United States District Court,
N.D. Illinois, Eastern Division.

BORGWARNER, INC., and Borgwarner Torqtransfer Systems, Inc,
Plaintiffs.
v.
NEW VENTURE GEAR,
INC. Defendants.

Dec. 27, 2002.

Patent holder brought infringement action against competitor over patent directed toward transfer case design that was electronically controlled by microcontroller. Construing the claims, the District Court, Bobrick, United States Magistrate Judge, recommended that: (1) incrementally engaging and disengaging meant discrete, fixed steps; (2) "means for determining a desired speed difference between said primary output shaft speed and said secondary output shaft speed" was interpreted as microcontroller programmed with specific algorithm; (3) "means for controlling operation of said clutch means in response to predetermined conditions" was interpreted as programmed microcontroller and electromagnetic ball/ramp clutch actuator; (4) phrase "predetermined rate" meant number of engagement steps that could occur per unit of time; and (5) phrase "electrically powered mover" and "electric operator" meant electromagnetic clutch assembly which included coil and armature actuator.

Ordered accordingly.

In patent directed toward transfer case design that was electronically controlled by microcontroller, phrase "a microcontroller for receiving speed information from the speed sensors" and phrase "and providing an output" included microcontroller programmed with algorithm disclosed in the specification.

MEMORANDUM ORDER

BOBRICK**, United States Magistrate Judge.**

Plaintiff BorgWarner charges defendant New Venture Gear with infringing U.S. Patents Nos. 5,407,024 ("patent 024"); 5,485,894 ("patent 894"); 6,000,488 ("patent 488"); and 6,062,330 ("patent 330"). This matter was referred to this Magistrate Judge for the purposes of conducting a *Markman* hearing and construing the disputed claims of the patents-in-suit. *See* Markman v. Westview Instruments, Inc., 52 F.3d 967, 979 (Fed.Cir.1995). The patents-in-suit deal with four-wheel drive systems employing active-on-demand transfer cases that automatically control the amount of torque transferred to front and rear wheels. A transfer case is an auxiliary transmission designed to permit the drive from the engine of a vehicle to be operatively split to both the front and rear driving axles. The patents-in-suit disclose a transfer case design that is electronically controlled by a microcontroller.

I. ***TECHNOLOGY***

The microcontroller transfer case is the substance of these patents. Four-wheel drive allows vehicles to operate better on slippery road surfaces, or in off-road conditions. Compared to two-wheel drive systems,

however, four-wheel drive systems can result in lower gas mileage, and decreased handling and performance in certain situations. Thus, a part-time four-wheel drive system has the advantage of allowing the operator to select the drive system based on the driving conditions at hand. The operator engages the four-wheel drive system by lever or switch and, within the transfer case, a clutch is engaged that locks the front and rear drive shafts together. The speed of the front and rear wheels becomes equal.

In an on-demand four-wheel drive system, the clutch in the transfer case engages and disengages automatically. This can be an advantage over the part-time, operator-initiated system because it is thought that the operator will not always know when driving conditions call for, or do not call for, four-wheel drive. On-demand transfer cases can be active or reactive. A reactive transfer case employs a mechanical system, such as a viscous clutch, which engages, or reacts, when there is a difference is speed between the front and rear drivelines. A viscous coupling is basically a drum filled with a thick fluid that houses several closely fitted, thin steel discs. One set of the discs is connected to the front wheels and the other to the rear. As one axle begins to demand more torque, the fluid heats up and its viscosity changes. This change in viscosity affects the discs and torque is split according to the actual demands of the axles.

Active on-demand transfer cases employ sensors that monitor traction needs and automatically adjust the delivery of power to the wheel. Sensors may monitor various factors-such as vehicle speed, wheel slip, accelerator pedal angle, or braking-for which a passive system cannot account. The reaction is quicker than in the passive systems, and some handling problems are eliminated as a result. While this can be an advantage, it can also be a disadvantage in some off-road conditions where the shift might be too abrupt. In addition, as it is a more complex system, it can be more costly.

The patents-in-suit describe an active on-demand system. BorgWarner states that its: "transfer cases have primary and secondary output shafts which drive the primary and secondary axles, front and rear output speed sensors, a modulating clutch to transfer torque from the rear output to the front output when necessary, a drive and a driven sprocket, a chain connecting the two sprockets, a planetary reduction gear for high and low range, and a dog clutch for selecting the range." (*Plaintiff's Markman Brief,* at 7). BorgWarner goes on to explain some of this as follows:

The modulating clutch is a friction plate clutch that includes plates that rotate with the primary output shaft and plates that rotate with the secondary output shaft. The plates are interleaved together so that when the plates are engaged (i.e., pressed together) torque is transferred from the primary output to the secondary output. The amount of torque transferred will vary with the amount of engagement. The patents-in-suit teach that the clutch actuator can be electromagnetic, hydraulic, or pneumatic.

A microcontroller controls the amount of clutch engagement and disengagement, The microcontroller is programmed with a control strategy that uses information about vehicle and road conditions to determine when to engage and disengage the modulating clutch. More specifically, the microcontroller first determines the amount of slip (i.e. the difference in rotational speeds) between the front and rear drivelines in determining whether to engage the clutch. A certain amount of slip is acceptable, and in fact, in cornering situations is required. However, when the slip exceeds a certain amount, vehicle handling and performance are affected adversely. The microcontroller determines when the amount of slip is too much. Specifically, the microcontroller receives signals from sensors that are indicative of the rotational speed of the front and rear drivelines. These sensors can be located in the transfer case or at the wheels. From these signals, the microcontroller is able to determine the slip or the speed difference between the front and the rear drivelines.

