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.

OPINION ISSUED: October 3, 2019
OPINION MODIFIED: July 31, 2020*

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

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* This opinion has been modified and reissued following a petition for rehearing filed by Appellant.

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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.

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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 Summ. J. 3, *American Axle & Manuf., Inc. v. Neapco Hldgs. LLC*, No. 15-01168 (D. Del. Aug. 11, 2017), ECF No. 164. AAM also withdrew the asserted claims of the '180 patent. *Id.* Neither the '613 nor the '180 patent is at issue on appeal.

§ 101. The district court granted Neapco's motion and held that the asserted claims are ineligible under § 101. We affirm in part and vacate and remand in part.

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.

AAM agreed that "[t]he methods for determining natural frequencies and damping are well known in the art."

AAM Op. Br. 8. Some of these are described in the specification. Those techniques include "the use of weights and liners." *Id.* col. 1, l. 54. Elaborating, the patent first describes the use of "plugs or weights" that are inserted to frictionally engage a propshaft to damp certain vibrations. *Id.* col. 1, l. 53–col. 2, l. 4. It then describes several prior-art dampers and "hollow liners." *See, e.g.*, *id.* col. 2, ll. 5–37; col. 6, ll. 49–53. The specification describes prior art hollow liners as 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.

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, through friction damping, the shell mode vibration of the propshaft. J.A. 1933, 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).

According to the '911 patent's specification, prior art weights, dampers, and hollow liners 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 invention is the tuning of a liner in order to produce frequencies that dampen both the shell mode and bending mode vibrations simultaneously. It argues as well on appeal that the use of liners to dampen bending mode vibration is itself inventive.

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 methods of manufacturing:

> 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;
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> tuning at least one liner to attenuate at least two types of vibration transmitted through the shaft member; and
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> 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.

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. Applying the two-step analysis of *Mayo Collaborative Services v. Prometheus Laboratories, Inc.*, 566 U.S. 66 (2012), and *Alice Corp. Pty. Ltd. v. CLS Bank International*, 573 U.S. 208 (2014), the court held that the asserted claims of the '911 patent are invalid because they claim ineligible subject matter under § 101.

The district court construed the claim 1 limitation "tuning at least one liner to attenuate at least two types of vibration transmitted through the shaft member" to mean "controlling characteristics of at least one liner to configure the liner to match a relevant frequency or frequencies to reduce at least two types of vibration transmitted through the shaft member." J.A. 1046. The district court construed the claim 22 limitation "tuning a mass and a stiffness of at least one liner" 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, 1047. No party contests the district court's construction on appeal.

At step 1 of the *Mayo/Alice* analysis, the district court concluded that the Asserted Claims, "considered as a whole," are "directed to the mere application of Hooke's law," treating claims 1 and 22 as representative. J.A. 4–5, 11. The district court held that the claims' direction to tune a liner to attenuate 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. The district court made no distinction between claims 1 and 22 in its analysis. *See* J.A. 15 n.3.

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 a natural phenomenon whereby damping "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.

At step 2 of the *Mayo/Alice* analysis, 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." J.A. 16 (quoting *Mayo*, 566 U.S. at 79–80). The district court concluded that the claims were not patent eligible. *Id*.

AAM appeals. We have jurisdiction under 28 U.S.C. § 1295(a)(1). We review a district court's grant of summary judgment 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), *cert. denied*, 140 S.Ct. 911 , 2020 WL 129532 (Jan. 13, 2020).

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*. 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).

We conclude that independent claim 22 of the '911 patent is patent ineligible under section 101 because it simply requires the application of Hooke's law to tune a propshaft liner to dampen certain vibrations. Independent claim 36 and asserted claims that depend from claim 22 are also ineligible. Because claim 1 also requires "positioning" in addition to tuning and may reflect a broader definition of tuning, we remand to the district court to address the eligibility of claim 1 and its dependent claims in the first instance.

I. CLAIM 22

We first address claim 22.

A

To determine what a claim is "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] A claim to a method of manufacturing

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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);

can be directed to a natural law.[3] The '911 patent claims a method of manufacturing a driveline propshaft containing a liner designed such that its frequencies attenuate two modes of vibration simultaneously and (according to the patentee on appeal) a manufacturing method to tuning liners to attenuate bending mode vibration. At step 1, the question is whether the claimed methods are directed to laws of nature.

The Supreme Court's cases focus on the claims, not the specification, to determine section 101 eligibility. As the Supreme Court said in *Mayo*: "We must determine whether the claimed processes have transformed these unpatentable natural laws into patent-eligible applications of those laws." *Mayo*, 566 U.S. at 72 (emphasis added); *see also Alice*, 573 U.S. at 221 ("[W]e must examine the elements of the claim to determine whether it contains an 'inventive

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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).

[3] *See Alice Corp. v. CLS Bank Int'l*, 573 U.S. 208, 224 (2014) ("The fact that a computer 'necessarily exist[s] in the physical, rather than purely conceptual, realm,' is beside the point. There is no dispute that a computer is a tangible system (in § 101 terms, a 'machine') . . . ."); *O'Reilly v. Morse,* 56 U.S. (15 How.) 62, 113 (1853) ("Neither could the man who first discovered that steam might, by a proper arrangement of machinery, be used as a motive power to grind corn or spin cotton, claim the right to the exclusive use of steam as a motive power for the purpose of producing such effects."); *ChargePoint, Inc. v. SemaConnect, Inc.*, 920 F.3d 759, 770 (Fed. Cir. 2019), *cert. denied*, 140 S. Ct. 983 (2020) ("[A]s the Supreme Court indicated in *Alice*, whether a device is 'a tangible system (in § 101 terms, a "machine")' is not dispositive." (quoting *Alice*, 573 U.S. at 224)).

concept.'" (emphasis added) (internal quotation marks omitted)).

Similarly, we have repeatedly held that features that are not claimed are irrelevant as to step 1 or step 2 of the *Mayo*/*Alice* analysis. *See*, *e.g.*, *ChargePoint*, 920 F.3d at 769 ("[A]ny reliance on the specification in the § 101 analysis must always yield to the claim language. . . . [T]he specification cannot be used to import details from the specification if those details are not claimed."); *Synopsys, 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 an alleged inventive concept because it was "not the invention claimed by the . . . patent" (emphasis added)); *Accenture Glob. Servs., GmbH v. Guidewire Software, Inc.*, 728 F.3d 1336, 1345 (Fed. Cir. 2013) ("[Where t]he limitations of the . . . claims . . . do not provide sufficient additional features or limit the abstract concept in a meaningful way[,] . . . the level of detail in the specification does not transform a claim reciting only an abstract concept into a patent-eligible system or method."); *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)).

In contrast to a number of other natural law cases, the patentee here does not even claim to have discovered a previously unknown natural law. Instead, it defines a goal ("tuning a liner" to achieve certain types of vibration attenuation). Claim 22 explicitly provides for "tuning a mass and a stiffness of at least one liner." '911 patent, col. 11, l. 31. Under the district court's construction, "tuning a mass and a stiffness of at least one liner" in claim 22 means "controlling the mass and stiffness of at least one liner to configure the liner to match the relevant frequency or frequencies." J.A. 15, 1047. Thus, claim 22 requires use of a

natural law of relating frequency to mass and stiffness—i.e., Hooke's law. Claim 22 confers patent coverage if the attenuation goal is achieved by one skilled in the art using any method, including any method implemented by computer modeling and trial and error. That claim 22 here merely describes a desired result is evident from the face of the claim. The claim on its face does not identify the "particular [tuned] liners" or the "improved method" of tuning the liners to achieve the claimed result. AAM Op. Br. 27; '911 patent, col. 2, ll. 39–43. No factual finding was or is required.

In arguing that patent claim 22 does not merely claim a result and so is not directed to whatever natural laws make the result possible, AAM does not dispute that Hooke's law mathematically relates the mass and/or stiffness of an object to the frequency with which that object oscillates (vibrates). In fact, 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 phrase 'tuning a mass and a stiffness of at least one liner' claims Hooke's law." J.A. 1604. 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).

Rather, AAM asserts that tuning a liner such that it attenuates two different vibration modes (or just dampens bending mode vibrations) is complicated in practice, involving more than simple application of Hooke's law. AAM Op. Br. 19 ("Complicated objects—such as propshaft liners—cannot be simplified to a single degree-of-freedom mass-spring damper such that their behavior is governed simply by Hooke's law."); *see also id.* at 39–41, 43. AAM insists that the process of tuning a liner according to natural laws may involve extensive computer modelling, including finite element analysis ("FEA"), and experimental modal analysis (that is, trial and error).[4] And while recognizing that "methods for determining natural frequencies and damping are well known in the art," including use of "FEA models" and "testing for natural frequencies and damping of propshafts by performing experimental modal analysis," AAM Op. Br. 8–11, 20–21, AAM contends that it invented an improved method of tuning.[5]

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[4] "Experimental modal analysis involves [physically] exciting the propshaft and/or liner using an actuator, measuring the response using a sensor, and calculating the natural frequencies and damping ratios using a computer algorithm." J.A. 5207.

