United States Court of Appeals for the Federal Circuit

AMERICAN AXLE & MANUFACTURING, INC.,
Plaintiff-Appellant

v.

NEAPCO HOLDINGS LLC, NEAPCO DRIVELINES LLC,
Defendants-Appellees

2018-1763

Appeal from the United States District Court for the District of Delaware in No. 1:15-cv-01168-LPS, Chief Judge Leonard P. Stark.

Decided: October 3, 2019

JAMES RICHARD NUTTALL, Steptoe & Johnson, LLP, Chicago, IL, argued for plaintiff-appellant. Also represented by JOHN LLOYD ABRAMIC, KATHERINE H. JOHNSON, ROBERT KAPPERS.

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SCOTT A. M. CHAMBERS, Porzio, Bromberg & Newman,

PC, Washington, DC, for amici curiae Christopher Frerking, Christopher Michael Holman, David Lund, Walter Matystik, Adam Mossoff, Kristen J. Osenga, Michael Risch, Mark F. Schultz, Ted M. Sichelman, Brenda M. Simon, Jonathan Stroud, David O. Taylor. Also represented by MATTHEW ZAPADKA, Bass, Berry & Sims, PLC, Washington, DC.

Before DYK, MOORE, and TARANTO, *Circuit Judges*.

Opinion for the court filed by *Circuit Judge* DYK.

Dissenting opinion filed by *Circuit Judge* MOORE.

DYK, *Circuit Judge*.

American Axle & Manufacturing, Inc. ("AAM") sued Neapco Holdings LLC and Neapco Drivelines LLC (collectively, "Neapco") alleging infringement of claims of U.S. Patent No. 7,774,911 ("the '911 patent").[1] The parties filed cross-motions for summary judgment as to the eligibility of the asserted claims of the '911 patent under 35 U.S.C. § 101. The district court granted Neapco's motion and held that the asserted claims are ineligible under § 101. We agree and therefore affirm.

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[1] AAM's complaint alleged infringement of two other patents—U.S. Patent Nos. 8,176,613 ("the '613 patent") and 8,528,180 ("the '180 patent"). During claim construction, the district court held the asserted claims of the '613 patent indefinite. Neapco Mot. for Summary Judgment at 3, *American Axle & Manuf., Inc. v. Neapco Hldgs. LLC*, No. 15-01168 (D. Del. Aug. 11, 2017), ECF No. 150. AAM also dropped the asserted claims of the '180 patent. *Id.* Neither the '613 nor the '180 patent is at issue on appeal.

BACKGROUND

I

The '911 patent generally relates to a method for manufacturing driveline propeller shafts ("propshafts") with liners that are designed to "attenuat[e] . . . vibrations transmitted through a shaft assembly." '911 patent, col. 1, ll. 6–7. Propshafts are "employed [in automotive vehicles] to transmit rotary power in a driveline." *Id.* col. 1, ll. 38–39. Because these propshafts are typically made of a "relatively thin-walled steel or aluminum tubing [they] can be receptive to various driveline excitation sources." *Id.* col. 1, ll. 40–42. These excitation sources, in turn, can cause the propshaft to vibrate in three modes: bending mode, torsion mode, and shell mode. *Id.* col. 1, ll. 42–44. The '911 patent describes these vibration modes as follows:

> Bending mode vibration is a phenomenon wherein energy is transmitted longitudinally along the shaft and causes the shaft to bend at one or more locations. Torsion mode vibration is a phenomenon wherein energy is transmitted tangentially through the shaft and causes the shaft to twist. Shell mode vibration is a phenomenon wherein a standing wave is transmitted circumferentially about the shaft and causes the cross-section of the shaft to deflect or bend along one or more axes.

Id. col. 1, ll. 44–52. These vibration modes correspond to different frequencies. Because such vibrations cause undesirable noise, "techniques [had, prior to the '911 patent,] been employed to attenuate vibrations in propshafts including the use of weights and liners." *Id.* col. 1, ll. 53–54.

One prior art method of attenuation involved the use of liners. Liners are hollow tubes made of a fibrous material (like cardboard) with outer resilient members that "frictionally engage the inner diameter of the [propshaft]." *Id.* col. 6, ll. 56–65. Liners, like propshafts, vibrate at different

frequencies, and depending on the frequencies at which they vibrate, may damp the vibration of the propshaft into which they are inserted. When certain variables related to the liner are changed (i.e., when the liner is "tuned"), the frequencies at which that liner vibrates, and therefore the liner's ability to damp the vibration of that propshaft, changes. *See, e.g.*, *id.* col. 7–8. It was known in the prior art to alter the mass and stiffness of liners to alter their frequencies to produce dampening. Indeed, this was sufficiently well known that prior art patents disclosed the use of particular materials to achieve dampening. *See, e.g.*, *id.* col. 2, lines 5–37.

Other prior art methods of dampening also existed, including the use of weights. For example, the '911 patent describes plugs or weights that are inserted to frictionally engage a propshaft and act as resistive attenuation means to damp bending mode vibrations. *Id.* col. 1, line 53–col. 2, l. 4. The patent also discloses a prior art damper that is inserted into a hollow shaft and frictionally engages the inside of the shaft by using a pair of resilient members. *Id.* col. 2, ll. 5–10.

Two types of attenuation are relevant here: resistive attenuation and reactive attenuation. "[R]esistive attenuation of vibration refers to a vibration attenuation means that deforms as vibration energy is transmitted through it . . . so that the vibration attenuation means absorbs . . . the vibration energy." *Id.* col. 1, ll. 61–65. A liner that is properly tuned to attenuate shell mode vibration through resistive attenuation "matches" the shell mode vibration (i.e., a particular natural frequency) of the propshaft such that it absorbs the shell mode vibration of the propshaft. J.A. 2000–02. "[R]eactive attenuation of vibration refers to a mechanism that can oscillate in opposition to the vibration energy [of the propshaft] to thereby 'cancel out' a portion of the vibration energy." '911 patent, col. 2, ll. 15–18. Thus, to design a liner to perform reactive attenuation of a bending mode vibration "the liner frequency must match

the propshaft frequency and involve translation of the liner to effectively couple with the propshaft bending mode." AAM Op. Br. 6 (citing J.A. 2076–77, 4036–37, 5218).

The district court treated independent claims 1 and 22 of the '911 patent as representative of the asserted claims (claims 1–6, 12, 13, 19–24, 26, 27, 31, 34–36). Those two claims recite:

> 1. A method for manufacturing a shaft assembly of a driveline system, the driveline system further including a first driveline component and a second driveline component, the shaft assembly being adapted to transmit torque between the first driveline component and the second driveline component, the method comprising:
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> providing a hollow shaft member;
>
> tuning at least one liner to attenuate at least two types of vibration transmitted through the shaft member; and
>
> positioning the at least one liner within the shaft member such that the at least one liner is configured to damp shell mode vibrations in the shaft member by an amount that is greater than or equal to about 2%, and the at least one liner is also configured to damp bending mode vibrations in the shaft member, the at least one liner being tuned to within about ±20% of a bending mode natural frequency of the shaft assembly as installed in the driveline system.
>
> * * *
>
> 22. A method for manufacturing a shaft assembly of a driveline system, the driveline system further including a first driveline component and a second driveline component, the shaft assembly being adapted to transmit torque between the first

> driveline component and the second driveline component, the method comprising:
>
> providing a hollow shaft member;
>
> tuning a mass and a stiffness of at least one liner, and
>
> inserting the at least one liner into the shaft member;
>
> wherein the at least one liner is a tuned resistive absorber for attenuating shell mode vibrations and wherein the at least one liner is a tuned reactive absorber for attenuating bending mode vibrations.