Once the amount of slip has been determined, the microcontroller uses that information to determine whether the modulating clutch should be engaged or disengaged. Specifically, the amount of slip is compared to a predetermined amount of allowed slip. If the actual slip is greater than the predetermined

amount, the microcontroller generates a signal that causes the modulating clutch to be engaged a discrete amount. The microcontroller then repeats its analysis. If the slip is still above the predetermined amount, the amount of engagement of the modulating clutch is increased again. However, if the slip is below the predetermined of threshold amount, the modulating clutch is disengaged by a discrete amount. Thus, the torque is increased and decreased in a stepwise manner. This incremental engagement and disengagement control is a closed loop control strategy that is repeated over and over again as long as the vehicle is in the on demand mode. The constant monitoring and stepwise clutch engagement and disengagement result in an on demand four-wheel drive system that operates without any driver input. In fact, the driver is unaware of this constant monitoring and engagement/disengagement process.

The patents-in-suit disclose that one technique for applying the incremental control strategy is to use pulse width modulation ("PWM") to control the amount of engagement applied by an electrical clutch actuator. In PWM, the voltage is pulsed to the electrical device to control the amount of power applied. For example, applying five volts to an electrical device will impart about one-half the power that ten volts will provide. However, the same reduced amount of power can be generated with ten volts by leaving it on for 50% of the time, i.e., turning it on and off so that the electrical device receives five volts instead of ten. This method of power application is called PWM because pulses of full voltage are used, but the width of the pulse (i.e., the time duration of the pulse) is adjusted to affect the overall average power.

Other vehicle operating conditions that can be utilized by the BorgWarner control strategy include the vehicle speed, throttle position (i.e., acceleration), brake application, and steering angle (i.e., cornering). The control strategy may utilize the vehicle speed by varying the predetermined amount of allowed slip depending on the vehicle speed. The control strategy may also utilize acceleration. Specifically, a throttle position sensor may be used to determine the throttle position that is indicative of the acceleration. The throttle position is used to determine if the clutch should be engaged to provide better acceleration. The control strategy may further utilize a brake sensor to determine if the vehicle is braking. The control strategy may use information about the steering angle for modifying the measured amount of slip to account for cornering.

The patents-in-suit also disclose that a minimum standby clutch engagement may be utilized in the on demand transfer case system. This standby engagement establishes a minimum torque transfer amount through the modulating clutch. The minimum engagement is sometimes called "touch off torque" or "preload." The purpose of the minimum engagement is to provide faster reactions time to prevent wind up or clunking that otherwise occurs when engagement begins.

(*Plaintiff's Markman Brief,* at 7-10). Obviously, NVG parts company with BorgWarner at significant junctures in this explanation of the patents-in-suit. Specifically, there are twelve claim terms in the three patents-in-suit which are in dispute. For three days beginning September 10, 2002, this court held a *Markman* hearing at which the parties presented their respective interpretations of the twelve patent claims at issue. *See* Markman v. Westview Instruments, Inc., 52 F.3d 967, 979 (Fed.Cir.1995) (*en banc*), *aff'd.* 517 U.S. 370, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996). The parties presented their cases for their interpretations of these twelve claim terms and the court must construe those claim terms in accord with the following applicable law.

II. *CLAIM CONSTRUCTION STANDARDS*

[1] [2] In *Markman,* the Federal Circuit held, and the Supreme Court affirmed, that it is the courts' responsibility as a matter of law to construe the claims of patents for the jury. 52 F.3d at 979. Claim construction is "the process of giving proper meaning to the claim language," the fundamental process that "defines the scope of the protected invention." Abtox, Inc. v. Exitron Corp., 122 F.3d 1019, 1023 (Fed.Cir.1997). Claim construction analysis must begin with the words of the claim, which define its scope.

Teleflex, Inc. v. Ficosa North America Corp., 299 F.3d 1313, 1324 (Fed.Cir.2002). "[T]he language of the claim frames and ultimately resolves all issues of claim interpretation." Abtox, Inc. v. Exitron Corp., 122 F.3d 1019, 1023 (Fed.Cir.1997).

[3] [4] [5] The words used in the claims are interpreted in light of the intrinsic evidence of record, including the written description, the drawings, and the prosecution history, if in evidence. Teleflex, 299 F.3d at 1324. The intrinsic evidence may provide context and clarification about the meaning of claim terms. *Id*. In the absence of an express intent to impart a novel meaning to claim terms, there is a "heavy presumption" that a claim term carries its ordinary and customary meaning. Teleflex, 299 F.3d at 1325. The ordinary meaning of a claim term may be determined by reviewing a variety of sources, including the claims themselves, other intrinsic evidence including the written description and the prosecution history, and dictionaries and treatises. *Id*. (citations omitted). FN1 In all cases, however, the ordinary meaning must be determined from the standpoint of a person of ordinary skill in the relevant art. *Id*. In this case, the parties inform us that one of "ordinary skill" in the art is a person with a Bachelor of Science Degree in engineering, with several years of experience in building and designing transfer cases. At the *Markman* hearing, the parties indicated, however, that expert testimony would not be necessary to their presentations, and neither had their expert attend the proceedings. Nevertheless, the parties referred throughout the proceedings to interpretations based on the understanding of one skilled in the art. While it is true that both sides included reports from their respective experts, those reports-obviously-simply supported the interpretations the parties advanced. In a situation where the parties call upon the court to interpret a dozen intricate claims, some of which are interrelated, FN2 in an area outside the court's expertise, live testimony, with opportunity for cross-examination and questions from the court would have been of real value.