[5] While the patent makes no references to computer modeling and trial and error, AAM pointed to computer modeling in its briefing in the district court, *see* note 4, *supra*, and it has done the same in its briefs in this court. *See,*

But neither established processes nor "improved" processes for implementing the underlying natural laws are claimed. While AAM may have discovered patentable refinements of the prior art process, such as particular uses of "sophisticated FEA [finite element analysis] models during its design process," *id.* at 45, neither the specifics of any novel computer modelling, nor the specifics of any experimental modal analysis are included as limitations in claim 22.[6] These unclaimed features cannot function to remove claim 22 from the realm of ineligible subject matter. *See ChargePoint*, 920 F.3d at 766.

To be clear, we do not suggest that such specific novel computer or experimental processes could not be claimed. This case would be significantly different, if, for example, specific FEA models were included in claim 22. But they

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e.g., AAM Op. Br. 20 ("American Axle uses 'very sophisticated FEA models.'" (quoting Dr. Sun, one of the named inventors of the '911 patent)) *id.* at 45 ("American Axle . . . uses sophisticated FEA models during its design process . . . ."); Reply Br. 12 ("Dr. Sun's cited testimony . . . concerned the use of FEA analysis . . . to simplify otherwise complex liners to model and predict their performance.").

[6] The specification 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 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. The specification's concept of tuning is merely results-based.

are not. What is missing is any physical structure or steps for achieving the claimed result. The focus of the claimed advance here is simply the concept of achieving that result, by whatever structures or steps happen to work.

The breadth of claim 22 is illustrated by the testimony of AAM's expert "that tuning involves controlling the characteristics (e.g., mass and stiffness) of the liner through, for example, its design, manufacturing, and installation to reduce vibration at a relevant frequency," J.A. 169, and by AAM's admission during the claim construction hearing, where AAM argued one could infringe claim 22 of the '911 patent by whatever means will achieve the result "[e]ven if you didn't try to [tune] and didn't know you did it." J.A. 699. Thus, the problem is that claim 22's instruction to tune a liner essentially amounts to simply claiming a result.

B

Claiming a result that involves application of a natural law without limiting the claim to particular methods of achieving the result runs headlong into the very problem repeatedly identified by the Supreme Court in its cases shaping 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 (1853). The Supreme Court has long held that claims that state a goal without a solution are patent ineligible. As early as *Le Roy v. Tatham*, 55 U.S. (14 How.) 156 (1852), the Court held that claiming a concept without the particular steps of carrying it out "would prohibit all other persons from making the same thing by any means whatsoever," and that such claims are ineligible for patentability. *Id.* at 174–75; *Corning v. Burden*, 56 U.S. 252, 268 (1853) ("It is for the discovery or invention of some practicable method or means of producing a beneficial result or effect, that a patent is granted, and not for the result or

effect itself."), quoted by *Diamond v. Diehr*, 450 U.S. 175, 182 n.7 (1981).

Our cases as well have consistently rejected such claims as unpatentable. As "reflected repeatedly in our cases," to avoid ineligibility, a claim must "ha[ve] the specificity required to transform [the] claim from one claiming only a result to one claiming a way of achieving it." *SAP Am., Inc. v. InvestPic, LLC*, 898 F.3d 1161, 1167 (Fed. Cir. 2018) (collecting cases).[7] Similarly, in *Interval Licensing*

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[7] *Affinity Labs of Texas, LLC v. DIRECTV, LLC*, 838 F.3d 1253, 1258 (Fed. Cir. 2016) (claim is an ineligible abstract idea because "[t]here is nothing in the claim that is directed to how to implement out-of-region broadcasting on a cellular telephone"); *Apple, Inc. v. Ameranth, Inc.*, 842 F.3d 1229, 1241 (Fed. Cir. 2016) (claims found ineligible and "directed to an abstract idea" because they "d[id] not claim a particular way of programming or designing the software to create menus . . . , but instead merely claim[ed] the resulting systems"); *Internet Patents Corp. v. Active Network, Inc.*, 790 F.3d 1343, 1348 (Fed. Cir. 2015) (finding claim abstract because it "contain[ed] no restriction on how the result is accomplished"); *Secured Mail Sols. LLC v. Universal Wilde, Inc.*, 873 F.3d 905, 911 (Fed. Cir. 2017) (finding claims abstract because they were "not limited by rules or steps that establish[ed] how the focus of the methods [wa]s achieved"); *ChargePoint,* 920 F.3d at 770 (finding claims directed to abstract idea where broad claim language "would 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[ed] of generic and conventional information acquisition and organization steps that are connected to, but do not convert, the abstract idea . . . into

LLC v. AOL, Inc., 896 F.3d 1335 (Fed. Cir. 2018), 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 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." *Id.* at 1343; *see also Electric Power Grp.,*

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a particular conception of how to carry out that concept" (emphasis added)); *Innovation Sci., LLC v. Amazon.com, Inc.*, 778 F. App'x 859, 863 (Fed. Cir. 2019) (finding ineligible a claim reciting coverage "in merely functional, result-oriented terms"); *Univ. of Fla. Research Found., Inc. v. Gen. Elec. Co.*, 916 F.3d 1363, 1364, 1368 (Fed. Cir. 2019) (finding claims to be "directed to an abstract idea" where "[n]either the . . . patent, nor its claims, explain[ed] how the drivers do the conversion that [Appellant] points to."); *Two-Way Media Ltd. v. Comcast Cable Commc'ns, LLC*, 874 F.3d 1329, 1337 (Fed. Cir. 2017) (claim ineligible abstract idea where "[t]he claim require[d] the functional results of 'converting,' 'routing,' 'controlling,' 'monitoring,' and 'accumulating records,' but d[id] not sufficiently describe how to achieve these results in a non-abstract way"); *see also Finjan, Inc. v. Blue Coat Sys., Inc.*, 879 F.3d 1299, 1305 (Fed. Cir. 2018) ("*Apple*, *Affinity Labs*, and other similar cases hearken back to a foundational patent law principle: that a result, even an innovative result, is not itself patentable."); *McRO, Inc. v. Bandai Namco Games Am. Inc.*, 837 F.3d 1299, 1314 (Fed. Cir. 2016) ("[In section 101 analysis w]e . . . look to whether the claims . . . focus on a specific means or method that improves the relevant technology or are instead directed to a result or effect that itself is the abstract idea and merely invoke generic processes and machinery.").

LLC v. Alstom S.A., 830 F.3d 1350, 1355–56 (Fed. Cir. 2016) (noting that "the essentially result-focused, functional character of claim language has been a frequent feature of claims held ineligible under § 101").

While many of these cases involved the abstract idea category, the same principle necessarily applies in natural law cases. In *Mayo*, the Court concluded that "to transform an unpatentable law of nature into a patent-eligible application of such a law, one must do more than simply state the law of nature while adding the words 'apply it.'" 566 U.S. at 72; *see also id.* at 82 ("[S]imply appending conventional steps, specified at a high level of generality, to laws of nature, natural phenomena, and abstract ideas cannot make those laws, phenomena, and ideas patentable." (emphasis added)). Similarly, in *Diamond v. Diehr*, 450 U.S. 175 (1981), the Court recognized "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." *Id.* at 191 (emphasis added).

The Supreme Court's decisions in *Le Roy* and *O'Reilly* may be viewed as applying this principle in the natural law context. For example, in *O'Reilly v. Morse*, 56 U.S. (15 How.) 62 (1853), the Supreme Court held claim for "use of the motive power of the electric or galvanic current . . . for marking or printing intelligible characters . . . at any distances" ineligible because "it matter[ed] not by what process or machinery the result [wa]s [to be] accomplished." *Id.* at 113–20. Both claim 8 in *O'Reilly* and claim 22 here recite a natural law (electromagnetism in *O'Reilly* and Hooke's law here) and a result to be achieved (printing characters at a distance in *O'Reilly* and producing a liner to dampen specific vibrations). And just as claim 8 in *O'Reilly* did not recite any engineering or techniques to achieve this result, claim 22 likewise provides no details. Thus, claim 22, like claim 8 in *O'Reilly*, is directed to a

natural law because it clearly invokes a natural law, and nothing more, to accomplish a desired result.

More recently, the Supreme Court's decision in *Parker v. Flook*, 437 U.S. 584 (1978), also exemplified this principle. 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.*; *see also id.* at 596–98 (quoting and describing claim). What was missing from the claimed method reflected what was missing from the patent application as a whole, which "d[id] not purport to explain how to select . . . any of the . . . variables" involved, or "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.

The Court in *Flook* held that the claimed method contained no patent-eligible invention. *Id.* at 594. Though the Court recognized 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 claimed method. *Id.* at 594.

Diehr, on the other hand, involved a situation in which a patent application 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.[8]

Like the claims in *Flook*, claim 22 of the '911 patent is directed to the use of a natural law: Hooke's law. As in *Flook*, where the claimed method did not specify how variables were measured or how the alarm system functioned, claim 22 here does not specify how target frequencies are

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[8] *See also Genetic Techs. Ltd. v. Merial L.L.C.*, 818 F.3d 1369, 1375 (Fed. Cir. 2016) (finding claim to be directed to ineligible law of nature because it "cover[ed] essentially all applications, via standard experimental techniques, of the law of linkage disequilibrium to the problem of detecting coding sequences of DNA"); *Athena Diagnostics, Inc. v. Mayo Collaborative Servs., LLC*, 927 F.3d 1333, 1359 (Fed. Cir. 2019) (Moore, J., dissenting) (order denying petition for en banc rehearing) ("[T]he Supreme Court suggests we should consider the level of specificity in the claims to determine whether the claim is even directed to the natural law."); *id.* at 1362 ("The concreteness and specificity of the claims in *Athena* move them from reciting a law of nature to a particular application of a law of nature.").

determined or how, using that information, liners are tuned to attenuate two different vibration modes simultaneously, or how such liners are tuned to dampen bending mode vibrations. Claim 22 here simply instructs the reader to tune the liner to achieve a claimed result, without limitation to particular ways to do so. This holding as to step 1 of *Alice* extends only where, as here, a claim on its face clearly invokes a natural law, and nothing more, to achieve a claimed result.