'911 patent, col. 10, ll. 10–27; *id.* col. 11, ll. 24–36 (emphases added). The district court construed the term tuning to mean "controlling the mass and stiffness of at least one liner to configure the liner to match the relevant frequency or frequencies." J.A. 15. No party contests the district court's construction on appeal.

According to the '911 patent's specification, prior art liners, weights, and dampers that were designed to individually attenuate each of the three propshaft vibration modes—bending, shell, and torsion—already existed. '911 patent, col. 1, l. 53–col. 2, l. 38. But these prior art damping methods were assertedly not suitable for attenuating two vibration modes simultaneously. *See id.* Thus, the patent identified "a need in the art for an improved method for damping various types of vibrations in a hollow shaft" that "facilitates the damping of shell mode vibration as well as the damping of bending mode vibration" simultaneously. *Id.* col. 2, ll. 39–43. AAM argues that the inventive concept to which these claims are directed is the tuning of a liner in order to produce frequencies that dampen both the shell mode and bending mode vibrations simultaneously.

AAM urges both that it "conceiv[ed] of the novel and unconventional concept of 'tuning' a liner," and that it

conceived of a tuned liner that "unlike previous dampers and absorbers . . . [can] dampen multiple types of vibration" simultaneously. AAM Op. Br. 13. AAM explains that "particular liners that are specifically tuned to match and damp multiple vibration modes and are utilized to manufacture improved propshafts . . . w[ere] entirely new and far from well-understood" at the time of the '911 patent. AAM Op. Br. 27. Neither the claims nor the specification describes how to achieve such tuning. The specification also discloses a solitary example describing the structure of a tuned liner, but does not discuss the process by which that liner was tuned. '911 patent, col. 8, ll. 4–23.

II

AAM sued Neapco on December 18, 2015, alleging infringement of the '911 patent. The parties filed cross-motions for summary judgment as to patent eligibility under § 101. On February 27, 2018, the district court granted Neapco's motion for summary judgment, and denied AAM's cross-motion, holding that the asserted claims of the '911 patent were invalid because they claim ineligible subject matter under § 101.

The district court concluded that "the Asserted Claims as a whole are directed to laws of nature: Hooke's law and friction damping." J.A. 10. The district court held that the claims' direction to tune a liner to attenuate to different vibration modes amounted to merely "instruct[ing] one to apply Hooke's law to achieve the desired result of attenuating certain vibration modes and frequencies" without "provid[ing] [a] particular means of how to craft the liner and propshaft in order to do so." J.A. 17. Hooke's law is an equation that describes the relationship between an object's mass, its stiffness, and the frequency at which the object vibrates. Friction damping is damping that "occur[s] due to the resistive friction and interaction of two surfaces that press against each other as a source of energy dissipation." J.A. 1604. Because the district court determined

that the claimed "additional steps consist of well-understood, routine, conventional activity already engaged in by the scientific community . . . and those steps, when viewed as a whole, add nothing significant beyond the sum of their parts taken separately," it concluded that the claims were not patent eligible. J.A. 16 (quoting *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 79–80 (2012)).

AAM appeals. We have jurisdiction under 28 U.S.C. § 1291. We review a district court's grant of summary judgement de novo, applying the same test on review that the district court applied. Summary judgment is appropriate where "there is no genuine dispute as to any material fact and the movant is entitled to judgment as a matter of law." Fed. R. Civ. P. 56(a). The issue of patent eligibility under § 101 is a question of law, reviewed de novo. *In re BRCA1– and BRCA2– Based Hereditary Cancer Test Patent Litig.*, 774 F.3d 755, 759 (Fed. Cir. 2014). "While patent eligibility is ultimately a question of law," the underlying issue of "[w]hether something is well-understood, routine, and conventional to a skilled artisan at the time of the patent is a factual determination." *Berkheimer v. HP Inc.*, 881 F.3d 1360, 1369 (Fed. Cir. 2018).

DISCUSSION

Section 101 provides that "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof" may be eligible to obtain a patent. 35 U.S.C. § 101. But the Supreme Court has long recognized that § 101 "contains an important implicit exception: Laws of nature, natural phenomena, and abstract ideas are not patentable." *Ass'n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576, 589 (2013) (brackets omitted) (quoting *Mayo*, 566 U.S. at 70). The Supreme Court has stated that "without this exception, there would be considerable danger that the grant of patents would 'tie up' the use of such tools and thereby 'inhibit

future innovation premised upon them.'" *Id.* (quoting *Mayo*, 566 U.S. at 73).

Our analysis of § 101 follows the Supreme Court's two-step test established in *Mayo* and *Alice Corp. Pty. Ltd. v. CLS Bank International*, 573 U.S. 208 (2014). At step one of the *Mayo/Alice* test, we ask whether the claims are directed to a law of nature, natural phenomenon, or abstract idea. *Alice*, 573 U.S. at 217 (citing *Mayo*, 566 U.S. at 77). If the claims are so directed, we then ask whether the claims embody some "inventive concept"—i.e., whether the claims contain "an element or combination of elements that is 'sufficient to ensure that the patent in practice amounts to significantly more than a patent upon the ineligible concept itself.'" *Id.* at 217–18 (brackets omitted) (quoting *Mayo*, 566 U.S. at 72–73).

I

To determine what the claims are "directed to" at step one, we look to the "focus of the claimed advance." *See, e.g.*, *Trading Techs Int'l, Inc. v. IBG LLC*, 921 F.3d 1378, 1384 (Fed. Cir. 2019).[2] There is no legal principle that a claim to a method of manufacturing cannot be directed to a natural law, nor are there any cases saying so. The '911 patent discloses a method of manufacturing a driveline propshaft containing a liner designed such that its frequencies attenuate two modes of vibration simultaneously.

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[2] *Accord Intellectual Ventures I LLC v. Capital One Fin. Corp.*, 850 F.3d 1332, 1338 (Fed. Cir. 2017); *Intellectual Ventures I LLC v. Erie Indemnity Co.*, 850 F.3d 1315, 1325 (Fed. Cir. 2017); *Affinity Labs of Tex., LLC v. DIRECTV, LLC*, 838 F.3d 1253, 1257–58 (Fed. Cir. 2016); *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1335 (Fed. Cir. 2016); *Genetic Techs. Ltd. v. Merial LLC*, 818 F.3d 1369, 1375–76 (Fed. Cir. 2016).