FN1. The Federal Circuit, after a course of consistently characterizing dictionaries as "extrinsic evidence," *see, e.g.,* Interactive Gift Exp., Inc. v. Compuserve Inc., 256 F.3d 1323, 1332 (Fed.Cir.2001); Union Carbide Chemicals & Plastics Technology Corp. v. Shell Oil Co., 308 F.3d 1167, 1178 (Fed.Cir.2002); has recently abandoned this categorization, and determined that "categorizing them as 'extrinsic evidence' or even a 'special form of extrinsic evidence' is misplaced and does not inform the analysis." Texas Digital Systems, Inc. v. Telegenix, Inc., 308 F.3d 1193, 1203 (Fed.Cir.2002). Accordingly, it is entirely proper for both trial and appellate judges to consult these materials at any stage of a litigation, regardless of whether they have been offered by a party in evidence or not. *Id*.

FN2. This case involves several tediously drawn, technically challenging claims, spread over four voluminous patents. The danger here is that a party's presentation on one claim might be found convincing, while the same party's presentation on another claim might not be. To the extent those claims were interrelated, the court's opinion would be internally inconsistent. The court endeavored to avoid such result here, although the parties' presentations seemed, at times, to lead down that path.

Of all the intrinsic evidence, courts have indicated that the specification is the "single best guide to the meaning of a disputed term." Vitronics, Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed.Cir.1996). "Usually, it is dispositive." *Id*. In *Teleflex,* the court indicated that "[o]ne purpose for examining the specification is to determine if the patentee has limited the scope of the claims." 299 F.3d at 1325. As an example of such an instance, the court said "an inventor may choose to be his own lexicographer if he defines the specific terms used to describe the invention with reasonable clarity, deliberateness, and precision." Teleflex, 299 F.3d at 1325. In addition, the specification may be consulted to resolve ambiguity if the ordinary and customary meanings of the words used in the claims are not sufficiently clear to allow the scope of the claim to be determined form the words alone. *Id*. "The patentee may demonstrate an intent to deviate from the ordinary and accustomed meaning of a claim term by including in the specification expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope." *Id*.

[6] On the other hand, while the claims must be read in view of the specification, limitations from the specification are not to be read into the claims. *Id*. at 1326. "That claims are interpreted in light of the specification does not mean that everything expressed in the specification must be read into all the claims." Raytheon Co. v. Roper Corp., 724 F.2d 951, 957 (Fed.Cir.1983). Quoting SRI International v. Matsushita Electric Corp., 775 F.2d 1107, 1121 (Fed.Cir.1985), the *Teleflex* court sought to explain this seeming contradiction:

If everything in the specification were required to be read into the claims, or if structural claims were to be limited to devices operated precisely as a specification-described embodiment is operated, there would be no need for claims. Nor could an applicant, regardless of the prior art, claim more broadly than that embodiment. Nor would a basis remain for the statutory necessity that an applicant conclude his specification with "claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention." 35 U.S.C. s. 112. It is the claims that measure the invention.

299 F.3d at 1326. The *Teleflex* court distilled these concerns to hold that "claims take on their ordinary meanings unless the patentee demonstrated an intent to deviate from the ordinary and accustomed meaning of a claim term by redefining the term or by characterizing the invention in the intrinsic record using words or expressions of manifest exclusion or restriction, representing a clear disavowal of the claim scope." 299 F.3d at 1327. Not surprisingly, with such language as their guide, the parties have engaged in a rather spirited disagreement over the role of the specification in the construction of the claims.

More recently, the Federal Circuit addressed this seemingly ambiguous area of law in Texas Digital Systems, Inc., 308 F.3d 1193 (Fed.Cir.2002), where it held that:

the intrinsic record also must be examined *in every case* to determine whether the presumption of ordinary and customary meaning is rebutted. Indeed, the intrinsic record may show that the specification uses the words in a manner clearly inconsistent with the ordinary meaning reflected, for example, in a dictionary definition. In such a case, the inconsistent dictionary definition must be rejected. In short, the presumption in favor of a dictionary definition will be overcome where the patentee, acting as his or her own lexicographer, has clearly set forth an explicit definition of the term different from its ordinary meaning. Further, the presumption also will be rebutted if the inventor has disavowed or disclaimed scope of coverage, by using words or expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope.

308 F.3d at 1204 (emphasis added, citations omitted). It would appear, then, that the intrinsic record, including the specification, would generally "trump" the claim language in construing the claim. The court, however, went on to caution:

Consulting the written description and prosecution history as a threshold step in the claim construction process, before any effort is made to discern the ordinary and customary meanings attributed to the words themselves, invites a violation of our precedent counseling against importing limitations into the claims. For example, if an invention is disclosed in the written description in only one exemplary form or in only one embodiment, the risk of starting with the intrinsic record is that the single form or embodiment so disclosed will be read to require that the claim terms be limited to that single form or embodiment. *Indeed, one can easily be misled to believe that this is precisely what our precedent requires when it informs that disputed claim terms should be construed in light of the intrinsic record*. But if the meaning of the words themselves would not have been understood to persons of skill in the art to be limited only to the examples or embodiments described in the specification, reading the words in such a confined way would mandate the wrong result and would violate our proscription of not reading limitations from the specification into the claims.

308 F.3d at 1204-05 (emphasis added, citations omitted). It would seem, however, that there will always be a tension in claim construction between reference to the claim language and reference to the specification, especially given what the Federal Circuit itself suggests is misleading precedent.