C

As to *Mayo*/*Alice* step 2, nothing in claim 22 qualifies as an "inventive concept" to transform it into patent eligible matter. AAM contends that claim 22 includes 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 or, at least, had not been used to damp two different vibration modes simultaneously (or perhaps just to damp bending mode vibrations).[9] This amounts to no more than a restatement of the assertion that the desired results are an advance. We have already explained that, insofar as claim 22 here merely claims the achievement of results, they are directed to ineligible matter. As we held in *BSG Tech LLC v. Buyseasons, Inc.*, 899 F.3d 1281 (Fed. Cir. 2018), "a claimed invention's use of the ineligible concept

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[9] 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 Summ. J. 8–9, *American Axle & Manuf., Inc. v. Neapco Hldgs. LLC*, No. 15-01168 (D. Del. Aug. 11, 2017), ECF No. 160.

to which it is directed cannot supply the inventive concept" required to cross the line into eligibility. *Id.* at 1290; *see also Trading Techs.*, 921 F.3d at 1385 ("The abstract idea itself cannot supply the inventive concept, 'no matter how groundbreaking the advance.'" (quoting *SAP*, 898 F.3d at 1170)); *ChargePoint*, 920 F.3d at 775 ("[T]he abstract idea itself . . . cannot supply the inventive concept at step two.").

Claim 22 discloses no other inventive concept. The real inventive work lies in figuring out how to design a liner to damp two different vibration modes simultaneously, and no such inventive work is recited in claim 22. The remaining steps of claim 22, like the steps involved in the *Flook* patent, amount to no more than conventional pre- and post-solution activity. There is no other inventive concept at step two in the claims and no dispute of any material fact.

Claim 22 is not patent eligible. Claim 36[10] is virtually indistinguishable from claim 22 and was not argued

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[10] Claim 36 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 a mass and a stiffness of at least one liner; and
>
> inserting the at least one liner into the shaft member;

separately on appeal or in district court. It is thus likewise not patent eligible.

II. CLAIMS DEPENDING FROM CLAIM 22

Having determined that independent claim 22 is not patent eligible under § 101, we need not separately determine eligibility of the asserted dependent claims. The district court found independent claim 22 collectively representative of all claims dependent from this claim. 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.[11] Although at oral argument AAM disagreed that 22 is 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

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> wherein a ratio of a mass of the at least one liner to a mass of the shaft member is about 5% to about 30%;
>
> 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 at least one of bending mode vibrations and torsion mode vibrations.

[11] While AAM's Reply Brief for the first time argued that specific limitations of dependent claims may render these claims independently eligible, *see* Reply Br. 27, those arguments were not properly preserved. *SmithKline Beecham Corp. v. Apotex Corp.*, 439 F.3d 1312, 1319 (Fed. Cir. 2006) ("Our law is well established that arguments not raised in the opening brief are waived.").

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. We note that in the rehearing petition concerning the earlier panel decision, AAM did not argue that the decision with respect to the dependent claims was erroneous, other than to say in a footnote that "AAM did not waive any arguments about these [dependent] claims." Petition 14 n.3.

III: CLAIM 1

Claim 1 is different from claim 22. While it is true that both claims require "tuning," claim 1 is more general. It requires "tuning at least one liner to attenuate at least two types of vibration transmitted through the shaft member." '911 patent, col. 10, ll. 19–28. The district court construed this term to mean "controlling characteristics of at least one liner to configure the liner to match a relevant frequency or frequencies to reduce at least two types of vibration transmitted through the shaft member." J.A. 1046 (emphasis added). The specification indicates or may suggest that the "characteristics" that can be "tuned" in claim 1 include variables other than mass and stiffness.[12] In

[12] The specification recites 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). 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

addition, claim 1, unlike claim 22 has an additional limitation of "positioning the at least one liner."[13] '911 patent, col. 10, ll. 19–28.

In light of the district court's construction of claim 1, which requires only controlling characteristics and positioning the liner, we cannot conclude that it is merely directed to Hooke's law. In contrast with claim 22, which as construed recites nothing more than a desired result and an instruction to apply Hooke's law, we cannot say claim 1 as construed is directed to a particular natural law and nothing more. The mere fact that any embodiment practicing claim 1 necessarily involves usage of one or more natural laws is by itself insufficient to conclude the claim is directed to such natural laws. The district court's opinion suggests that the broader concept of tuning is an abstract idea, J.A. 16–17, and the same question may be raised about the broad concept of positioning. On appeal, Neapco relied on both the natural law and abstract idea categories of ineligibility in defending the district court's decision. *See*, *e.g.*, Neapco Resp. Br. 21, 24. But the abstract idea basis was not adequately presented and litigated in the

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> 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.

[13] The claim 22 limitation of "inserting the at least one liner into the shaft member" is not equivalent to claim 1's "positioning" limitation, and AAM never argued otherwise in the district court or on appeal. As discussed *supra* in Section II, any argument that dependent claims 34 and 35 have a "location limitation," *see* Dissent Op. 27–28, have been waived by AAM.

district court. We think that it is appropriate to vacate the judgment as to claim 1 and its dependent claims and remand the case for the district court to address this alternative eligibility theory in the first instance.

IV

Some brief response to the dissent is required.

First, contrary to the dissent, we are not "depart[ing] from existing § 101 precedent," Dissent Op. 9, but rather faithfully following it in the narrow circumstances of this case.

Second, the dissent argues that "[o]ne important difference between this natural law case and every other one ever decided is that these claims do not actually recite any particular natural law." Dissent Op. 7. One problem with this argument is its characterization of this case as not involving a recitation of the natural law. Claim 22 expressly requires varying frequency attenuation (tuning) based on mass and stiffness, as the dissent recognizes (Dissent Op. 26 (under claim 22, "the liner is tuned to a given frequency by adjusting its mass and stiffness")). As is undisputed, what Hooke's law does is precisely to relate frequency to mass and stiffness. *See supra* at 7. In all but name, therefore, claim 22 recites Hooke's law. To be clear, however, our holding should not be read as an invitation to raise a validity challenge against any patent claim that requires the application of an unstated natural law; our ruling as to claim 1 should make that clear enough. Rather, our holding is limited to the situation where a patent claim on its face and as construed clearly invokes a natural law, and nothing else, to accomplish a desired result.

There is, moreover, a more fundamental problem with the dissent's argument about claim recitation of a natural law. It is true that in *Mayo* and many other cases the natural law itself was stated in the claim. *See, e.g.*, *Mayo*, 566 U.S. at 74–75. But the longstanding rejection of eligibility

for a claim to a "result" or "effect," *see Diehr*, 450 U.S. at 182 n.7; *Corning*, 56 U.S. at 268; *Le Roy*, 55 U.S. at 175, is not limited to claims that also state the natural law that produces the result or effect. Moreover, nothing in *Mayo* or any other case suggests that the natural law exception requires an express claim recitation of a natural law: the analysis is a substantive one about whether the claim is "directed to" ineligible matter and, if so, whether there is enough other than the ineligible matter itself to create eligibility. *See Alice*, 573 U.S. at 217–18; *Mayo*, 566 U.S. at 72–73, 77. If patentees could avoid the natural law exception by failing to recite the law itself, patent eligibility would depend upon the "draftsman's art," the very approach that *Mayo* rejected. *Id.* at 72. Significantly, both *Mayo* and *O'Reilly* rely on a foundational English case, *Neilson v. Harford*, Webster's Patent Cases 295, 371 (1841), which involved this very situation, where the patent did not recite the natural law, because the inventor was "not aware of the nature and principle of his discovery." *Id.* at 344. "[T]he principle," "regarded as well known," "that hot air would promote the ignition of fuel better than cold," was not in the patent but was "embodied in th[e described] machine." *O'Reilly*, 56 U.S. at 116; *see also Mayo*, 566 U.S. at 82–84. The patent was held eligible only because it "explained how the principle could be implemented in an inventive way." *Mayo*, 566 U.S. at 83.