The claims are directed to tuning liners—i.e., "controlling a mass and stiffness of at least one liner to configure the liner to match the relevant frequency or frequencies." J.A. 15. As is clear from the specification itself, most aspects of the '911 patent were well known in the art. It was known that driveline propshafts were prone to bending, shell, and torsion mode vibrations. '911 patent, col. 1, ll. 38–52. It was known that shell mode vibrations could be damped by resistive attenuation and that bending mode vibrations could be damped by reactive attenuation. *Id.* col. 1, l. 53–col. 2, l. 38. It was also known that a liner or weight could be designed specifically to have a frequency that would allow it to function as either a resistive attenuation means or as a reactive attenuation means. *Id.* AAM does not dispute that these features were known in the art. AAM agrees that the selection of frequencies for the liners to damp the vibrations of the propshaft at least in part involves an application of Hooke's law.

Hooke's law is a natural law that mathematically relates the mass and/or stiffness of an object to the frequency with which that object oscillates (vibrates). Here, both parties' witnesses agree that Hooke's law undergirds the design of a liner so that it exhibits a desired damping frequency pursuant to the claimed invention. For example, Neapco's expert, Dr. Becker, stated that the tuning limitations claim "nothing more than Hooke's law . . . [and/or] the law of nature / natural phenomenon for friction damping." J.A. 1603–05. Dr. Sun, one of the named inventors of the '911 patent, stated in his deposition:

> Q. But to change the frequency of any damper, it comes down to basic physics, doesn't it; changing the mass or the stiffness of that damper that will adjust the frequency?
>
> A. You change a tuned liner, yeah, by adjusting the controlling variables and to get to the tuning that is needed.

Q. And one of those variables is stiffness, correct?

A. Correct.

Q. And one of them is the mass, correct?

A. Yes.

J.A. 1757 (92:15–25). AAM's engineering manager likewise admitted that "if [one] do[es] something to control the stiffness [or mass]" of a liner—the variables directly implicated by Hooke's law—that person is "directly controlling tuning." J.A. 2547 (20:23–21:1). At the same time, the patent claims do not describe a specific method for applying Hooke's law in this context. They simply state that the liner should be tuned to dampen certain vibrations. Thus, the problem is that the claims' instruction to tune a liner essentially amounts to the sort of directive prohibited by the Supreme Court in *Mayo*—i.e. "simply stat[ing] a law of nature while adding the words 'apply it.'" 566 U.S. at 72.

But AAM argues that the claims are not merely directed to Hooke's law. AAM points to testimony suggesting that tuning a liner such that it attenuates two different vibration modes is a process that involves more than simple application of Hooke's law. For example, AAM's expert, Dr. Rahn, testified that a "liner is not a spring with a single stiffness, it is a complex, distributed object with different stiffnesses in different directions (e.g., shell and bending) that depend on the location of the applied force and the measured displacement." J.A. 1928. Dr. Rahn in numerous instances explained that liners are different from a single spring–mass system as they "can bounce, they can rock, they can deform, [and] they can bend." J.A. 2505 (137:2–4). In essence, AAM's argument is that the system of the invention (a driveline propshaft and its liner) is too complex to be described by mere application of Hooke's law, which itself is a simple approximation of a single-degree-of-freedom spring–mass system. AAM also appears to

argue that liners had not previously been used to dampen bending mode—as opposed to shell mode—vibrations.[3]

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[3] Contrary to the dissent at 6–7, the majority does not assert that this point was not disputed on appeal. Although raised on appeal, this argument by AAM was not properly raised below. In the district court, AAM did not make this claim in arguing for § 101 eligibility in any of its relevant summary judgment filings—its motion for summary judgment in its favor, its reply in support of that motion, or its opposition to Neapco's motion for summary judgment. *See* J.A. 4330–36, 5236–37, 6094–96; *see also* J.A. 6194, 7049 (supplemental summary judgment briefings). Instead, in those filings, AAM identified as an inventive concept only the idea of dual-mode dampening we have identified. *See* J.A. 4330–36, 5236–37, 6094–96, 6194. Only at the oral hearing on summary judgment, after the papers that defined the issue were complete, did AAM make this claim—in passing in one sentence, before immediately invoking the dual-mode dampening notion as the inventive concept. J.A. 7193–94.

And the argument is not supported by the patent specification. While noting that certain prior art liners ("[t]hese liners" referenced at col. 2, lines 23–38 of the '911 patent) did not dampen bending mode vibrations, no suggestion that prior art liners generally did not attenuate bending mode vibrations appears in the patent specification; and the specification notes that "the damper of the [1963] '406 patent appears to be a reactive damper for attenuating bending mode vibration." '911 patent, col. 2, lines 13–15 (citing U.S. Patent No. 3,075,406). The '911 specification makes clear that this damper is a "liner" by incorporating the '361 patent "as if fully set forth in its entirety." '911 patent, col. 6, lines 49–53. The incorporated

The problem with AAM's argument is that the solution to these desired results is not claimed in the patent. We have repeatedly held that features that are not claimed are irrelevant as to step 1 or step 2 of the *Mayo*/*Alice* analysis. *Alice*, 573 U.S. at 221 ("[W]e must examine the elements of the claim to determine whether it contains an 'inventive concept.'" (emphasis added)); *Synopsis, Inc. v. Mentor Graphics Corp.*, 839 F.3d 1138, 1149 (Fed. Cir. 2016) ("The § 101 inquiry must focus on the language of the Asserted Claims themselves."); *Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 788 F.3d 1371, 1379 (Fed. Cir. 2015) (rejecting alleged inventive concept because it was "not the invention claimed by the . . . patent" (emphasis added)); *see also Ariosa Diagnostics, Inc. v. Sequenom, Inc.*, 809 F.3d 1282, 1286 (Fed. Cir. 2015) (Lourie, J., concurring) (noting that the appropriate focus is "on the claims we have rather than those we might have had" (emphasis added)).

The elements of the method here that AAM argues take the patent outside the realm of ineligible subject matter—

'361 patent states: "Various kinds of vibration dampers have been proposed heretofore. Typical of such dampers are the liners disclosed in U.S. Patent No[]. . . 3,075,406 . . . ." U.S. Patent No. 4,909,361, col. 1, lines 16–18. Moreover, AAM's own testing data shows that prior art liners did in fact dampen bending mode vibrations, as admitted by Dr. Sun, one of the named inventors of the '911 patent. Patentee's technical expert suggested that certain types of liners have not previously been used to significantly dampen specific modes of vibration. Yet the representative claims are not limited to any type of liner or the dampening of specific bending modes. In any case, it makes no difference to the section 101 analysis whether the use of liners to attenuate bending mode vibrations was known in the prior art.

i.e., the mechanisms for achieving the desired result—are not actually claimed in claim 1 or claim 22 of the patent. To be sure, as AAM indicates in its brief, the process of tuning a liner may involve extensive computer modelling and experimental modal analysis, a process utilized in the prior art. But even the patent specification recites only a nonexclusive list of variables that can be altered to change the frequencies exhibited by a liner and a solitary example of a tuned liner (though not the process by which that liner was tuned).[4] Most significantly, the claims do not instruct how the variables would need to be changed to produce the multiple frequencies required to achieve a dual-damping result, or to tune a liner to dampen bending mode vibrations.

