, paragraph 6.

Our decision in Unidynamics v. Automatic Products International, Ltd., 157 F.3d 1311, 48 USPQ2d 1099 (Fed. Cir. 1998), is consistent with the conclusion we reach in this case. In Unidynamics, we concluded that the claim language "spring means tending to keep the door

closed" was in means-plus-function form and therefore governed by section 112, paragraph 6. The specification in Unidynamics stated that a "spring" was only one example of a "spring means," which indicated that the claim term "spring means" was broader than the meaning of the term "spring" generally recognized in the mechanical arts. Thus, we concluded that the patentee in Unidynamics defined spring means functionally as anything that performs a springing or biasing function.

In this case, by contrast, the claim recites a particular kind of spring—a "compressed spring"—and the specification makes clear that the claim term "compressed spring means" was used to denote structure, not function. The preferred embodiment uses S-shaped compressed springs. The specification adds that other types of springs can be employed, but there is no suggestion that the claim was meant to include biasing mechanisms other than springs. Accordingly, we conclude that the patentee in this case has defined "compressed spring" to refer to a particular type of device. Because neither the term "radial positioning means" nor the term "compressed spring means" is subject to section 112, paragraph 6, those limitations are not restricted by the corresponding structures disclosed in the specification and their equivalents.

GE concedes that a flat spring is a type of compressed spring, as that term is generally understood. Nonetheless, GE asserts that Brandon disclaimed the use of flat springs in the course of the prosecution and that flat springs are therefore not covered by the claims.

During prosecution, the examiner rejected Brandon's claims as anticipated by a British patent issued to Warth. Warth's patent specifically disclosed the use of flat (or leaf) springs interposed between the casing shoulder and the inner surface of an outer ring portion of the seal segment. In distinguishing Warth, Brandon stated:

In summary, Applicant's invention is essentially a two-position packing ring system. That is, at low speeds and low loads it is fixed at a large clearance position. When a low, predetermined load, and pressure condition is reached, the ring moves swiftly to its small clearance position. This is a significant distinction over Warth's system that employs leaf springs with nearly frictionless ring segments that gradually allow the ring clearance to lessen as load is increased.

GE argues that this statement disclaims all embodiments employing flat (or leaf) springs.

GE reads too much into the prosecution history. The clear thrust of Brandon's argument was that his invention is a two-position packing ring system, while Warth's invention is a multiple-position packing ring system. Brandon described Warth's invention as including an equalizing passage through the seal segment, which was designed to reduce the axial fluid pressure and allow the space at the top of the seal segment to communicate with the annular space on the low pressure side of the seal segment. According to Brandon, the equalizing passage enabled the Warth seal to assume a medium clearance position as well as a small and large clearance position, which had certain disadvantages that were cured by his two-position seal. Whether or not Warth employed flat springs was irrelevant to that distinction. In fact, in the same response, Brandon added a claim specifically directed to flat springs. The addition of that claim further indicates that Brandon was not disclaiming all embodiments employing flat springs. Instead, it appears that Brandon was simply noting that while Warth's invention used flat springs, it was otherwise distinguishable from the claimed invention. We therefore conclude that the term

"compressed spring means" should be construed to include flat (or leaf) springs, because such springs are within the generally understood meaning of that term and because Brandon did not disclaim such springs or otherwise indicate that a special meaning should be given to the term "compressed spring means."

Finally, GE argues that the "compressed spring means" limitation includes a stricture on the location of the spring. However, there is no such limitation in claim 1. On the contrary, dependent claims 2 and 4 add such a limitation, providing that the springs must either be interposed between the casing shoulders and an inner surface of the outer ring portion of the ring segment, or be interposed between the ends of the ring segments.

The "radial positioning means" limitation of claim 1 also recites the use of "working fluid which is freely admitted to the annular space between said casing and said ring segments." In construing that term, it is appropriate to consider the "for example" language that was added to the specification during prosecution of the '311 patent. Although the district court concluded that the amendment added new matter, the amendment actually added no more than the concept, originally disclosed, that "[v]arious other modifications of the invention may occur to those skilled" in the art. '311 patent, col. 5, ll. 17-18.

With respect to the "working fluid" limitation, GE argues that Brandon disclaimed certain steam pathway configurations when he distinguished the Warth prior art reference. In distinguishing Warth, Brandon stated that "[d]rilled holes above the ring, as used in Warth, are unnecessary since this space already communicates to the upstream pressure by way of slots [cutouts] in the ring and holder." According to GE, that statement disclaims all embodiments that do not employ cutouts in the casing shoulder for steam passage.