Third, the dissent criticizes our analysis as improperly merging enablement and eligibility, arguing that the failure of the claims to designate how to achieve the desired result is exclusively an issue of enablement. Dissent Op. 23–26. But we think the criticism rests on a failure to distinguish two different "how" requirements in patent law. The first such requirement, that of eligibility, is that the claim itself (whether by its own words or by statutory incorporation of specification details under section 112(f)) must go beyond stating a functional result; it must identify "how" that functional result is achieved by limiting the

claim scope to structures specified at some level of concreteness, in the case of a product claim, or to concrete action, in the case of a method claim. The Supreme Court has so required dating back at least to the Court's rejection of Morse's claim 8 in *O'Reilly v. Morse*, and this requirement is an eligibility requirement we have applied repeatedly, as explained above.[14]

The second, distinct "how" requirement applies to the specification, not the claim: once the required concrete

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[14] In *O'Reilly*, the specification contains a number of detailed technical drawings and corresponding descriptions, which all claims but claim 8 incorporated. *See* Reissue Patent No. 117 (issued June 13, 1848) (Figure 1–5 and pages 2–3). In contrast, claim 8 of *O'Reilly* specifically did not limit itself to the specification and for that reason was, unlike claims 1–7, found ineligible:

> Eighth. I do not propose to limit myself to the specific machinery, or parts of machinery, described in the foregoing specifications and claims; the essence of my invention being the use of the motive power of the electric or galvanic current, which I call electro-magnetism, however developed, for making or printing intelligible characters, letters, or signs, at any distances, being a new application of that power, of which I claim to be the first inventor or discovered.

O'Reilly, 56 U.S. at 86 (emphasis added). Subsequently, the Supreme Court explained that claim 8 in *O'Reilly* was struck down precisely because it "was a claim 'for a patent for an effect produced by the use of electro-magnetism, distinct from the process or machinery necessary to produce it,'" whereas other claims incorporated the descriptions of how to produce the effect. *Dolbear v. Am. Bell Tel. Co.*, 126 U.S. 1, 534 (1888).

physical structures or actions are set out in the claim, the specification must set forth enough information for a relevant skilled artisan to be able to make and use the claimed structures or perform the claimed actions. This is the enablement requirement, which is distinct from the eligibility requirement. [15] Although the word "how" is used in both contexts, neither requirement replaces the other. Enablement is concerned with whether "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 are directed to 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 uncertainty, while assuming that those sections can do work that they are not equipped to do.").

Fourth, the dissent argues that "[n]o party introduced evidence that the desired result of claim 22 (reducing two types of vibration) is accomplished by application of Hooke's law and nothing more." Dissent Op. 11. The dissent also argues that the claim element "wherein the at least one liner is a tuned resistive absorber for attenuating shell mode vibrations" of claim 22 "is not achieved by Hooke's law, but rather is achieved by application of a different natural law—friction damping." Dissent Op. 13. The dissent's arguments do not alter our conclusion that

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[15] In fact, none of the amici, some of whom argued that the issue is enablement, attempted to distinguish the cases holding claims that state a goal without a solution to be patent ineligible. *See* IPO Br. 6; BIO Br. 9; USIJ Br. 8.

claim 22 in all but name recites Hooke's Law and nothing more to tune the liner to achieve the claimed result of reducing two types of vibration.

As the dissent observes, the "directed to" inquiry does not look for all natural laws that are "involved" in a claimed method. Dissent Op. 6–7. Yet that is the most one can say about friction damping in the language of claim 22. What claim 22 says is that "tuning a mass and stiffness of at least one liner" achieves both the attenuations stated in the "wherein" clauses—each of which requires a "tuned" liner.[16] Tuning a mass and stiffness, as explained above, without further guidance is nothing but an invocation of Hooke's Law.

Neapco has noted that friction damping is involved in a liner's functioning as "a tuned resistive absorber for attenuating shell mode vibrations," but AAM has consistently taken the position that the invention is the "tuning" that achieves this claimed result. AAM Op. Br. 13 ("The American Axle inventors . . . conceiv[ed] of the novel and unconventional concept of 'tuning' a liner to damp specific propshaft vibration modes." (emphasis added)).[17] To be

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[16] Claim 22 requires: "tuning a mass and a stiffness of at least one liner" "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. 11, ll. 31–36.

[17] AAM's expert Dr. Rahn asserted that "[f]riction damping is unrelated to . . . 'tuning a mass and stiffness of at least one liner.'" J.A. 1930–31. This is also made clear in AAM's own motion for summary judgement, where it stated that "[t]he Asserted Claims are not directed to friction damping[,]" explaining that they are limited to "tuned liners," J.A. 4333–34, and that "the Asserted Claims

sure, the tuned liner is in contact with the propshaft, and when it is put into use, that contact allows the tuning to achieve the desired result of friction damping of the tuning-focused frequencies. This is so because, as the district court and AAM's own expert recognized, friction damping is a law of nature or natural phenomenon for any contact between two surfaces. J.A. 11 (citing and quoting J.A. 1930). It is the tuning used to create the liner, not the post-creation use, that is claimed. And AAM itself has not pointed to the role of friction damping in dual-mode attenuation as a reason that the manufacturing claim is not directed to a natural law under the § 101 test.

We read the district court as effectively adopting AAM's own view when it recognized that both Hooke's law and friction damping are at least involved but that their roles are critically different. The court said that "[t]he claimed methods are applications of Hooke's law with the result of friction damping," J.A. 11 (emphasis added), and that friction damping is a "result that is achieved from performing the method rather than an active step in the method." *Id.* at 16. Those conclusions accurately reflect the role of friction damping in post-manufacturing, unclaimed use of the device whose manufacture is what is claimed. The recited alleged invention of "tuning a mass and a stiffness of at least one liner" does not recite anything other than the invocation of Hooke's law.

Moreover, AAM could gain nothing by saying that claim 22 is directed to both Hooke's law and friction damping. That assertion would simply leave it with a claim

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involve the transformation [of] a liner to a 'tuned' liner by 'controlling its mass and stiffness,' such that the tuned liner is both a 'tuned resistive absorber for attenuating shell mode vibrations' and a 'tuned reactive absorber for attenuating bending mode vibrations,'" J.A. 4336 (emphasis added).

directed to two identified natural laws. J.A. 11 (quoting AAM's expert, at J.A. 1930, stating that friction damping "is a property of physics experienced by any two surfaces in contact"). If claim 22's language could be properly interpreted in a way such that it invokes friction damping as it does with Hooke's law, the claim would still on its face clearly invoke natural laws, and nothing more, to achieve a claimed result.

Finally, the dissent argues that the majority rejected AAM's step two arguments "with no explanation at all" and that "[i]t is inconsistent with precedent to hold claims ineligible without analyzing the step two arguments." Dissent Op. 21. The majority does apply step two. What it concludes is what this court has elsewhere concluded on earlier occasions: the only asserted "inventive concept" is ineligible subject matter. *See BSG Tech*, 899 F.3d at 1290; *Trading Techs.*, 921 F.3d at 1385; *ChargePoint,* 920 F.3d at 775.

CONCLUSION

We affirm as to claim 22 and its asserted dependent claims, and as to claim 36, which claim ineligible subject matter under § 101. We vacate as to claim 1 and its dependent claims and remand for further proceedings consistent with this opinion.

AFFIRMED IN PART, VACATED IN PART, AND REMANDED

COSTS

No costs.

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 collapses the *Alice/Mayo* two-part test to a single step—claims are now ineligible if their performance would involve application of a natural law. The majority makes three critical errors of law and in doing so, has inflated § 101 beyond the statutory language and Supreme Court precedent. First, the majority finds claims *directed to* natural laws, yet they clearly contain no such natural law. The majority creates a new test for when claims are *directed to* a natural law despite no natural law being recited in the claims, the *Nothing More* test. The majority refuses to ask the parties for

supplemental briefing on the application of its new *Nothing More* test or to remand to the district court to assess the applicability of the new test in the first instance. The majority instead holds that we appellate judges, based on our background and experience, will resolve questions of science de novo on appeal. We will determine whether Hooke's law *and nothing more* results in a reduction of two types of vibration in a propshaft. The majority reaches this conclusion despite all of the briefing and record evidence contradicting it. Second, the majority refuses to consider the unconventional claim elements. Third, the majority has imbued § 101 with a new superpower—enablement on steroids. The majority's blended 101/112 analysis expands § 101, converts factual issues into legal ones and is certain to cause confusion for future cases.

The claims at issue contain a specific, concrete solution (inserting a liner inside a propshaft) to a problem (vibrations in propshafts). Although some degree of trial and error in modifying the mass, stiffness, and location of the liner to optimize the reduction in vibration of a given shaft could (if undue) create an enablement concern, that is not a § 101 problem. American Axle (AAM) and the many amici believe each of these errors of law are likely to create confusion for the district courts and to expand § 101 profoundly.[1] I agree.

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[1] *See, e.g.,* USIJ Br. at 1 ("The panel decision, if allowed to stand, will add further confusion to a body of jurisprudence regarding patent eligibility that already has proven to be difficult if not wholly impenetrable to apply with any consistency."); *id.* at 5 (quoting *Alice*) ("The majority decision, in short, threatens to 'swallow all of patent law,' because 'at some level, all inventions . . . embody, use, reflect, rest upon, or apply laws of nature, natural phenomena, or abstract ideas.'"); IPO Br. at 8 ("the decision has the

The majority claims this is a narrow decision—I think not. This case turns the gatekeeper into a barricade. Unstated natural laws lurk in the operation of every claimed invention. Given the majority's application of its new test, most patent claims will now be open to a § 101 challenge for being directed to a natural law or phenomena.