The trial-and-error process for determining the desired frequencies was well-known. AAM makes clear in its opening brief that "methods for determining natural

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[4] The patent discloses a nonexclusive list of variables related to a liner that can be altered to change the frequencies exhibited by the liner so that the liner attenuates certain vibration modes of the propshaft. These variables include:

> mass, length and outer diameter of the liner 204, diameter and wall thickness of the structural portion 300, material of which the structural portion 300 was fabricated, the quantity of resilient members 302, the material of which the resilient members 302 was fabricated, the helix angle 330 and pitch 332 with which the resilient member 302 are fixed to the structural portion 300, the configuration of the lip member(s) 322 of the resilient member 302, and the location of the liners 204 within the shaft member 200.

'911 patent, col. 7, l. 60–col. 8, l. 2.

frequencies and damping are well known in the art," including "testing for natural frequencies and damping of propshafts by performing experimental modal analysis." AAM Op. Br. 8–11. While AAM may have discovered patentable refinements of this process, such as "us[ing] sophisticated FEA [finite element analysis] models during its design process," *id.* at 45, neither the specifics of any novel computer modelling nor experimental modal analysis are disclosed in the patent, much less included in the claims themselves, and these unclaimed features cannot function to remove claims 1 and 22 from the realm of ineligible subject matter. *See ChargePoint*, 920 F.3d at 766. This case might well be significantly different, if, for example, specific FEA models were included in the claims. But, the claims' general instruction to tune a liner amounts to no more than a directive to use one's knowledge of Hooke's law, and possibly other natural laws, to engage in an ad hoc trial-and-error process of changing the characteristics of a liner until a desired result is achieved.

The claiming of a natural law runs headlong into the very problem repeatedly identified by the Supreme Court in its cases shaping our eligibility analysis. *See Mayo*, 566 U.S. at 71–73; *Parker v. Flook*, 437 U.S. 584, 590–95 (1978); *Mackay Radio & Telegraph Co. v. Radio Corp. of Am.*, 306 U.S. 86, 94–101 (1939); *O'Reilly v. Morse*, 56 U.S. (15 How.) 62, 112–17 (1854). As the Supreme Court stated in *Le Roy v. Tatham*, 55 U.S. (14 How.) 156, 174–75 (1853), "[a] patent is not good for an effect, or the result of a certain process, as that would prohibit all other persons from making the same thing by any means whatsoever." The same approach is embodied by this court's case law.[5]

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[5] *See e.g.*, *ChargePoint, Inc. v. SemaConnect, Inc.*, 920 F.3d 759, 769–70 (Fed. Cir. 2019) (finding claims directed to abstract idea where broad claim language "would

This distinction between results and means is fundamental to the step 1 eligibility analysis, including in law-of-nature cases, not just abstract-idea cases. *See Diamond v. Diehr*, 450 U.S. 175, 191 (1981) ("We recognize, of course, that when a claim recites a mathematical formula (or scientific principle or phenomenon of nature), an inquiry must be made into whether the claim is seeking patent protection for that formula in the abstract." (emphasis added)). In *Interval Licensing*, we reiterated the importance of this distinction in describing prior Supreme Court cases in which inventors "lost . . . claim[s] that encompassed all solutions for achieving a desired result" because "the claims

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cover any mechanism for implementing network communication on a charging station" rather than a specific way of doing so); *Interval Licensing LLC v. AOL, Inc.*, 896 F.3d 1335, 1345–46 (Fed. Cir. 2018) (claims ineligible "because they consist of generic and conventional information acquisition and organization steps that are connected to, but do not convert, the abstract idea . . . into a particular conception of how to carry out that concept" (emphasis added)); *Electric Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1355–56 (Fed. Cir. 2016); *see also Innovation Sci., LLC v. Amazon.com, Inc.*, ___ F. App'x ___, 2019 WL 2762976, at *4 (Fed. Cir. 2019) (claim directed to patent ineligible matter where it "s[ought] to capture the broad concept of switching to a more secure server, rather than a specific way to do so"); *Univ. of Fla. Research Found., Inc. v. Gen. Elec. Co.*, 916 F.3d 1363, 1368 (Fed. Cir. 2019) (finding claims to be "directed to an abstract idea" where "[n]either the '251 patent, nor its claims, explains *how* the drivers do the conversion that UFRF points to."); *Two-Way Media Ltd. v. Comcast Cable Commc'ns, LLC*, 874 F.3d 1329, 1337 (Fed. Cir. 2017) ("The claim requires the functional results of 'converting,' 'routing,' 'controlling,' 'monitoring,' and 'accumulating records,' but does not sufficiently describe how to achieve these results in a non-abstract way.").

failed to recite a practical way of applying an underlying idea . . . [and] instead were drafted in such a result-oriented way that they amounted to encompassing 'the principle in the abstract' no matter how implemented." 896 F.3d at 1343; *see also Electric Power*, 830 F.3d at 1355–56 (noting that "the essentially result-focused, functional character of claim language has been a frequent feature of claims held ineligible under § 101"). The same reasoning is applicable here, notwithstanding the fact that the patent here is directed to a natural law rather than an abstract idea.

The Supreme Court's analysis in *Parker v. Flook* reinforces our conclusion that a claim to a natural law concept without specifying the means of how to implement the concept is ineligible under section 101. In *Flook*, the Supreme Court considered the patent eligibility of a method for updating alarm limits during catalytic conversion processes. 437 U.S. at 585. The method involved an initial step of measuring temperature, a second step of using a formula to calculate an updated alarm-limit value, and a final step in which the alarm limit is adjusted to the updated value. *Id.* But the patent "d[id] not purport to explain how to select . . . any of the . . . variables" involved, nor did it "purport to contain any disclosure relating to the chemical process at work, the monitoring of process variables, or the means of setting off an alarm or adjusting an alarm system." *Id.* at 586, 588. The patentee argued that the inventive part of the patent was the mathematical formula used in the second step of the claimed method. *Id.* at 588. The patentee further contended that his claimed invention should be patent eligible because it was limited to a particular process and involved post-solution activity that ensured that the patent did not "wholly preempt [use of] the mathematical formula." *Id.* at 589–90.