That being said, there are four patents involved in this dispute, with twelve disputed claim interpretations. The parties briefed these disputes prior to the commencement of the three-day *Markman* hearing. Unfortunately, at least one of the disputes raised at the hearing had not been briefed by the parties. In addition, some of the parties' claim interpretations were changed either during or following the hearing, rendering much of the exposition that went on prior to the change of no import. Following the hearing, the parties were given one more opportunity to set forth their arguments in post- *Markman* briefs. Based on this record, then, the court endeavors to interpret the disputed claims.

III. *CONSTRUCTION OF DISPUTED CLAIMS*

A. *Patent '024*

1. "Incrementally Engaging and Disengaging"

[7] [8] Claims 1, 23, 33, 62, 64, and 66 of patent '024 recite that the modulating clutch is incrementally engaged when a measured speed difference between the primary and secondary drivelines is greater than a predetermined amount and is incrementally disengaged when the speed difference between these drivelines is below that amount. The parties' dispute is over the meaning of the phrase "incrementally engaging and disengaging."

BorgWarner:	**NVG:**
"Incrementally engaging and disengaging" is a closed loop control strategy that incrementally increases the clutch engagement when the slip is above a predetermined amount and incrementally decreases-the clutch engagement when the slip is below that amount. This incrementally engaging and disengaging is done in discrete steps, which may be the same or different sizes. (*Plaintiff's Markman Brief,* at 14).	"Incrementally engaging and disengaging" means discrete steps that are fixed (pre-set prior to using the system). The size of the step is not dependent on the magnitude of the wheel slip and therefore not continuously variable. (*Markman Reply Brief of NVG,* at 8).

The issue regarding this claim distills down to the definition of "incrementally": whether it can describe steps of varying sizes or must mean step of fixed sizes. As noted above, we begin with the "heavy presumption" that a claim term carries its ordinary and customary meaning. Teleflex, 299 F.3d at 1325. To discern the ordinary and customary meaning of a term we may look to dictionary definitions of the word. Kopykake Enterprises, Inc. v. Lucks Co., 264 F.3d 1377, 1382 (Fed.Cir.2001). Dictionaries, as noted earlier, may always be relied on by the court to determine the meaning of the claim terms "so long as the dictionary definition does not contradict any definition found in or ascertained by a reading of the patent documents." *Id., quoting* Vitronics, 90 F.3d at 1584 n. 6.

In this case, the parties offer a buffet of dictionary definitions. BorgWarner's sampling is geared toward a definition of "increment" as "the finite increase of a variable quantity." *Webster's New Twentieth Century Dictionary,* at 926 (2nd ed.1978). FN3 Accordingly, BorgWarner argues that the "ordinary and customary meaning of the word 'incrementally' refers to stepwise changes and that these changes may be variable (or

different) sizes." (*Plaintiff's Markman Brief,* at 15). Not surprisingly, NVG's selections refer to changes in steps of fixed or constant sizes. For example, NVG points to the *Oxford Modern English Dictionary's* definition of increment as "an increase or addition, esp. one of a series on a fixed scale." (*Markman Brief of NVG,* at 10, citing *Oxford Modern English Dictionary,* at 539 (1992)). From the court's perspective, the difference is merely one of context.

FN3. Plaintiff cites additional dictionary definitions to support its interpretation as follows:
Other dictionaries provide similar meanings. The American Heritage Dictionary of the English Language defines "increment" as "1. An increase in number, size, or extent; growth; enlargement. 2. Something added or gained. 3. A small increase in quantity. 4. *Mathematics*. A small positive or negative change in a variable." (Ex. 14.) The Compact Edition of the Oxford English Dictionary defines increment as an amount of increase; an amount or portion added to a thing so as to increase it, an addition ... (Ex. *15.)* Webster's Third New International Dictionary defines "increment" as 1: an increasing or growth in bulk, quantity, number, or value: enlargement, increase 2 a: something that is gained or added: an added quantity or character b: one of a series of regular consecutive additions of like or proportional size or value. (Ex. 16.).

(*Plaintiff's Markman Brief,* at 15).
BorgWarner argues that words in a claim are entitled to their broadest dictionary definition, citing Rexnord Corp. v. Laitram Corp., 274 F.3d 1336, 1342 (Fed.Cir.2001). (*Plaintiff's Post Markman Brief,* at 2). We cannot disagree that, generally, an increment could be of "variable quantity," as BorgWarner argues, of different sizes. There is a specific context here, however, which a definition such as that of the *Oxford Modern English Dictionary* addresses. Beyond that, we are not really resolving the issue of what "increment" means, but what "incrementally" means as used to describe "engaging and disengaging."

We are dealing with "increment" as the root of the adverb "incrementally," which is used to modify "engaging" and "disengaging." While the noun "increment" may refer to a single, step, addition, or unit of increase which may be of any size, the adverb "incrementally" must be applied to the process of engaging and disengaging. Then, we are not speaking of *an* "increment," but a potential series of *increments*. Once the size of *an* increment is determined, "incrementally" would refer to a series of steps or additions of that determined size: one increment following another. Ordinarily and customarily, one might refer to such a process as occurring "in increments of ...," followed by a single amount, as in "increments of 5." It is doubtful, or would at least be rare, that the phrase would ever be followed varied amounts, as in "increments of 5, 7, and 10."