Finally, though not a legal question, I am troubled by the deprivation of property rights without due process. The majority declares claims representative despite the fact that no party argued below or to this court that there were representative claims, and AAM argued the import to the § 101 analysis of dependent claim limitations throughout these proceedings. And the majority finds against the patentee by reaching a claim construction issue of the majority's own creation. The majority concludes, though no party argued it at any point in this litigation or appeal, that the claim terms "positioning" and "inserting" have different meanings. And only because of its newly proffered, completely *sua sponte* construction, claim 22 is deemed ineligible. There is simply no justification for the majority's application of its new *Nothing More* test other than result-oriented judicial activism. This is fundamentally unfair. I dissent from this unprecedented expansion of § 101.

I. THESE CLAIMS ARE NOT DIRECTED TO A NATURAL LAW

A. The majority's expansion of "*directed to*"

The '911 patent, directed to a method of manufacturing a drive shaft assembly for a car, is the type of traditional manufacturing patent of automotive parts which has been

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potential to blur the lines between the section 101 and 112 analysis. This will increase confusion and uncertainty in the law of patent eligibility and could open the door to hybrid eligibility and written description-enablement arguments."); BIO Br. at 2 ("it is now Section 101 that has engulfed the other statutory sections").

eligible for patent protection since the invention of the car itself. "Industrial processes such as this are the types which have historically been eligible to receive the protection of our patent laws." *Diamond v. Diehr*, 450 U.S. 175, 184 (1981).

The majority's holding that these claims to manufacturing an automotive drive shaft are ineligible has sent shock waves through the patent community. "It's unthinkable the courts found this invention, a manufacturing process for making a key automotive part, as patent ineligible." Rep. Doug Collins. *American Axle* is a "poster child for how the current test for patent eligibility is being applied to reach rather absurd results." Perry Cooper, *Ball in Federal Circuit's Court on Patent Eligibility Clarity*, Bloomberg News (Jan. 30, 2020) (quoting Professor David Taylor). "[I]f 'industrial-process,' physically-based patents like these are ineligible under *Mayo/Alice*, then seemingly every patent is in ineligibility jeopardy." Michel Br. at 7. "'The optics are challenging for this, because you're talking about a way to make a drive shaft for a car, and that sounds like the kind of thing that's been getting patented for 100 years,' . . . The decision brings to the foreground an issue that has been bubbling in patent eligibility cases for some time, which is that every invention at some level operates according to natural laws." Ryan Davis, *Drive Shaft Ruling May Expand Challenges to Patent Eligibility*, Law 360 (Oct. 24, 2019). "This is a specific, practical application of the laws of thermodynamics in an industrial process—an innovative process deemed patentable by the courts since the nineteenth century." Law Profs. Br. at 4. *See also* Michael Cicero, *Patent Ineligibility Defense Expands to Mechanical Subject Matter*, Bloomberg News (Dec. 4, 2019); Jonathan Osha, *American Axle: The Latest Twist of Patent Eligibility* Oshaliang Newsletter (Oct. 17, 2019) (*American Axle* is "a new low in patent eligibility jurisprudence . . . if a *method of manufacturing a propeller shaft* is not eligible

subject matter, it is difficult to imagine where a future line might be drawn.").[2] These claims do not preempt use of a natural law and the majority significantly broadens the *directed to* test to find otherwise.

In this case, the natural law which the claims are purportedly directed to has been a constantly moving target. Neapco argued and its expert testified that claim 22 was directed to the application of two natural laws working together to achieve the claimed reductions in vibration: Hooke's law (which reduces bending mode vibration) and friction damping (which reduces shell mode vibration). The district court held that claim 22 is directed to "law**s** of nature: Hooke's law and friction damping.'" J.A. 10. On appeal, Neapco continues to assert that claim 22 is directed to the application of two natural laws:

> Hooke's Law and friction damping are two separate laws of nature. Indeed, the [district court] opinion states that "the issue presented is whether the Asserted Claims as a whole are directed to laws of nature: Hooke's law ***and*** friction damping."

Neapco Br. at 56 (emphasis in original). The prior majority opinion in this case explained that the claimed invention is "more complex than just a bare application of Hooke's Law, and that other natural laws may be relevant." Prior Maj. at 20. It further explained that the claims are directed to "Hooke's law and possibly other natural laws." *Id.*

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[2] "*Amici* once proposed as a *reductio ad absurdum* that even an automobile engine can be framed as a mere application of the laws of thermodynamics and thus deemed unpatentable. Adam Mossoff, *A Brief History of Software Patents (and Why They're Valid),* 56 Ariz. L. Rev. 65, 71 (2014). The panel majority decision has made this absurdity a legal reality." Law Prof. Br. at 3.

Changing course on rehearing, the majority now concludes claim 22 is directed to Hooke's law and only Hooke's law "because it simply requires the application of Hooke's law to tune a propshaft liner to dampen certain vibrations." Maj. at 9. And revising history, the majority now claims that the district court itself held that the claims were directed to Hooke's Law and nothing more. Maj. at 7. This is contrary to both parties' understanding about the district court's holding and the majority's own prior conclusion about the district court's holding:

> "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.'"

Prior Maj. at 7. Attempting to revise history is not good: "The past was erased, the erasure was forgotten, the lie became the truth." GEORGE ORWELL, 1984.

1. The majority's holding conflicts with precedent

The majority's holding is in direct conflict with our precedent and a dramatic expansion of § 101. As we have explained,

> The "directed to" inquiry . . . cannot simply ask whether the claims involve a patent-ineligible concept, because essentially every routinely patent-eligible claim involving physical products and actions involves a law of nature and/or natural phenomenon—after all, they take place in the physical world. Rather, the 'directed to' inquiry applies a stage-one filter to claims, considered in light of the specification, based on whether "their character as a whole is directed to excluded subject matter."

Enfish LLC v. Microsoft Corp., 822 F.3d 1327, 1335 (Fed. Cir. 2016) (citations omitted). "[A]t step one, it is not enough to merely identify a patent-ineligible concept underlying the claim; we must determine whether that patent-ineligible concept is what the claim is *directed to*."

ChargePoint, Inc. v. SemaConnect, Inc., 920 F.3d 759, 766 (Fed. Cir. 2019) (internal citations omitted). A claim is not *directed to* a natural law simply because it touches upon, implicates, uses or involves a natural law.

The majority cites *Diehr*, *Flook*, *O'Reilly*, and *Mayo* as supporting its conclusion that these claims are *directed to* a natural law. But, in each of those cases, the natural law was undeniably, expressly articulated in the claim. "When a claim recites a mathematical formula (or scientific principle or phenomena of nature), an inquiry must be made into whether the claim is seeking patent protection for that formula in the abstract." Maj. at 18 (quoting *Diehr*). One important difference between this natural law case and every other one ever decided is that these claims do not actually recite any particular natural law and likely implicate many (as all mechanical inventions must comply with the laws of physics).

Claim 22 does not recite a natural law, about that there can be no doubt. Hooke's law is not mentioned by name or formula anywhere in the claims, specification or prosecution history. The majority overcomes this defect by articulating a new test (the *Nothing More* test) for when a claim is directed to a natural law despite not reciting one:

> This holding as to step 1 of Alice extends only where, as here, a claim on its face clearly invokes a natural law, ***and nothing more, to achieve the claimed result.***

Maj. at 21. The majority explains that claim 22 is directed to Hooke's law because the tuning element in claim 22 includes "controlling the mass and stiffness . . . Thus, claim 22 requires use of a natural law." Maj. at 11–12. Every mechanical invention requires use and application of the laws of physics. It cannot suffice to hold a claim *directed to* a natural law simply because compliance with a natural law is required to practice the method.

Section 101 is monstrous enough, it cannot be that use of an unclaimed natural law in the performance of an industrial process is sufficient to hold the claims *directed to* that natural law. The majority's only citation in support of this dramatic expansion of our law is an English case from 1841, *Neilson v. Harford*, Webster's Patent Cases 295, 371 (1841). There was no claim in *Neilson* as claiming practice did not exist and the English court actually held the patent eligible: "the plaintiff does not merely claim a principle, but a machine embodying a principle." *Id.*[3] I cannot discern the logic in the majority's suggestion that this English case supports its decision to depart from existing U.S. precedent. It cannot be that a claim is *directed to* a natural law when there is no specific natural law discernable in the claim or even the specification. All physical methods must comply with, and apply, the laws of physics and the laws of thermodynamics. The fact that they do does not mean the claims are *directed to* all such laws.

The majority also attempts to justify its result by comparing claim 22 to claim 8 in *O'Reilly*. Claim 8 in O'Reilly reads:

> Eighth. I do not propose to limit myself to the specific machinery or parts of machinery described in the foregoing specification and claims; the essence of my invention being the use of the motive power

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[3] The majority claims that in *O'Reilly* and *Mayo,* the Supreme Court held that in *Neilson* the principle "was not in the patent but was embodied in th[e described] machine." Maj. at 27. Neither decision holds nor indicates that the principle was not disclosed in the patent. When discussing *Neilson*, the Supreme Court stated: "the claimed process included not only a law of nature but also several unconventional steps . . . that confined the claims to a particular, useful application of the principle." *Mayo*, 566 U.S. at 84.

> of the electric or galvanic current, which I call electromagnetism, however developed for marking or printing intelligible characters, signs, or letters, at any distances, being a new application of that power of which I claim to be the first inventor or discoverer.