Brandon made several arguments to distinguish Warth, including the argument that his invention did not require "drilled holes above the ring." Brandon thus represented to the public in clear and definite terms that his invention did not require any such holes. See Watts v. XL Sys., Inc., 232 F.3d 877, 883, 56 USPQ2d 1836, 1840 (Fed. Cir. 2000) (holding that the patentee limited his invention by arguments made to distinguish the primary reference cited by the examiner). TurboCare cannot now retreat from that position in asserting the Brandon patent against GE. However, Brandon's statement about Warth should not be construed unduly broadly. Brandon characterized his invention as not employing drilled holes above the ring, but he did not characterize it as lacking drilled holes altogether or as requiring local cutouts in the high pressure side of the casing shoulder. Claim 1 requires that steam or working fluid be freely admitted to the annular space between the casing and the ring segments. In accordance with Brandon's characterization of his invention in the course of the prosecution, the "working fluid" limitation should be construed to exclude devices in which steam is admitted to the space between the casing and ring segments through a drilled hole above the ring. But that limitation should not be interpreted to exclude any device in which steam is admitted through a drilled hole, regardless of where the drilled hole is located.

#### Large Clearance Position

The parties also dispute the meaning of the term "large clearance position." Claim 1 provides in relevant part:

each segment of said seal ring including . . . a radially outwardly facing arcuate surface on said seal ring segment which is located opposite to a radially inward

facing arcuate surface of said casing for limiting said large clearance position by contact between said opposing surfaces . . . .

The district court construed the "large clearance position" limitation as requiring that the outward facing surface of the inner ring portion of the seal ring segment touch the inward facing surface of the casing shoulders when the seal is in the large clearance position. TurboCare argues that there is nothing in the specification or prosecution history supporting such a restriction. The plain language of claim 1 requires only contact between an outward facing surface of the seal ring segment and an inward facing surface of the casing. There is no basis for reading a limitation from the preferred embodiment into the language of the claim. See Laitram Corp. v. Cambridge Wire Cloth Co., 863 F.2d 855, 865, 9 USPQ2d 1289, 1299 (Fed. Cir. 1988) ("References to a preferred embodiment, such as those often present in a specification, are not claim limitations."). That is particularly true where another claim restricts the invention in exactly the manner suggested by the district court's narrow claim construction. See Beachcombers v. Wildewood Creative Prods., Inc., 31 F.3d 1154, 1162, 31 USPQ2d 1653, 1659 (Fed. Cir. 1994) (a claim construction rendering a dependent claim superfluous is presumptively unreasonable). While the "large clearance position" certainly encompasses the preferred embodiment, it also encompasses an arrangement in which there is contact between the outward facing surface of the outer ring portion of the seal ring segment (i.e., the top of the seal) and the inward facing surface of the casing groove.

#### Small Clearance Position

The parties dispute the meaning of the terms "small clearance position" and "contact." Claim 1 provides in relevant part:

each segment of said seal ring including . . . an outer ring portion disposed within said seal ring groove for both axial and radial movement therein and having a pair of shoulders, extending axially in opposite directions for making radial contact respectively with said pair of spaced apart shoulders on said casing and thereby limiting said small clearance position . . . .

TurboCare does not dispute that the small clearance position limitation requires contact between the inward facing surface of the outer ring portion of the seal ring segment and the outward facing surface of the casing shoulders. It does dispute, however, the meaning of the term "contact." The district court construed that term as meaning direct contact, i.e. touching. In addition, the district court seemed to indicate that certain types of indirect contact such as indirect contact through "solely passive pads or buffers . . . to adjust the degree of clearance or compensate for wear and tear" would also constitute "contact" as that term is used in the claims of the '311 patent. TurboCare asserts that all indirect contact is "contact" within the meaning of the claims.

TurboCare points to language in the specification in which Brandon referred to "direct contact" between the neck of the seal segment and the casing. '311 patent, col. 2, ll. 62-64. TurboCare argues that this language implies that when Brandon used the term "contact" alone, he must have meant something other than direct contact. The language to which TurboCare directs us,

however, is found in a discussion of the pressure seal that is formed between the neck of the seal segment and the casing as a result of axial fluid pressure. The use of the term "direct contact" to denote a pressure seal does not suggest that when the term "contact" is used elsewhere in the patent it must encompass objects that are in indirect contact, i.e., objects that do not touch one another but have other objects interposed between them. In the absence of a special definition of the term "contact" in the specification, that term should be given its ordinary and accustomed meaning. The district court properly construed the term, according to its ordinary meaning, to mean "touching." Whether so-called "indirect contact" could give rise to infringement is an issue of equivalency.

## B

The second step in the infringement analysis is comparing the properly construed claims to the devices accused of infringing. There are four GE devices accused of infringement: (1) the Original Version, (2) the 1992 N-2 Version, (3) the 1992 Diaphragm Version, and (4) the 1995 Version. The different devices raise different infringement issues.

### The Original Version and the 1992 N-2 Version

These devices do not infringe claim 1 as construed. They both have a drilled hole above the ring to admit steam into the space at the top of the seal segment. As we have discussed, Brandon disclaimed that type of arrangement during prosecution, and it is therefore not within the scope of the claims as properly construed. Nor is the doctrine of equivalents available with a respect to these devices in light of Brandon's express disavowal of coverage. See SciMed Life Sys. v. Advanced Cardiovascular Sys., 242 F.3d 1337, 1345-47, 58 USPQ2d 1059, 1066-68 (Fed. Cir. 2001).