Nevertheless, the Court held that the patent contained no patent-eligible invention. *Id.* at 594. The Court explained that "if a claim is directed essentially to a method

of calculating, using a mathematical formula, even if the solution is for a specific purpose, the claimed method is nonstatutory." *Id.* at 595 (quoting *In re Richman*, 563 F.2d 1026, 1030 (C.C.P.A. 1977)). It first noted that limiting the law of nature described in the patentee's mathematical formula to application in a specific process did not transform the subject matter to which the patent was directed into eligible matter. *Id.* at 593. Though the Court went on to state that the use of a mathematical formula or law of nature did not alone make a claim patent ineligible, it explained that what was required was "an inventive application of the principle." *Id.* at 593–94. Such an inventive application, the Court concluded, was not present in the patented method. The process to which the claims were directed (catalytic conversion of hydrocarbons) was well known, as were the use of alarm limits to trigger alarms, repeated recalculation and readjustment of alarm-limit values, and the use of computers for automatic monitoring-alarming. *Id.* at 594. Because the Court found that the purportedly new formula itself was only a mathematical one, which it deemed a "principle" akin for eligibility analysis to an existing natural relationship, *id.* at 589, and given that nothing else in the patent claims exhibited more than conventional pre- and post-solution activity, it concluded that the patent was directed to nonstatutory matter. *Id.* at 594–95.

Diehr, on the other hand, involved a situation in which a patent claimed a new and specific process of molding rubber products "which incorporate[d] in it a more efficient solution of the [Arrhenius] equation" (a natural law). 450 U.S. at 188. Though the Supreme Court in *Diehr* explained that a mathematical formula itself was not patent eligible subject matter, it concluded that the alleged invention claimed in that case was patent eligible. The invention involved a new rubber-curing process with a specific and detailed series of steps (one of which included the use of a natural law) that limited the possibility of preempting the

natural law itself. *Id.* at 187–88, 191–92. In *Diehr*, unlike this case, "[t]hese other steps apparently added to the formula something that in terms of patent law's objectives had significance—they transformed the process into an inventive application of the formula." *Mayo*, 566 U.S. at 81 (discussing *Diehr*, 450 U.S. at 187). Nevertheless, the Court reaffirmed *Flook*'s teaching that "[a] mathematical formula does not suddenly become patentable subject matter simply by having the applicant acquiesce to limiting the reach of the patent for the formula to a particular technological use" nor through the addition of "token postsolution activity." *Diehr*, 450 U.S. at 191–92 & n.14.

Like the claims in *Flook*, the claims of the '911 patent are directed to the utilization of a natural law (here, Hooke's law and possibly other natural laws) in a particular context. As in *Flook*, where the patent did not disclose how variables were measured nor the means by which the alarm system functioned, the claims here do not disclose how target frequencies are determined or how, using that information, liners are tuned to attenuate two different vibration modes simultaneously. The claims here simply instruct the reader to tune the liner—a process that, as explained above, merely amounts to an application of a natural law (Hooke's law) to a complex system without the benefit of instructions on how to do so.[6] The breadth of

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[6] The specification makes this much clear, as it describes tuning in terms of the result achieved, rather than the particular process by which the result is accomplished. For instance, the specification states that "a liner 204 will be considered to be tuned to a relevant frequency if it is effective in attenuating vibration at the relevant frequency." '911 patent, col. 8, ll. 28–31. Later in the same column, the patent gives an example of a "liner [that is] considered to be tuned to a relevant shell mode frequency

these claims is illustrated by AAM's admission during the claim construction hearing that one could infringe the claims of the '911 patent "[e]ven if you didn't try to [tune] and didn't know you did it." J.A. 699.

Finally, though we recognize that AAM may be correct in its assertion that the system involved in the '911 patent is more complex than just a bare application of Hooke's law, and that other laws of nature may be relevant, that does not render the subject matter patent eligible. What is missing is any physical structure or steps for achieving the claimed result of damping two different types of vibrations. The focus of the claimed advance here is simply the concept of achieving that result, by whatever structures or steps happen to work.

The dissent suggests that the failure of the claims to designate how to achieve the desired result is exclusively an issue of enablement. Dissent Op. at 2, 11–14. Both the Supreme Court cases and our cases addressing section 101 have held otherwise, as the earlier discussion demonstrates. Enablement is concerned with whether the "the specification of a patent… teach[es] those skilled in the art how to make and use the full scope of the claimed invention." *In re Wright*, 999 F.2d 1557, 1561 (Fed. Cir. 1993). Section 101 is concerned with whether the claims at issue recite a natural law, not whether the specification has adequately described how to make and use the concretely claimed structures and steps. The Supreme Court in *Mayo* made clear that section 101 serves a different function than enablement. *Mayo*, 566 U.S. at 90 ("[T]o shift the patent-eligibility inquiry entirely to these later [statutory] sections risks creating significantly greater legal

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if it damps shell mode vibrations by an amount that is greater than or equal to about 2%." *Id.* at col. 8, ll. 44–47. This makes clear that the concept of tuning embodied by the patent is merely results-oriented.

uncertainty, while assuming that those sections can do work that they are not equipped to do."). Moreover, even if, as the dissent says, the specification gives one adequately concrete embodiment, which we need not decide, that is not enough: *O'Reilly* established long ago that an inadequately concrete claim is not saved from ineligibility by the presence of adequate concrete recitations in the specification or in other claims. 56 U.S. at 112–20 (holding eighth claim ineligible while upholding first seven claims).

II

As to *Mayo*/*Alice* step 2, nothing in the claims qualifies as an "inventive concept" to transform the claims into patent eligible matter. AAM contends that the claims include numerous inventive concepts that were neither previously known, nor conventional or routine. AAM's arguments in this respect essentially amount to an assertion that prior to the '911 patent, liners had never been tuned to damp propshaft vibrations and, more specifically, liners had not been used to damp two different vibration modes simultaneously. This amounts to no more than an elaborated articulation of its reasons as to why the claims are not directed to a natural law (reasons we have already rejected).

The claimed advance is simply controlling various known characteristics of the liner so as to achieve attenuation of two vibration modes simultaneously, whether that is by changing the mass or thickness of the liner, altering the location of the liner in the propshaft, or modifying any other physical attributes that will produce the claimed dual-attenuation. AAM admits that it was well known "in the automotive industry [to] test for natural frequencies and damping of propshafts by performing experimental modal analysis." AAM Op. Br. 8. As explained above, this direction to engage in a conventional, unbounded trial-and-error process does not make a patent eligible invention,

even if the desired result to which that process is directed would be new and unconventional.

Nor does the direction in claim 1 to "position" the liner within the propshaft add an inventive concept. Under the claim language itself, and as reaffirmed by the district court's now-undisputed construction, positioning is not part of tuning. And even if it were, the specification makes clear that it was well known to position dampers in the propshaft so as to maximize vibration damping. *See, e.g.*, '911 patent, col. 1, ll. 57–60. Notably, AAM does not appear to argue that positioning was more than conventional. In listing alleged inventive concepts in its opening brief, AAM does not include positioning.

The remaining steps of claims 1 and 22, like the steps involved in the *Flook* patent, amount to no more than conventional pre- and post-solution activity. As the Supreme Court made clear in *Flook*, neither such conventional additions, nor the limiting of the use of a natural law or mathematical formula to a particular process suffices to create patent eligibility.[7]

Claims 1 and 22 are not patent eligible.[8]

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[7] AAM does not appear to argue on appeal that the numerical limitations in claim 1 represent an inventive concept. In any event, as explained above, these limitations describe a desired result but do not instruct how the liner is tuned to accomplish that result.