56 U.S. (15 How.) 62, 112 (1854). The Supreme Court held claim 8 ineligible because the claim was not limited to "specific machinery or parts of machinery described," but instead claimed electromagnetism [(the natural phenomenon was actually articulated in the claim)] developed by any means to mark or print at any distance. *Id.* The Supreme Court's concern was not, as the majority contends, that an artisan would not know "how" to print at any distance using electromagnetism. The concern was that Morse's claim 8 was not limited to *any* specific "process or machinery," and that the expressly limitless claim would preclude "some future inventor . . . [who] discover[s] a mode of writing or printing at a distance by means of the electric or galvanic current, without using any part of the process or combination set forth in the plaintiff's specification" from practicing his invention. *Id.* at 112–113. Unlike Morse claim 8, claim 22 does not preclude all use of, or even expressly recite, the natural law and it does expressly articulate the "machinery" used to achieve the result of dampening specific vibrations—the liner.

Amici are understandably troubled, as am I, by the majority's departure from existing § 101 precedent. "The panel seems to conclude that step one can be satisfied even if the natural law, or laws, at issue are not identified. . . . General and non-specific statements should not be enough to satisfy step one." IPO Br. at 8–9. "The specification invokes Hooke's Law no more than it does the law of gravity . . . the majority elected to sweep into its analysis one or more unidentified natural laws in addition to Hooke's Law in order to assert that the claims were indeed 'directed to' some number of natural laws." BIO Br. at 6.

"Just because an invention operates according to laws of nature (as all inventions must) cannot mean that it is 'directed to' these laws." BIO Br. at 7.

2. The majority's new *Nothing More* test leaves the science to the appellate judges to decide de novo

The majority's *Nothing More* test, like the great American work *The Raven* from which it is surely borrowing, will, as in the poem, lead to insanity. The majority has concluded that on appeal, as a matter of law, we judges can decide as a matter of physics whether claim 22's results—attenuating two types of vibration—are accomplished by Hooke's law and nothing more. To say this feels like a bit of an overreach is an understatement. Today, contrary to all arguments in the case, the record, the district court's decision, and its own prior opinion, the majority concludes that claim 22 is directed to "Hooke's law and *nothing more*," to accomplish the claimed results of reducing two kinds of vibrations.

The district court did not hold that claim 22's results—attenuated shell mode vibration and bending mode vibration in the propshaft—were achieved by Hooke's law and *nothing more*. In fact, as the majority previously recognized, the district court clearly held that they were achieved by the combination of Hooke's law and friction damping. Prior Maj. at 7. Neither party argued that claim 22 is directed to Hooke's law and *nothing more*. Even Neapco argued it was the combination of Hooke's law and friction damping, "two separate natural laws" which accomplished the claimed vibration damping. Neapco Br. at 56.[4]

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[4] In its summary judgment briefing Neapco argued that claim 22 was directed to "well-known law**s** of physics," including both Hooke's law and "the law of nature or

No party introduced evidence that the desired result of claim 22 (reducing two types of vibration) is accomplished by application of Hooke's law *and nothing more*. In fact, both parties' experts expressly and unequivocally testified to the contrary.[5] All evidence in this case is to the contrary.

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natural phenomenon for friction damping." J.A. 1248–50. On appeal, Neapco likewise argues that the claims are "directed to natural laws (Hooke's laws and the law of friction damping)." Neapco Br. at 30. Neapco leaves no doubt when responding to AAM's argument:

> "[The district court opinion] states that Hooke's law and friction damping are two separate laws of nature. Indeed, the opinion states that 'the issue presented is whether the Asserted Claims as a whole are directed to laws of nature: Hooke's law *and* friction damping.' The opinion goes on to accurately describe Hooke's law . . . [and] observed that friction damping, a separate law of nature, 'is a property of physics experience by two surfaces in contact.'"

Id. at 56.

[5] AAM's expert testified that Hooke's law is not required to practice claim 22 nor is application of Hooke's law sufficient to practice claim 22:

> Nor do any of the above claim limitations (and their constructions) require the application of Hooke's law or any variation thereof. Hooke's law is simply a linear relationship between the force F and displacement x of a spring with stiffness k. Taking the first limitation as an example, e.g., "tuning a mass and stiffness of at least one liner," claim 22 involves a method having the step of "controlling a mass and stiffness of at least one liner to configure

"The testimony of opposing technical experts was refreshingly harmonious; perhaps because these principles of classical electricity are beyond debate." *Perkin-Elmer Corp. v. Westinghouse Elec. Corp.*, 822 F.2d 1528, 1536 (Fed. Cir. 1987) (Newman, J., dissenting).

Lest there be any doubt, the accused infringer's (Neapco's) expert analyzes claim 22's three claim elements related to reducing vibrations:

> 1. "tuning a mass and a stiffness of at least one liner;"
>
> 2. "wherein the at least one liner is a tuned reactive absorber for attenuating bending mode vibrations;" and
>
> 3. "wherein the at least one liner is a tuned resistive absorber for attenuating shell mode vibrations."

J.A. 1602–05, ¶¶ 172–79. Neapco's expert testifies that the first two elements can be achieved by application of Hooke's law *and nothing more*:

> 176. Thus, the phrase "tuning a mass and a stiffness of at least one liner" claims Hooke's law. Similarly, the claim element "tuned reactive absorber for attenuating bending mode vibrations" claims nothing more than Hooke's law again, how one body will react to the mass spring mass damper.

> the liner to match a relevant frequency or frequencies." One can perform that step, like the other steps of claim 22, without considering, applying, or even knowing of Hooke's law.

J.A. 1928. Experts for both sides agree that claim 22 is not directed to Hooke's law and nothing more.

However, when it comes to the third element (reducing shell mode vibration), this expert is crystal clear that it is not achieved by Hooke's law, but rather is achieved by application of a different natural law—friction damping:

> 177. Similarly, the claim element "tuned resistive absorber for attenuating shell mode vibrations" claims *nothing more* than the law of nature/natural phenomenon for friction damping. Friction damping has been modeled as both Coulomb damping and viscoelastic damping which occur due to the resistive friction and interaction of two surfaces that press against each other as a source of energy dissipation.

Shell mode vibration, according to Neapco, is reduced by insertion of the liner into the propshaft in a manner to cause a press fit which will reduce shell mode vibrations by friction damping.

Neapco's expert directly contradicts the majority's current conclusion. His opinion is that claim 22 is directed to and requires application of two different natural laws to achieve the result of reducing two types of vibration in the propshaft:

> 179. In short, the claimed invention claims nothing more than the law of nature and/or natural phenomenon of Hooke's Law ***and friction damping.***

Rather than address these, the parties' arguments, as we are bound to do as appellate judges, the majority recasts these arguments as "the dissent's arguments" and dismisses them in conclusory fashion.[6] The majority claims

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[6] In an attempt to deflect and cause confusion, the majority cites AAM's arguments that claim 22 is not directed to friction damping or any other natural law. First,

that the "most one can say about friction damping in the language of claim 22" is that it is merely "involved" in the claimed method.[7] Maj. at 30. Not only can the parties and the district court say more, they did. The parties and their experts uniformly agree that the claims are not directed to Hooke's law and nothing more. The majority's conclusion to the contrary, without so much as acknowledging the parties' arguments or evidence, casts a cloud of confusion not just over the bounds of this case, but over our role as judges. The majority's conclusion that Hooke's law and nothing more reduces two types of vibration in propshafts amounts to a clear rule of law—judges, not experts, will determine as a matter of law, when claims are directed to a natural law and *nothing more*. We are the scientific experts now. Whether Hooke's law and nothing more achieves reduction in two types of vibration in propshafts should be a question of fact, but the majority concludes otherwise. It decides this question of physics as a matter of

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AAM has not been given an opportunity to respond to the majority's new *Nothing More* test. Second, AAM's argument that claim 22 is not directed to or preempts friction damping does not in the least support the majority's conclusion that Hooke's law and nothing more achieves the reduction of two types of vibrations. Finally, even if this twisted logic could be followed, it would at most create a question of fact about which the parties disagree and it would thus be improper to grant summary judgment.

[7] Acknowledging in the end, that Hooke's law alone may not achieve the reduction of two types of vibration, the majority pivots and states that the claim is still ineligible if multiple unclaimed natural laws working together are used to achieve the claimed results. Maj. at 31–32. The majority's conclusion that a claim is ineligible because multiple unclaimed natural laws could be involved in achieving the claimed results is an incredibly broad ruling and will invite a § 101 challenge in every case.

law on appeal in the first instance even at summary judgment.

The majority also holds that determining whether a claim "invokes" a natural law, though no natural law is articulated in the claim is also a question of law for the court to decide. It is undisputed that claim 22 does not mention a natural law either by name or formula. Since Hooke's law is not mentioned by name or formula anywhere in the intrinsic record, how can we conclude, as a matter of law, the claim nonetheless clearly invokes Hooke's law?