### 1992 Diaphragm Version and the 1995 Version

The remaining two devices, the 1992 Diaphragm Version and the 1995 Version, do not literally infringe claim 1 as construed. The 1992 Diaphragm Version has a drilled hole through the seal segment to admit steam into the space at the top of the seal segment. In distinguishing the Warth patent, Brandon disclaimed only those devices with drilled holes above the ring. Because steam is freely admitted through the drilled hole in the ring segment to the annular space between the casing and the ring segment, and because Brandon did not disclaim that structure, the 1992 Diaphragm Version satisfies the "working fluid" limitation. In addition, the 1992 Diaphragm Version includes a spring means—in this case, flat springs—biased against the ring segments to forcibly cause the segments to move to the large clearance position. That device therefore falls within the literal scope of the radial positioning means limitation.

GE does not contest that the 1992 Diaphragm Version meets the large clearance position limitation, with contact between an outward facing surface of the seal ring segment and an inward facing surface of the casing. It does, however, contend that the device does not meet the small clearance position limitation.

The 1992 Diaphragm Version includes dowels that are attached to the shoulders of the outer ring portion of the seal ring segment. The purpose of the dowels is to accommodate variations in the casing. However, the dowels also prevent the inward facing surface of the outer ring portion of the seal ring segment from touching the outward facing surface of the casing shoulders. Because those two surfaces are not touching, the 1992 Diaphragm Version does

not literally infringe claim 1.

The 1995 Version also does not literally infringe claim 1 as construed. Although it meets the other limitations of claim 1 of the '311 patent, it does not satisfy the small clearance position limitation for the same reasons as the 1992 Diaphragm Version.

TurboCare argues that even if there is no literal infringement, the 1992 Diaphragm Version and the 1995 Version infringe the '311 patent under the doctrine of equivalents. GE counters that the doctrine of equivalents is foreclosed by prosecution history estoppel. Brandon's original independent claim 1 did not include a "contact" limitation, although it did refer to a "small diameter position corresponding to . . . small clearance of the seal ring with regard to the rotating shaft or rotor." In response to a rejection based on the Warth patent, Brandon cancelled that claim and added a new independent claim that specifically defined the "small diameter" or "small clearance" position with reference to contact between certain surfaces. GE argues that Brandon narrowed his claims by virtue of that amendment and that no range of equivalents is therefore available. See Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 234 F.3d 558, 56 USPQ2d 1865 (Fed. Cir. 2000) (en banc), cert. granted, 121 S. Ct. 2519 (2001). However, that is true only if Brandon did in fact narrow the literal scope of his claims. See Festo, 234 F.3d at 587-88, 56 USPQ2d at 1889-90.

The small clearance position limitation was present in the original claim. Although the cancelled claim did not specifically state that the small clearance position was delineated by "contact" between certain surfaces, that was the meaning that the patentee gave the term "small diameter position" in the specification:

As load is increased, the fluid pressure increases proportionately around the rings in such fashion . . . to cause the springs to be compressed and the seal ring segments to move radially inward until restrained by contact at surface 17. The dimensions of the seal ring and surface 17 on the casing are selected to create the smallest clearance between the teeth 14 and the rotor surface determined to be practical for loaded, relatively steady state operation.

'311 patent, col. 3, ll. 15-23 (emphasis added). The specification also states that the seal segment depicted in Figure 1 of the patent is shown in a "small clearance condition." Id., col. 3, ll. 24-25. That figure shows the relevant surfaces touching. Here, the newly added claim only redefined the small clearance position limitation without narrowing the claim. Therefore Festo is not applicable.

Thus, the issue with respect to the doctrine of equivalents is whether the intrusion of the dowels between the casing and the ring segments creates any substantial differences between the claimed invention and the accused devices. In light of our claim construction, it is not clear that TurboCare cannot prevail on its doctrine of equivalents argument by showing that the 1992 Diaphragm Version or the 1995 Version devices is insubstantially different from the claimed invention. We therefore remand to the district court to address TurboCare's doctrine of equivalents argument with respect to GE's 1992 Diaphragm Version and 1995 Version devices.

In summary, we affirm the district court's ruling that claim 2 is invalid for an inadequate written description. We also affirm the court's ruling that neither the Original Version, nor the 1992 N-2 Version infringes claims 1, 5, 6, or 7, literally or under the doctrine of equivalents. We further affirm the district court's ruling that neither the 1992 Diaphragm Version nor the 1995 Version literally infringes claims 1, 5, 6, or 7. We remand the case to the district court to consider whether the 1992 Diaphragm Version or the 1995 Version infringes the '311 patent under the doctrine of equivalents and to consider the validity of claims 1, 5, 6, and 7 in light of our claim construction.

Each party shall bear its own costs for this appeal.

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AFFIRMED IN PART, VACATED IN PART, AND REMANDED.