[8] To the extent that AAM's opening summary judgment brief as to § 101 patent eligibility can be understood to argue that there are disputed issues of material fact as to whether the patent discloses an inventive concept, it relies only on Dr. Rahn's testimony that dual-damping of bending mode and shell mode vibrations was new and unconventional. AAM Mot. for Summary Judgment at 8–9,

III

Having determined that independent claims 1 and 22 are not patent eligible under § 101, we need not separately determine eligibility of the dependent claims. The district court found independent claims 1 and 22 collectively representative of all the asserted claims. AAM did not argue before the district court that the dependent claims change the outcome of the eligibility analysis. Nor did AAM make such an argument in its opening brief on appeal. Although at oral argument AAM disagreed that claims 1 and 22 are representative of the others and stated that it never acceded to such a finding, Oral Arg. 30:07–40, it was unable to identify any part of its opening brief that presented such an argument and admitted that it was "not suggesting that the other claims should come out differently," *id.* at 30:40–31:16. We therefore find any such argument waived. *See Affinity Labs*, 838 F.3d at 1256 n.1 (treating certain claims as representative where no meaningful argument made that other claims are materially different); *Electric Power*, 830 F.3d at 1352.

CONCLUSION

Because we conclude that the asserted claims of the '911 patent are directed to ineligible subject matter under § 101, we affirm.

AFFIRMED

COSTS

No costs.

American Axle & Manuf., Inc. v. Neapco Hldgs. LLC, No. 15-01168 (D. Del. Aug. 11, 2017), ECF No. 160. But as addressed in detail above, dual-damping is merely a desired result and, without more, is insufficient to make the '911 patent eligible pursuant to § 101.

United States Court of Appeals for the Federal Circuit

AMERICAN AXLE & MANUFACTURING, INC.,
Plaintiff-Appellant

v.

NEAPCO HOLDINGS LLC, NEAPCO DRIVELINES LLC,
Defendants-Appellees

2018-1763

Appeal from the United States District Court for the District of Delaware in No. 1:15-cv-01168-LPS, Chief Judge Leonard P. Stark.

MOORE, *Circuit Judge*, dissenting.

The majority's decision expands § 101 well beyond its statutory gate-keeping function and the role of this appellate court well beyond its authority. The majority opinion parrots the *Alice/Mayo* two-part test, but reduces it to a single inquiry: If the claims are directed to a law of nature (even if the court cannot articulate the precise law of nature) then the claims are ineligible and all evidence of non-conventionality will be disregarded or just plain ignored. The majority rejects the notion that claims which contain an "inventive concept" survive the gatekeeper. In the words of the majority, "it makes no difference to the section 101 analysis whether the use of liners to attenuate bending

mode vibration was known in the prior art." Maj. at 13. I am deeply troubled by the majority's disregard for the second part of the *Alice/Mayo* test, its fact finding on appeal and its repeated misrepresentation of the record, in each instance to the patentee's detriment; all when we are to be applying the summary judgment standard no less.

The majority's concern with the claims at issue has nothing to do with a natural law and its preemption and everything to do with concern that the claims are not enabled. Respectfully, there is a clear and explicit statutory section for enablement, § 112. We cannot convert § 101 into a panacea for every concern we have over an invention's patentability, especially where the patent statute expressly addresses the other conditions of patentability and where the defendant has not challenged them.

The district court held that the claims at issue are ineligible under § 101 because they are directed to a natural law, specifically, "applications of Hooke's law with the result of friction damping." J.A. 11. Even the majority does not agree with the district court that the claims are directed to Hooke's Law. Instead the majority concludes that the claims are ineligible because they are "directed to the utilization of a natural law (here, Hooke's law *and possibly other natural laws*) in a particular context." Maj. at 19; *see also* Maj. at 20 ("though we recognize that AAM may be correct in its assertion that the system involved in the '911 patent is more complex than just a bare application of Hooke's law, *and that other laws of nature may be relevant*, that does not render the subject matter patent eligible"). Section 101 is monstrous enough, it cannot be that now you need not even identify the precise natural law which the claims are purportedly directed to. The "focus of the claimed advance," as repeatedly alleged by the patentee, is to use liners (a physical liner) positioned inside a drive shaft to reduce shell mode vibration and bending mode vibration. The claims at issue are directed to methods of manufacturing shaft assemblies for driveline systems for

automotive vehicles using liners to reduce specific types of vibration. *See* '911 Patent Claims. Claim 1, for instance, recites:

> A method for manufacturing a shaft assembly of a driveline system, the driveline system further including a first driveline component and a second driveline component, the shaft assembly being adapted to transmit torque between the first driveline component and the second driveline component, the method comprising:
>
> providing a hollow shaft member;
>
> tuning at least one liner to attenuate at least two types of vibration transmitted through the shaft member; and
>
> positioning the at least one liner within the shaft member such that the at least one liner is configured to damp shell mode vibrations in the shaft member by an amount that is greater than or equal to about 2%, and the at least one liner is also configured to damp bending mode vibrations in the shaft member, the at least one liner being tuned to within about ±20% of a bending mode natural frequency of the shaft assembly as installed in the driveline system.

As the patentee argues, the dependent claims further narrow the physical characteristics of the liners to be used and their positioning within the drive shaft: "Several dependent claims, for example, recite particular liner materials (e.g., cardboard or paperboard) and structures (helically-wrapped resilient member). . . . claims 12, 13, 19, 26, 27,

31." Appellant's Reply Br. at 27.[1] I do not see how these claims are directed to a natural law. And even if part one of the *Alice/Mayo* test was satisfied here, there is a part two. The claims will not be held ineligible (remember § 101 is meant to be a gatekeeper) if the claims contain an "inventive concept." There are ***many*** here, articulated in the claims themselves, about which there exist at least questions of fact which should have precluded summary judgment. Argued below, and throughout the briefing on appeal and during oral argument to this panel, the patentee maintains that liners had never before been used to reduce bending mode vibration. *See* Appellant's Br. at 12, 25–26, 27, 35, 57–60, 63, and 65 n.5; Appellant's Reply Br.