As appellate judges, we are well-equipped to discern meaning from legal documents. But things get murkier as we muddle our way into the intersection of science and the law. Thus, the Supreme Court has wisely announced a line between that which we can evaluate de novo (the intrinsic record, composed largely of legal documents) and that which we cannot (everything extrinsic to the record, including expert testimony). *See Teva Pharm. USA, Inc. v. Sandoz, Inc.*, 574 U.S. 318, 324–28 (2015); *see also Aatrix Software, Inc. v. Green Shades Software, Inc.*, 882 F.3d 1121, 1125 (Fed. Cir. 2018); *Berkheimer v. HP Inc.*, 881 F.3d 1360, 1365 (Fed. Cir. 2018). Where, as here, *nothing* in the intrinsic record so much as mentions Hooke's law, we are unquestionably in the extrinsic category. There is nothing in the '911 patent that "clearly invokes a natural law." Yet the majority concludes, as if it would be apparent to anyone who looked, that the claim limitations equal Hooke's law. One can reach such a conclusion only through factfinding based on expert testimony. But judges are not fact or technical experts. The only appropriate fact finder is the district court and not on summary judgment.

If we are going to embark in a tumultuous area of law on a new test for ascertaining when claims are directed to unmentioned natural laws—we should do so with the benefit of briefing or even better, we should remand for the district court to apply the test in the first instance since it

requires resort to extrinsic evidence. Future cases will use this case as a template for how judges can determine as a matter of law when a claim invokes an unmentioned natural law and *nothing more*. All aspects are henceforth a question of law and the record is irrelevant. We are the experts and we will determine when a claim invokes an unmentioned natural law and when nothing but that natural law is necessary to achieve the claimed results.

A disturbing amount of confusion will surely be caused by this opinion, which stands for the proposition that claims can be ineligible as *directed to* a natural law even though no actual natural law is articulated in the claim or even the specification. The majority holds that claims are *directed to* a natural law if performance of the claimed method would use the natural law. The majority has "open[ed] the door to countless challenges to mechanical inventions with underpinnings in one or more, potentially unnamed natural laws." IPO Br. at 9. Holding these claims ineligible under a purported natural law analysis "leaves patentees awash in a sea of uncertainty; how can one determine if a claim is directed to a natural law without a natural law being apparent either on the face of the claim, or under a proper claim construction?" BIO Br. at 5. And the majority's addition of its *Nothing More* test will add nothing more to the clarity. As we see in this case, the *Nothing More* test can be met even when all of the arguments and evidence are to the contrary and will not be finally resolved until we judges bring our scientific acumen to bear on the questions.

B. Claim 1 vs. Claim 22

The majority holds that claim 1 is not directed to a natural law (Hooke's law) because of the additional positioning limitation and the possible inclusion of variables other than mass and stiffness in the tuning limitation of claim 1. Maj. at 24–25. I agree that claim 1 is not directed to a natural law. I would, however, reverse rather than vacate

because under the second step of the *Alice/Mayo* test, there are at least factual questions regarding this claim's inventive concepts which preclude summary judgment. *See infra* Part II. Since we are remanding, the district court will have an opportunity to address these fact questions regarding claim 1 in the first instance.

To hold claim 22 ineligible, the majority holds that claim 22's *inserting* limitation is not equivalent to claim 1's *positioning* limitation "and AAM never argued otherwise." Maj. at 25 n.13. The majority is *sua sponte* interpreting undisputed, unappealed claim terms with reference to nothing. They do not cite the patent, the prosecution history, or any briefs. Neither party ever suggested that the inserting and positioning limitations had different meanings. Claim 22 requires tuning and inserting *wherein* the liner will function as a tuned resistive absorber (damp shell mode) and a tuned reactive absorber (damp bending mode). AAM argued in its Opening Brief that the location of the liner within the shaft was a characteristic which impacted attenuation of vibration. *See, e.g.*, AAM Opening Br. at 64–65 ("The '911 patent specifically teaches how to control the characteristics of a liner to not only match but damp relevant propshaft vibrations, including the thickness of the liner, the interference fit, *the location of the liner*"). "One liner characteristic that can be controlled—'*location* of the liners 204 within the shaft member 200'—is independent of its structure, e.g., its mass and stiffness." *Id.* at 42; *see also* Oral Arg. at 1:36–2:00 ("The specification tells you, here's what you control, you control the diameter of the liner, the thickness of it, where you place the liner, location is important."). Neapco's own expert explained that shell mode vibration is reduced by the fit achieved when the liner is inserted into the propshaft. The majority's *sua sponte* appellate claim construction is improper, unfounded and unsupported by the record. It is not our job on appeal to create our own claim construction issues to hold claims

ineligible especially when they were never briefed or argued by the parties.

II. UNCONVENTIONAL CLAIM ELEMENTS RENDER A CLAIM ELIGIBLE EVEN IF IT FAILS STEP ONE

Even if the majority's analysis of the claims satisfied step one of the *Alice/Mayo* test, which it did not, there is a step two. Step two is a required inquiry precedent to holding that claims are ineligible for patenting. 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 appeal, AAM maintains that liners had never been used to reduce bending mode vibration. *See* AAM Br. at 12, 25–26, 27, 35, 57–60, 63, and 65 n.5; AAM Reply Br. 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*."); *Id.* at 19 ("It was inventive to use a liner to damp bending mode vibrations"); *Id.* at 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. Only to be bolstered by additional strong, fact-based, arguments such as the unconventional use of liners to attenuate multiple vibration modes and unconventional control of characteristics (including mass, stiffness and location) to damp vibration. AAM's opening brief set these 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.

AAM Br. at 57–58.

The patent discloses prior use of plugs, weights, and dampers to attenuate bending mode vibrations, but stresses that liners were not used. '911 patent at 2:29–38. AAM explained that before the '911 patent, liners were not used to damp bending mode vibrations, instead car manufacturers shoved masses of wadded up cardboard into the propshaft. Oral Arg. 6:46–7:11. More than a dozen times in the briefs and during oral argument AAM argued that the use of liners to attenuate bending mode vibration was one of its inventive concepts. During oral argument, AAM 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."

Oral Arg. 6:37–49. Even Neapco acknowledged that the patent states that liners had not been used to attenuate bending mode vibrations. *See* Neapco Br. at 8.[8] It matters not at all to the majority that AAM alleges that liners had not been used to reduce bending mode vibration, nor that Neapco presented no contrary evidence. This majority opinion ignores this step two argument entirely—it never addresses it.

In its prior decision, the majority did address AAM's argument that one of its inventive concepts was to use liners to reduce bending mode vibrations: it suggested that AAM did not make this argument, Prior Maj. at 12 n.3, it made its own fact finding based on evidence not of record that liners were used to attenuate bending mode vibrations, *id.*, and then finally, it held (contrary to *Alice/Mayo*), "it makes no difference to the section 101 analysis whether the use of liners to attenuate bending mode vibrations was known in the art," *id*. Each of these positions has been abandoned today, but the result is the same—this time with no explanation at all. It is inconsistent with precedent

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[8] Though Neapco admits that *the patent* asserts liners had never been used to attenuate bending mode, it argues that whether it was previously unknown to use a liner to attenuate bending mode is "a point that Neapco disputes and the record evidence contradicts." Neapco Br. at 36. Given *Berkheimer*, this, on its face, at least creates a question of fact regarding step two which should have precluded summary judgment of ineligibility. *Berkheimer v. HP Inc.*, 881 F.3d 1360 (Fed. Cir. 2018).

to hold claims ineligible without analyzing the step two arguments.[9]

In *Mayo*, the Supreme Court reflected on the process of updating alarm limits held ineligible in *Flook*. The *Flook* claims recited a mathematical formula and did not explain how the variables used in the formula were to be selected. 556 U.S. at 81. The Court did not stop at step one, it considered the inventiveness of every single claim limitation, and only after concluding that they were all "well-known" held that "there was no inventive concept in the claimed application of the formula." *Id.* at 82. In contrast, the majority stops at step one.

According to the majority, "[w]hat is missing is any physical structure or steps for achieving the claimed result." Maj. at 15. The majority never addresses whether a claim to using a physical, hollow liner inserted inside a hollow drive shaft to attenuate bending mode vibrations in the shaft (yes these are all express claim limitations), was conventional. Much less whether a claim to using the same physical liner to attenuate both bending mode *and* shell mode vibrations was conventional. The result is not, as the majority claims, a tuned liner; the result is the reduction of vibration in the propshaft. And these claims expressly require the reduction of bending mode and shell mode vibrations employing a liner positioned inside the hollow shaft, which according to AAM had never been done before. Goodness sakes, the dependent claims held ineligible by the majority specify the material the liner must be made of (cardboard or plastic or fiberglass or metal (claim 31)) and the actual physical form it must take (extending helically

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[9] The majority states in generality only that "a claimed invention's use of the ineligible concept to which it is directed cannot supply the inventive concept." Maj. at 21–22. AAM has never claimed that its inventive concept is Hooke's law (the ineligible natural law).

(claim 27), with fingers (claim 33), circumferentially wrapped (claim 29) or over-molded (claim 32)) and the place the liners must be positioned ("symmetrically about a bending anti-node" (claims 34, 35)). *See also* Oral Arg. at 29:39–57 ("The claims talk about not only specific locations you put it at anti-nodes for specific modes. The dependent claims also include that they have to be directed to the second bending mode or the second shell mode."). It is remarkable that the majority thinks that claims with all of these very physical, very concrete, very structural limitations are "missing any physical structure or steps." A fiberglass liner with a helically shaped resilient member extending circumferentially around the liner or over-molded to the structural portion of the liner certainly feels like the "physical structure" that the majority says is missing from the claims.