As BorgWarner describes that process, once the microcontroller determines the amount of slip, it compares it to a predetermined amount of allowed slip. If the actual slip is greater than the predetermined amount, the microcontroller causes the modulating clutch to be engaged a "discrete" amount, and the analysis is repeated. If the slip is still above the predetermined amount, the amount of engagement of the modulating clutch is increased again; if the slip is below the predetermined of threshold amount, the modulating clutch is disengaged, again by a "discrete" amount. Certainly, these "discrete amounts" would be "increments," but to suggest they would be of a random or variable size would be counterintuitive. If they could be, the analysis spoken of could simply be performed a single time and the slip corrected for in whatever "increment" was called for. According to BorgWarner, such a single step correction is "very apparentto the driver and undesirable." (*Plaintiff's Markman Brief,* at 8-9 n. 5). It would seem that at least one supposed innovation of the patents-in-suit, the unnoticed correction of slippage, would be defeated by the interpretation BorgWarner advances here. FN4

FN4. At the risk of oversimplification, if the slippage is at a value of ten, BorgWarner suggests that it need not be corrected in five increments of two, but perhaps by one increment of two and an increment of eight. This, one would think, would be nearly as noticeable as a single correction in one increment of ten.

This dispute, then, is resolved by the ordinary and customary meaning of "incrementally engaging." Clearly, the "increments" by which the clutch engages or disengages must be of the same size. "Incrementally engaging and disengaging" means discrete, fixed steps.

2. "Clutch Means", "Modulating Clutch Means", and "Adjustable Clutch Means"

[9] Claims 1, 23, 33, 59, 62, and 64 all recite some form of modulating clutch means. For example, Claim 1 recites:

a transfer case having a primary output shaft adapted to drive said primary wheels, a secondary output shaft adapted to drive said secondary wheels, ***modulating clutch means for selectively transferring torque from said primary output shaft to said secondary output shaft and substantially inhibiting torque transfer from said primary output shaft to said secondary output shaft.***

Claims 23, 33, 62, and 64 all include similar limitations, which may be phrased "clutch means" or "adjustable clutch means." The use of the term "means" in each of the claim limitations, along with the recitation of a function, such as "selectively transferring torque ..." raises the issue of the applicability of 35 U.S.C. s. 112, paragraph 6, which deals with "means-plus-function" claims.FN5 The parties' disagreement over the interpretation of this claim concerns the applicability of "means-plus-function" interpretation rules.

FN5. The paragraph provides that: "[a]n element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material or acts described in the specification and equivalents thereof."

BorgWarner:	**NVG:**
"Modulating clutch means" is a clutch that can transfer different amounts of torque from the primary output shaft to the secondary output shaft. The "modulating clutch means" may be a disk-pack-friction-plate clutch. The "modulating clutch means" does not include an actuator and may be actuated by any type of acceptable actuator. (*Plaintiff's Markman Brief,* at 20).	A means-plus-function element, properly interpreted under s. 112 para. 6 to be the structure described in the specification that performs the recited function, or its equivalent. The structure for performing the function must include clutch assembly 124, which includes an electromagnetic ball/ramp actuator, the drive and driven sprockets 160 and 166 and chain 164. (*Markman Brief of NVG,* at 16).

[10] [11] The use of the word "means" triggers a presumption that the inventor used the term advisedly to invoke the statutory mandate for "means-plus-function" clauses. Allen Engineering Corp. v. Bartell Industries, 299 F.3d 1336, 1347 (Fed.Cir.2002). This area of patent law is a bit counterintuitive from the court's perspective. According to the Federal Circuit:

[t]he question whether a claim element triggers section 112(6) is ordinarily not a difficult one. Claim drafters conventionally use the preface "means for" (or "step for") when they intend to invoke section 112(6), and there is therefore seldom any confusion about whether section 112(6) applies to a particular element.

Greenberg v. Ethicon Endo-Surgery, Inc., 91 F.3d 1580, 1583 (Fed.Cir.1996). It would seem to be a well-settled and simple rule and, consequently, it is puzzling why the patent in this case would employ the

terminology if it was not meant to invoke s. 112, para. 6. That is what BorgWarner claims the patent does here, however, thereby creating the confusion which "seldomly" occurs.

[12] [13] True, there are two circumstances, however, in which courts have allowed that the presumption is not controlling. First, if a claim element employs the word "means" but recites no corresponding function, then s. 112 para. 6 is not applicable. Allen Engineering, 299 F.3d at 1347. Second, even if the claim recites a function, if it also recites sufficient structure or material for performing that function, s. 112 para. 6 does not apply. *Id*. It is this second circumstance that BorgWarner hopes to take advantage of in this case: according to it, a "modulating clutch means" is a structure sufficient to perform the stated functions of "selectively transferring torque ... and substantially inhibiting torque ..." from the primary output shaft to the secondary output shaft. NVG disagrees, but the difficulty here seems to be that both sides have support in the applicable case law.

Part of the problem here stems from somewhat murky, or at least less than specific, case law. As already noted, the court in *Allen Engineering* held that s. 112 para. 6 did not apply if the claim element "recites sufficient structure or material for performing that function." 299 F.3d at 1347. Then, the court went on to state that "[a] claim term recites sufficient structure if the term, as the name for the structure, has a reasonably well-understood meaning in the art." *Id*. In this case, we would be hard-pressed to disagree with BorgWarner that the term "modulating clutch" has a well-understood meaning in the art. Understandably, then, BorgWarner argues that "[t]he clear reasoning of *Allen Eng'g* dictates that 'modulating clutch means for ...' does not invoke s. 112 para. 6 because it recites structure that has a reasonably understood meaning in the art." (*Plaintiff's Post Markman Hearing Brief,* at 10).