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[1] I do not agree with the majority's conclusion that claims 1 and 22 are representative. First, Neapco never argued that claims 1 and 22 should be representative and in fact argued the dependent claims separately. *See* Dkt. 150 (Neapco's Mot. for Summ. J.) at 32–33. Second, AAM expressly argued that they are not representative. AAM's statement that the dependent claims should not come out differently does nothing more than confirm that it believes *all* of the claims are patent-eligible. Third, the majority inaccurately states the patentee did not argue limitations of the dependent claims. AAM's briefs provide multiple references to the type of material and other limitations found only in the dependent claims as providing the inventive concepts which are not routine or conventional. *See, e.g.*, Appellant's Br. at 13–14, 36, 57–58, and 64–65. Merely by way of example, dependent claim 31 limits the material for the liner to cardboard among others. AAM claimed using a "cardboard liner to reduce bending mode vibrations" was an "inventive concept" and not "conventional or routine." *Id.* at 57–58. It is inappropriate in light of these facts for the majority to sua sponte declare the claims representative and ignore the expressly argued dependent claims and limitations.

at 2, 15 ("Prior art liners were used to provide general broadband damping of shell mode vibrations, *but liners were not used to dampen bending mode vibrations prior to the claimed invention*."), 19 ("It was inventive to use a liner to damp bending mode vibrations"), 24–25, and 29. The argument that liners were never before used to attenuate bending mode vibrations was AAM's first and one of its strongest non-conventionality arguments. AAM's opening brief set this forth on the very first page of its step-two argument:

> 1. The Claims Contain Inventive Concepts and Are Not Conventional or Routine
>
> * * *
>
> [T]he asserted claims include at least the following inventive concepts:
>
> - **using a cardboard liner to reduce bending mode vibrations**;
> - using a cardboard liner to reduce bending and shell mode vibrations;
> - tuning a cardboard liner by controlling its characteristics;
> - controlling the characteristics of a cardboard liner such that it matches and damps bending mode vibrations;
> - controlling the characteristics of a cardboard liner such that it damps bending mode vibrations by oscillating in opposition to a specific propshaft bending mode frequency; and
> - controlling the characteristics of a cardboard liner such that it matches and damps vibration of multiple different types of propshaft vibration, e.g., both bending and shell mode vibrations.

Appellant's Br. at 57–58.

The majority rejects this "inventive concept" in its § 101 analysis, first as inaccurate (a fact finding made by the majority on appeal and contrary to all the evidence of record) and second as irrelevant. Let's begin with the majority's claim that the patent itself discloses the use of liners to reduce bending mode vibration: "According to the '911 patent's specification, prior art liners, weights, and dampers that were designed to individually attenuate each of the three propshaft vibration modes—bending, shell and torsion—already existed." Maj. at 6. And again, citing the patent, the majority claims, "It was also known that a liner or weight could be designed specifically to have a frequency that would allow it to function as either a resistive attenuation means [shell mode vibration] or as a reactive attenuation means [bending mode vibration]. AAM does not dispute that these features were known in the art." Maj. at 10. These statements are false.

The patent admits that liners had been used to reduce shell mode vibration. '911 patent at 2:23–36. It then states: "These liners, however, do ***not*** appear to be suitable for bending mode vibration or torsion mode vibration." *Id.* at 2:36–38. The patent discloses prior use of plugs, weights, and dampers to attenuate bending mode vibrations, but stresses that liners were not suitable. The patentee explained that before the '911 patent, liners were not used, car manufacturers shoved masses of wadded up cardboard into the propshaft to reduce bending vibrations. Oral Arg. 6:46–7:11. More than a dozen times in the briefs and during oral argument the patentee argued that the use of liners to attenuate bending mode vibration was one of its inventive concepts. Without regard for the arguments made, the majority declares "AAM does not dispute that these features were known in the art." Maj. at 10. Yes, it

certainly did dispute this more than a dozen times.[2] In fact, AAM's counsel corrected the court when a member of the majority tried to suggest that liners to attenuate bending mode were known in the prior art:

> Judge: "None of that is new, there were liners, there were changes to the liners to make them dampen, right? That was not new."
>
> AAM: "The liners had never been used to damp bending mode."

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[2] In a footnote, the majority suggests that while the patentee made the argument throughout its briefing and argument on appeal, it was not properly raised below. Maj. at 12 n.3. There is no doubt the district court understood the argument as having been made and Neapco did not argue otherwise:

> THE COURT: "So what is it that is not conventional in the claims other than the application of Hooke's law?
>
> MR. NUTTALL: Tuning a liner to target a specific bending mode was new and different and nobody thought you could do that or should do that before, much less coupling that with also being tuned to a shell mode vibration."

The majority stops short of saying that it deems the argument waived, and in fact then decides the fact question which was disputed in the briefs before us by the parties. The majority likely does not find the argument waived because Neapco never alleges it was waived and it is axiomatic that one can waive waiver. *See, e.g.*, *Norwood v. Vance,* 591 F.3d 1062, 1068 (9th Cir. 2010) (It is "well-established" that a party can "'waive waiver' implicitly by failing to assert it.").

Oral Arg. 6:46–49. Even Neapco acknowledged that the patent states that liners had not been used to attenuate bending mode vibrations. *See* Appellee's Br. at 8. Neapco never disputed the patentee's claim that liners had never been used to dampen bending mode vibration. It matters not at all to the majority that the patentee alleges that liners had not been used to reduce bending mode vibration, and that Neapco presented no argument or evidence to contradict that. The majority has decided to make its own fact finding that prior art liners had been used. The majority finds that U.S. Patent No. 3,075,406, never introduced as evidence in this case or cited by either party, which discloses a rigid cylindrical metal bar with two circular ends resembling a metal dumbbell—is a liner. Thus, according to the majority, there is at least one liner in a single prior art patent which was used to reduce bending mode. This is a fact question, nobody argued it, and reasonable minds could disagree over whether a dumbbell is a liner. Moreover, a disclosure in a single patent does not establish that the use of liners to attenuate bending mode vibration was "well-understood, routine, conventional activity" as required by the Supreme Court.

Doubling down, the majority then claims that the patentee's own testing proved that prior art liners "did in fact dampen bending mode vibrations." Maj. at 13. I fail to see how the patentee's invention that liners could be used, the very invention for which they have obtained patent protection, supports the majority's finding that liners were known in the prior art to be used to reduce bending mode vibration. To be clear, there is no record evidence that liners had been used to dampen bending mode vibration much less that the use of liners to dampen bending mode vibration was routine and conventional. The patentee argued throughout that one of the inventive concepts present in every single claim of the patent was the novel use of liners to reduce bending mode vibration. Ultimately, the majority says the inventive concept "makes no difference to the

section 101 analysis." Maj. at 13. I understand this to be an outright rejection of the second step of the *Alice/Mayo* test. The majority explains: "Section 101 is concerned with whether the claims at issue recite a natural law, not whether the specification has adequately described how to make and use the concretely claimed structures and steps." Maj. at 21. This statement of law is just plain wrong. Missing is any recognition that the *Alice*/*Mayo* test is a two-part test and that the second step has meaning. The concretely claimed structures and steps, as in these claims, are exactly what can move the claim from ineligible to eligible by virtue of step 1 or step 2.