AAM alleges throughout that the concept of tuning a liner, i.e. controlling the characteristics of a liner to dampen vibration of a given system is also an inventive concept. *See id.* at 27–28 and 57–67; AAM Reply Br. at 2, 16, and 18–29. The particular characteristics of the tuned liner will depend on the characteristics of the propshaft it is being used in (for example the natural frequencies, which are inherent properties of each shaft). *See* '911 patent at 7:44–55; AAM Br. at 4, 6, 46, and 53. And the '911 patent's specification explains how to tune liners to attenuate those vibrations. 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 working example of tuned liners for use in a propshaft with specific dimensions and frequencies. *Id.* at 8:2–23. The claims include limitations which get progressively more detailed about the structure and positioning of the liner inside the drive shaft, none of which are addressed by the majority.

AAM has at least raised factual questions about its asserted inventive concepts which should have precluded

summary judgment in this case. Rather than confront AAM's actual claimed and argued unconventional elements (such as a liner for attenuating bending mode vibrations), the majority creates its own strawman to knock down. The majority argues that AAM may have invented patentable refinements to sophisticated FEA software or computer modeling, but that they are not claimed. Maj. at 13–14. Nowhere in the patent or the briefing does AAM claim that the '911 patent's improvement is FEA or computer modeling.

The majority never addresses the inventive concepts alleged by AAM and listed in the above bullets points directly from AAM's opening brief. The second step of *Alice/Mayo* cannot be disregarded in the eligibility analysis.

III. ENABLEMENT ON STEROIDS

"A more accurate statement of the majority's view would have been: 'Section 101 can do everything 112 does-and then some.'" BIO Br. at 9. The majority's new blended 101/112 defense concerns the biotech and pharmaceutical industries who "expend great effort during patent prosecution to meet the rigorous written description and enablement requirements." BIO Br. at 7.

Despite the fact that no party has argued that the claims are not enabled or that a skilled artisan would not know how to design a tuned liner and insert it into a given propshaft to reduce vibration, the majority nonetheless concludes the claims are ineligible because they don't teach *how* to tune a liner. The majority's concern is not preemption of a natural law (which should be the focus), but rather that the *claims* do not teach a skilled artisan *how* to tune a liner without trial and error. The majority's new blended 101/112 defense is confusing, converts fact questions into legal ones and eliminates the knowledge of a skilled artisan.

According to the majority, even if the claims are enabled, they are still ineligible because the claims themselves didn't teach *how* (the majority calls this the first *how* requirement). It is certainly correct that "[a]n improved result, without more stated in the claim, is not enough to confer eligibility." *Koninklije KPN N.V. v. Gemalto M2M GmbH,* 942 F.3d 1143, 1150 (Fed. Cir 2019); *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1356 (Fed. Cir. 2016) (claims are directed to an ineligible abstract idea when they "purport to monopolize every potential solution to the problem"). But such is not the case here. The *goal* or the *result* of the claimed invention is not a tuned liner; it is a drive shaft with reduced vibrations. Claims 1 and 22 read:

> 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:
>
> 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.

The majority states the claim "must identify 'how' that functional result is achieved by limiting the claim scope to structures specified at some level of concreteness." Maj. at 27–28. It is clear from the claims themselves that the functional result is a drive shaft assembly with reduced vibrations. "The present invention relates to . . . a method for attenuating driveline vibrations transmitted through a shaft assembly." '911 patent at 1:4–7. It is undisputed that there exist many different ways to attenuate vibrations in a drive shaft such as dampers, plugs, weights, liners, even wadded up cardboard. The '911 patent claims one specific way to attenuate vibrations, a concretely identified physical structure—a liner inserted inside the propshaft. It does not just claim a result (reducing vibration)—it claims a specific means of accomplishing the result—a liner positioned in the shaft. Even the amount of required reduction in vibration is an element in some claims (claim 1). Claim 22 even specifies (as do others) that the liner is tuned to a

given frequency by adjusting its mass and stiffness. And AAM alleges and the claims require that the liner's placement inside the shaft aids in reducing vibration. There is no question the claims identify a concrete structure and even specify precise variables (mass and stiffness) to be adjusted to tune the liner to the frequency of any given propshaft. The only remaining question (the majority's true concern with these claims) is would a skilled artisan know *how* to adjust the mass, stiffness, and positioning of the liner in order to damp vibration without undue experimentation. *See* Oral Arg. at 12:04–11 (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 29:20–36 (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."). This is the question the majority has and this is a question of enablement, not eligibility.

I dissent from the majority's attempt to inject a heightened enablement requirement into the § 101 analysis. These claims contain a specific, concrete solution (inserting a liner into a propshaft) to a problem (vibrations in a propshaft). Some degree of trial and error in modifying the mass and stiffness of the liner to optimize the reduction in vibration of a given shaft, could (if undue) create an enablement concern, but it is not a § 101 problem. And if § 101 did require an analysis of whether too much trial and error would be required to reduce vibration of a given shaft at a particular frequency, surely this would be a question of fact and not something we decide for the first time on appeal.

IV. FUNDAMENTAL FAIRNESS

I do not agree with the majority's conclusion that claims 1 and 22 are representative or that AAM waived its arguments as to the dependent claims. First, Neapco never

argued that claims 1 and 22 are representative and in fact argued the dependent claims separately. *See* Neapco SJ Br. at 32–33. Second, AAM expressly argued that they are *not* representative. Oral. Arg. 30:50–31:07. 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 AAM 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. *See, e.g.*, AAM's Opening Br. at 13–14, 36, 57–58, and 64–65. I do not agree that AAM waived the dependent claims.

As for claim 34 and 35 in particular, there is an even stronger basis for concluding that the majority is wrong. At six locations in the Opening Brief, AAM argues that location of the liners is one of its inventive control characteristics. *Id.* at 63 ("controlling its characteristics (e.g., length, width, interference fit, *location*, etc.)"); *Id.* at 64–65 ("The '911 patent specifically teaches how to control the characteristics of a liner to not only match but damp relevant propshaft vibrations, including the thickness of the liner, the interference fit, *the location of the liner*"); *Id.* at 13 ("The specification of the '911 patent further explains that liners are tuned for damping by controlling 'various characteristics' including . . . *location* of the liners within the propshaft"); *see also id.* at 35–36 (same). "One liner characteristic that can be controlled—"*location* of the liners 204 within the shaft member 200—is independent of its structure, e.g., its mass and stiffness." *Id.* at 42. And during oral argument, AAM explained that it did argue dependent limitations in the Opening Brief:

> "Q: I didn't see in the Blue Brief separate argument about features of the dependent claims?

> A: We certainly talked about the location of the liner, that's in our briefs, and talked about at length."

Oral Arg. at 30:50–31:01.

Given that the majority now *sua sponte* holds that claim 22 does not contain a location limitation, it is unfair to refuse to review the dependent claims which unquestionably have detailed location limitations. Claim 34 states: "The method of claim 22, wherein a first one of the liners is positioned along the shaft member symmetrically about a bending anti-node." Claim 35 further limits the location of a second liner placed in the shaft. Under these circumstances, it is fundamentally unfair for the majority to hold that AAM did not present arguments regarding the dependent claim limitations in its Opening Brief. Finally, contrary to the majority's assertion (Maj. at 24), the petition for rehearing did not simply state that AAM did not waive arguments related to dependent claims. It pointed to three separate places in the Opening Brief (13–14, 57–59 and 64–65) where it expressly argued location of the liner. Given the Opening Brief's repeated arguments about location and the majority's nascent determination that claim 22 does not have a location limitation, it is wrong to hold AAM waived its arguments regarding dependent claims which contain location limitations.

CONCLUSION

The majority holds that claims are directed to natural laws and are ineligible under § 101 if practicing the method would require application of a natural law and *nothing more* to achieve the claimed results, even when all of the technical experts disagree. The majority has concluded that the *Nothing More* question will be decided on appeal as a matter of law, without briefing and argument, and without regard to what the experts think. I cannot fathom the confusion that will be caused by declaring that claims are ineligible as directed to a natural law, when it is clear

to all involved that this patent does not recite any particular natural law. Every mechanical invention must apply the laws of physics—that does not render them all ineligible, or maybe it does now. Section 101 simply should not be this sweeping and this manipulatable. And the majority's collapse of the two-part *Alice/Mayo* test into a one-part test cannot stand. AAM has argued that there are unconventional elements in these claims, such as using a liner to attenuate bending mode vibrations; this is not the natural law itself. The majority offers no explanation for why this patentee is not entitled to step two consideration, especially at this, the summary judgment stage.

Our job, our mandate from Congress is to create a clear, uniform body of patent law. Our inability to do so in the § 101 space has not been a mess of our making. But, the unfairness, confusion and uncertainty that will be caused by this opinion is all us. Today, we make a choice. I dissent from this choice to extend the notions of ineligibility and to extend the role of the appellate court. Section 112 adequately protects for exactly the concerns the majority expresses, though honestly, I see no enablement problem and none was raised by the defendant. I dissent from the majority's chimeric approach to § 101 which is inconsistent with precedent, a vast expansion of § 101, and bound to cause confusion in future cases.

I dissent from the conclusion that we judges are the true scientific experts. We should not be deciding technical questions, such as whether two types of vibration are reduced by application of Hooke's law and nothing more, as questions of law de novo on appeal.