[14] While the language of *Allen Engineering* might appear to allow such an argument, we feel it skips a step. The court was relying in part on Watts v. XL Systems, Inc., 232 F.3d 877 (Fed.Cir.2000), which stated that "[a]s an *aid* in determining whether sufficient structure is in fact recited by a term used in a claim limitation, this court has inquired into whether the term, as the name for structure, has a reasonably well understood meaning in the art." 232 F.3d at 880-81 (emphasis added). As such, we begin with the term, and we first query whether that term has a reasonably well understood meaning in the art. Certainly, "modulating clutch" is such a term. The analysis is not complete, however: the term may have a reasonably understood meaning, but it must "be understood by one skilled in the art *as being adequate to perform the recited function*." Budde v. Harley-Davidson, Inc., 250 F.3d 1369, 1377 (Fed.Cir.2001). Based on the court's reading of these cases, it is not enough that the term at issue simply have a reasonably well understood meaning in the art, as it is understood, it must also be adequate to perform the recited function.

With this understanding in mind, we can review what evidence the parties have compiled to support their contentions as to whether "modulating clutch" is a sufficient structure to perform the recited function. They rely, essentially, on expert reports (*Plaintiff's Markman Brief,* at 20-21; *Markman Brief of NVG,* at 20-21) although, as noted above, neither party presented expert testimony at the *Markman* hearing. As a result, the court is left to choose between dry statements, neither of which is subject to questioning from the court or cross-examination. According to BorgWarner, a "modulating clutch means" is a structure sufficient to perform the stated functions of "selectively transferring torque ... and substantially inhibiting torque ..." Its expert, John Starkey explains that:

A "clutch" is a device that provides an interruptible torque connection between two rotating elements. A "clutch" can use positive contact, friction, magnetic forces, or fluid pressure to transfer torques between two elements. A "modulating clutch" is an even more specific type of clutch that can transfer different amounts of torque. The dictionary definition of modulate is "to vary the amplitude." This is exactly what the modulating clutch does, i.e., vary the amount of torque transferred from none to full capacity. Such clutches use magnetic fields, fluid pressure, or friction plates to transfer the torque.

(*Plaintiff's Markman Brief,* at 20-21, citing App. V, Ex. A, pp. 6-7). NVG argues that this structure-the modulating clutch-cannot perform the function without an "actuator" which turns the clutch on and off, relying on its expert, Jeffrey Stein. (*Markman Brief of NVG,* at 20, citing Ex. 9a, para. 54). In his report, Mr. Stein stated:

a "friction clutch with multiple plates"is insufficient to perform the claimed function. One reason ... is because the this[sic] "friction clutch" requires an actuator in order to "selectively" transfer torques (or as stated in some of the claims, "modulate" or "adjust" torque levels). Dr. Starkey's "friction clutch with multiple plates"... would fail to perform this function this structure is missing an actuation mechanism (e.g. the electromagnetic actuation mechanism described in the specification). Additionally, the recited function requires that the torque is selectively transferred from the primary output shaft to the secondary output shaft .... a "friction clutch" alone cannot accomplish this function-a chain and sprocket assembly is necessary to transfer torque from the "friction clutch" to the secondary output shaft.

(*Id.*). Indeed, another of BorgWarner's experts-in patent law if not transfer cases-Gerald Bjorge, testified-tentatively, as he put it "that the term modulating clutch means by itself would not recite enough structure to be a nonmeans plus function element." (*Markman Brief of NVG,* Ex. 16, at 72). This automotive engineering version of "he said, he said" culminated at the deposition of BorgWarner's expert, who testified as follows:

Q: Now, what components make up that friction clutch with multiple plates?

A: The components which transmit the torque through the clutch.

Q: Can the friction plates transmit torque without an actuator of some type?

A: Clearly they need other enabling components to transmit the torque, but they are the ones that transmit the torque through the clutch.

(*Markman Brief of NVG,* App., Ex. 11 at 123-24). This is the type of thing that just goes back and forth and, unfortunately, the court did not have the opportunity to question the experts, and perhaps force them to commit to one position, at the *Markman* hearing. Significantly, though, for our purposes, the plaintiff's expert testimony stops short of asserting that the "modulating clutch" is sufficient to perform the recited function.FN6 Considering all the evidence, and the varying opinions, it appears that, while "modulating clutch" may have a well understood meaning in the art, it is not a sufficient structure to perform the recited function. Accordingly, we find that s. 112, para. 6 is applicable.

FN6. Indeed, plaintiff's argument regarding the sufficiency of the structure to perform the recited function is without citation to the record:
The structure identified by the limitation "modulating clutch means" is sufficient to perform the functions identified in the claims. A modulating clutch clearly enables torque to be transferred from the primary output shaft to the secondary output shaft when the clutch is engaged a certain amount. Likewise, a modulating clutch will "substantially inhibit torque transfer" if the clutch is not engaged or only slightly engaged. Because a "modulating clutch" is a specific structure that both transfers torque and inhibits torque transfer from the primary output to the secondary output shaft, this limitation should not be interpreted under 35 U.S.C. s. 112 para. 6.

(*Plaintiff's Markman Brief,* at 21). These are all conclusory, unsupported assertions, however, and are inadequate, without more, to bolster BorgWarner's position.
[15] [16] Construction of a means-plus-function limitation involves two steps. First, the court must identify

the claimed function. Cardiac Pacemakers, Inc. v. St. Jude Medical, Inc., 296 F.3d 1106, 1113 (Fed.Cir.2002)(citing Telemac Cellular Corp. v. Topp Telecom, Inc., 247 F.3d 1316, 1324 (Fed.Cir.2001)). The court must construe the function of a means-plus-function limitation to include the limitations contained in the claim language, and only those limitations. Cardiac Pacemakers, 296 F.3d at 1113. The court may neither narrow the scope of the function beyond the claim language, nor broaden the scope of the claimed function by ignoring clear limitations in the claim language. *Id*. Here, "modulating clutch means" must be interpreted to be the structure set forth in the specification that performs the claimed function of "selectively transferring torque from said primary output shaft to said secondary output shaft and substantially inhibiting torque transfer from said primary output shaft to said secondary output shaft."