There are additional alleged "inventive concepts" which I will briefly mention. The claims include limitations which get progressively more detailed about the structure and positioning of the liner inside the drive shaft. The patentee argues throughout that the position of the liner inside the shaft (an express claim element) is one of the characteristics to be controlled in attenuating bending mode vibration. *See* Appellant's Br. at 14, 36, 42, and 65. The patentee alleges throughout that the concept of tuning a liner, i.e. controlling the characteristics of a liner to dampen vibration of any given system is an inventive concept. *See id.* at 27–28, and 57–67; Appellant's Reply Br. at 2, 16, and 18–29. The particular characteristics of the tuned liner will depend on the characteristics of the drive shaft it is being used in (for example the natural frequencies, which are inherent properties of each shaft).[3] *See* '911 patent at 7:44–55; Appellant's Br. at 4, 6, 46, and 53**.**

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[3] And the '911 patent's specification explains how to tune liners to attenuate those vibrations. For example, the specification explains that different characteristics of the liners are controlled corresponding to the structure of the propshaft. '911 patent at 7:56–8:43. It even provides a

The majority claims: "What is missing is any physical structure or steps for achieving the claimed result of damping two different types of vibration. The focus of the claimed advance here is simply the concept of achieving that result, by whatever structures or steps happen to work." Maj. at 20. The "focus of the claimed advance," as repeatedly alleged by the patentee and as expressly claimed, is to insert a liner (a concretely identified physical liner) inside a drive shaft to reduce shell mode vibration and bending mode vibration. *See*, *e.g.*, claims 1 & 22. The dependent claim limitations further narrow this "identified physical structure." Claims limit the material from which the liner can be made, for example, cardboard. *See* claims 19 & 31. Other claims limit the physical structure of the liner itself. It can extend helically (claims 13 & 27) or longitudinally (claims 14 & 28) or circumferentially (claims 15 & 29). The liner includes a "plurality of fingers" (claims 18 & 33). And the claims limit where the liner can be placed within the shaft. Claim 20 for example requires the liner to be positioned within the shaft symmetrically about a bending anti-node. It is remarkable that the majority thinks that claims with all of these very physical, very concrete, very structural limitations are nonetheless "missing any physical structure or steps." It is not, as the majority claims, "whatever structures or steps happen to work." Maj. at 20. It is a physical liner positioned inside the shaft.

The tuned liner element is the crux of what bothers the majority in this case. The majority's true concern with these claims is not that they are directed to Hooke's Law (because this is clearly a much more complex system not limited to varying mass and stiffness), but rather the patentee has not claimed precisely *how* to tune a liner to dampen both bending and shell mode vibrations. As the

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particular example of tuned liners for use in a propshaft with specific dimensions. *Id.* at 8:2–23.

following quotes from the majority demonstrate, their problem with these claims is not one of eligibility, but rather one of enablement:

- "Most significantly, the claims do not instruct *how* the variables would need to be changed to produce the multiple frequencies required to achieve a dual-damping result." Maj. at 14–15.
- "[T]he claims' general instruction to tune a liner amounts to no more than a directive to use one's knowledge of Hooke's law, and possibly other natural laws, to engage in an ad hoc trial-and-error process of changing the characteristics of a liner until a desired result is achieved." Maj. at 15.
- "The claims here simply instruct the reader to tune the liner . . . without the benefit of instructions on *how* to do so." Maj. at 19–20.
- "The problem is it really doesn't tell you how to do it, right? It says 'do tuning,' but it doesn't tell you *how* to do the tuning." Oral Arg. at 1:35–42 (Judge).
- "Looking at this patent, you couldn't tell how to do it. Someone skilled in the art wouldn't know *how* to do it. You would need additional information, right?" Oral Arg. at 2:09–2:16 (Judge).
- "That is just a statement of the result, it doesn't tell you *how* to do it . . . it doesn't tell you *how* to change the variables, right?" Oral Arg. at 5:50–6:15 (Judge).
- "Basically it is done by trial-and-error. You start with a computer program and then you do trial and error to come to the correct result, right?" Oral Arg. at 12:04–11 (Judge).

- "The real question here is do we have anything more than a result? Even if you use all of these different variables, it doesn't really tell you *how* to use the variables. And that's the problem." Oral Arg. at 21:40–22:20 (Judge).
- "The more variables there are, the more difficult it is to know how to do it, and the more guidance that's needed, and there is none as to the use of all these variables other than just use a lot of variables and figure it out." Oral Arg. at 27:10–23 (Judge).
- "The claims themselves don't even provide you with a list of variables, there are a lot of different variables, done by trial and error, and all the claims are telling you is here is a desirable result and use trial and error to get there." Oral Arg. at 29:20–36 (Judge).
- "At least what I am listening for, and I have been focused on throughout this is . . . is it only make and place a liner so that two damping effects occur, you figure out how? That seems to me kind of the question that we are struggling with." Oral Arg. at 35:17–38 (Judge).

"[T]o be enabling, the *specification* of a patent must teach those skilled in the art how to make and use the full scope of the claimed invention without 'undue experimentation.'" *See Genentech, Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1365 (Fed. Cir. 1997). There is undue experimentation when "the trial and error required to practice the claimed invention could be unduly laborious." *Old Town Canoe Co. v. Confluence Holdings Corp.*, 448 F.3d 1309, 1320 (Fed. Cir. 2006). And whether undue experimentation is required is a question of fact. *Transocean Offshore Deepwater Drilling, Inc. v. Maersk Contractors USA, Inc.*, 617 F.3d 1296, 1305 (Fed. Cir. 2010). The majority faults the '911 patent because the claims themselves fail to

describe "how to achieve such tuning." Maj. at 7. The majority concludes, apparently de novo, that too much "trial and error" would be required to determine how to tune a particular liner to the frequencies associated with a given propshaft. The majority advises that if the claims had themselves mentioned using computer modeling to determine how to tune the liner, it may have made all the difference. Yet, earlier the majority explains that such computer modeling and experimental modal analysis was already used in the prior art. How does adding a limitation to the claims to "use a computer program to figure out how to tune the liners" alleviate the majority's concern that these claims are directed to a natural law? Surely, this is the first time adding software to a claim would make it eligible. The majority acknowledges that there is a very specific example given in the patent with precise dimensions, weights, lengths, materials, positioning, etc. *See* '911 patent at 8:2–23. Whether this disclosure combined with the knowledge of a skilled artisan would permit that skilled artisan to tune a liner to a given propshaft in order to reduce bending mode vibrations without undue experimentation is exactly and precisely the enablement test pursuant to § 112. A patentee's failure to enable his invention renders the claims invalid under § 112, it does not, however, render the claims ineligible under § 101. The '911 patent claims include a concretely identified physical structure—a liner inserted inside the propshaft—to reduce vibrations. According to the majority, it is not enough that a skilled artisan reading the specification would know how to tune a liner to the frequency of any given propshaft—the claims themselves must recite these steps. To be clear, according to the majority, even if these claims are enabled, they are still ineligible because the claims themselves didn't teach *how*. This is now the law of § 101. The hydra has grown another head.

Today, the majority concludes that the '911 patent claims are not eligible because they do not teach a skilled

artisan *how* to tune a liner. The majority holds that they are directed to some unarticulated number of possible natural laws apparently smushed together and thus ineligible under § 101. The majority concludes that the inventive concepts "make no difference." Section 101 simply should not be this sweeping and this manipulatable. It should not be used to invalidate claims under standards identical to those clearly articulated in other statutory sections, but not argued by the parties. It should not subsume § 112. It should not convert traditional questions of fact (like undue experimentation) into legal ones. The majority's validity goulash is troubling and inconsistent with the patent statute and precedent. The majority worries about result-oriented claiming; I am worried about result-oriented judicial action. I dissent.