[17] Second, the court must determine what structure, if any, disclosed in the specification corresponds to the claimed function. *Id*. In order to qualify as corresponding, the structure must both perform the claimed function, and clearly associate the structure with performance of the function. *Id*. The court does this-or at least attempts to-from the perspective of a person of ordinary skill in the art. *Id*.

The parties, with some reliance on their respective experts, direct the court to two different structures disclosed in the specification that purportedly perform the claimed function. BorgWarner submits that:

the components that actually transfer torque and inhibit the transfer of torque are the components of the disc pack clutch assembly 150 described in the specification. Those components include interleaved friction plates or discs 152, clutch hub 155, and annular housing 156.

(*Plaintiff's Markman Reply Brief,* at 14 (*citing* Patent '024, col. 8, ls. 52-58)). NVG claims that this interpretation ignores the requirement that torque be *selectively* transferred, and that it be transferred *between* the two shafts. As NVG would have it:

The specification makes clear that the claimed function is performed by the clutch assembly 124 (including ball/ramp device), the chain drive sprockets 160 and 166, and the drive chain 164. The specification states that these components transfer torque from the primary out put shaft 40 to the secondary output shaft 26 of the transfer case when energized, as is required by the claims.

(*Markman Brief of NVG,* at 21 (citing Patent '024, col. 9, ls. 34-42)). BorgWarner criticizes this interpretation as confusing the performance of the function with the *enablement* of that performance. Through several rounds of briefing, the parties offer no response to these respective criticisms.

In Asyst Technologies, Inc. v. Empak, Inc., 268 F.3d 1364 (Fed.Cir.2001), upon which BorgWarner relies, the court attempted to differentiate between a structure that actually performed a recited function, and one that merely enabled the pertinent structure to operate as intended. In that case, the recited function was "receiving and processing digital information ..." and the disputed structure was the line that transferred the information. Obviously, the line did not "receive and process" but merely enabled that function by transmitting, so it was found not to be pertinent structure. 268 F.3d at 1370-71. BorgWarner fails to expound upon the purported analogy to its position, however. (*Plaintiff's Markman Brief,* at 14). The function at issue is the selective transfer of torque between the two shafts. The structure cited by NVG is directly involved in the function, along with the clutch. If "transferring" were part of the function in *Asyst,* we suspect the line would be pertinent structure. Accordingly, we must find that the structure for performing the function must include clutch assembly 124, which includes an electromagnetic ball/ramp actuator, the drive and driven sprockets 160 and 166 and chain 164.

[18] We must address one final point regarding this claim dispute. After two rounds of briefing, BorgWarner came up with a new argument at the *Markman* hearing and in its post- *Markman* hearing brief: that NVG's interpretation violates the doctrine of claim differentiation. Under the doctrine of claim

differentiation, there is a presumption that each claim in a patent is different in scope, especially if "there is a dispute over whether a limitation found in a dependent claim should be read into an independent claim, and that limitation is the only meaningful difference between the two claims." Ecolab, Inc. v. Paraclipse, Inc., 285 F.3d 1362, 1375 (Fed.Cir.2002). BorgWarner submits that claim 1, an independent claim, must be broader that its dependent claims, such as claim 10. It argues that NVG's interpretation-that the "modulating clutch" of claim 1 must have a "electromagnetic ball/ramp actuator"-renders claim 1 impermissibly narrower than claim 10.

[19] [20] The doctrine of claim differentiation, however, only guides the court's interpretation of the claims, it is not a "hard and fast rule of construction." Kraft Foods, Inc. v. Int'l Trading Co., 203 F.3d 1362, 1368, (Fed.Cir.2000). Indeed, it is settled law that independent claims containing means-plus-function limitations do not have the same literal scope as dependent claims reciting specifically the structure that performs the stated function. Medtronic, Inc. v. Advanced Cardiovascular Systems, Inc., 248 F.3d 1303, 1313 (Fed.Cir.2001). In *Laitram Corp. v. Rexnord, Inc.,* the court held that "[a] means-plus-function limitation is not made open-ended by the presence of another claim specifically claiming the disclosed structure which underlies the means clause or an equivalent of that structure." 939 F.2d 1533, 1538, (Fed.Cir.1991). Thus, claim differentiation will not be applied to a situation where, as here, a dependent claim recites the only structure disclosed in the specification that could correspond to the means claimed in the independent claim.FN7 Accordingly, our interpretation of this claim, then, remains unchanged: the structure for performing the function must include clutch assembly 124, which includes an electromagnetic ball/ramp actuator, the drive and driven sprockets 160 and 166 and chain 164.

FN7. BorgWarner argues that the case of Wenger Mfg., Inc. v. Coating Mach. Sys., Inc., 239 F.3d 1225 (Fed.Cir.2001) mandates that the doctrine of claim differentiation be applied in a means-plus-function situation, such as in this case. (*Plaintiff's Post Markman Hearing Brief,* at 12). In *Wenger,* unlike here, the court was dealing with a dependent claim that recited a *separate and distinct function* from the independent claim. 239 F.3d at 1234. Accordingly, the court found that the structure that performed the function recited in the independent claim should not be interpreted as requiring structure to perform the additional function of the dependent claim. *Id.* Plaintiff does not explain how the holding applies to the instant case, which is more akin to the situation in *Laitram.*

3. "Means for Determining a Desired Speed Difference"

[21] Claim 52 reads, in part, "means for determining a desired speed difference between said primary output shaft speed and said secondary output shaft speed." The parties agree that this limitation is a "means-plus-function" element under s. 112 para. 6. The dispute is over what structure is disclosed in the specification for performing the function of "determining a desired speed difference ..."

BorgWarner:	**NVG:**
"Means for determining a desired speed difference between said primary output shaft speed and said secondary output shaft speed" is circuitry within a microcontroller for determining a desired speed difference between said primary output shaft speed and said secondary output shaft speed. (*Plaintiff's Markman Brief,* at 23).	A means-plus-function element, properly interpreted under s. 112 para. 6 to be the structure described in the specification that performs the recited function, or its equivalent. That structure is a microprocessor with specific circuitry (i.e., programmed with a specific algorithm) that determines the desired speed threshold based on (1) whether the brakes are on or off and (2) whether the transfer case is in high or low gear. (*Markman Brief of NVG,* at 23).

As we interpret the parties' presentations, the dispute here is whether the claim can be interpreted as broadly as a general "circuitry within the microcontroller" or whether it must be interpreted to include specific programming of that microcontroller circuitry. According to BorgWarner, the structure that is disclosed in the specification for performing the recited function is circuitry within the microcontroller, which is described in detail in column 13, lines 52-68, of Patent '024. (App.I, p. 27.). As BorgWarner explains:

It is commonly known among those of ordinary skill in the art that the circuitry of the microcontroller stores and implements the control programs and routines, as well as facilitates the computations, analyses, and generation of output signals. The specification states that "the microcontroller utilizes an interrupt driven program which functions with four internal loops having distinct cycle times." During the steps of one of the routines performed by the microcontroller, "the maximum allowable drive shaft speed difference" is determined. Also, "a process step 254 determines the maximum allowable wheel speed difference (which is indicative of wheel slip) for the present vehicle speed inferred from the speed of the drive shaft which is rotating more slowly." Furthermore, this "desired speed difference" is the "threshold" slip value "below which the system does not take action to correct for wheel slip and above which the system begins to correct for wheel slip."

(*Plaintiff's Markman Brief,* at 23-24). NVG submits that the structure that performs the recited function is a microcontroller programmed with the specific algorithm disclosed in the specification.

In WMS Gaming, Inc. v. International Game Technology, 184 F.3d 1339 (Fed.Cir.1999), the court dealt with a means-plus-function limitation involving a microcomputer. As the court explained:

The structure of a microprocessor programmed to carry out an algorithm is limited by the disclosed algorithm. A general purpose computer, or microprocessor, programmed to carry out an algorithm creates "a new machine, because a general purpose computer in effect becomes a special purpose computer once it is programmed to perform particular functions pursuant to instructions from program software." The instructions of the software program that carry out the algorithm electrically change the general purpose computer by creating electrical paths within the device. These electrical paths create a special purpose machine for carrying out the particular algorithm.

184 F.3d at 1348. The court held that, "[i]n a means-plus-function claim in which the disclosed structure is a computer, or microprocessor, programmed to carry out an algorithm, the disclosed structure is not the general purpose computer, but rather the special purpose computer programmed to perform the disclosed algorithm." 184 F.3d at 1349.

In this case, NVG contends that the only "disclosed algorithm" for determining the desired speed difference employs brake and gear information:

The maximum allowable wheel speed difference for a given vehicle speed (which is indicative of wheel slip) is determined from that part, i.e., Part A, B, C, or D of Section 1 of Table II which corresponds to the then current operating conditions of the vehicle, i.e., *whether the brake switch is activated and whether the transfer case is in high or low gear*.

(Patent '024, col. 17, ls. 33-39). Under *WMS Gaming,* then, the disclosed structure must be interpreted as the microcontroller programmed with a specific algorithm that determines the desired speed threshold based on (1) whether the brakes are on or off and (2) whether the transfer case is in high or low gear.

BorgWarner argues that the specification also states that the desired speed difference is related to the vehicle speed and the identity of the overrunning shaft, and "may also be dependent upon, for example, steering angle and braking." (*Plaintiff's Markman Reply Brief,* at 15 (citing Patent '024, col. 2, ls. 46-49)).

BorgWarner also submits the specification contains still other algorithms that can be used, including one involving steering angle (col. 10, 1.64-col. 11, 1.2). (*Plaintiff's Markman Reply Brief,* at 15 n. 15). At this point, the parties once again descend into a "he said, she said" battle: NVG claims these are not algorithms; BorgWarner says they are.

Through several rounds of briefing, unfortunately, neither party expounds on their algorithm position, or offers any support for their positions beyond conclusory assertions. (*Plaintiff's Markman Reply Brief,* at 15 n. 15 ("the specification of the patents in suit makes clear that there are many algorithms that can be used to determine the desired speed difference"); *Post Markman Hearing Brief of NVG,* at 10 (describing BorgWarner's citations as "merely part of the Summary" portion of the specification-despite the fact that not all cited portions were in the Summary, and "not an *algorithm* that performs the claimed function"); *Plaintiff's Post Markman Hearing Brief,* at 13 ("The specification discloses multiple algorithms that may be used by the microcontroller to determine the desired speed difference ...")). The parties leave the court to speculate as to what a person skilled in the art would make of all these putative algorithms; whether such an individual would understand they were to employ them to program the microcontroller to determine the desired speed difference. Based on the record the parties have developed, however, the court is constrained to find the only *algorithm* to be found in the patent-as opposed to lists of possible influencing factors which BorgWarner cites-determines the desired speed threshold based on (1) whether the brakes are on or off and (2) whether the transfer case is in high or low gear. Accordingly, the disclosed structure must be interpreted as the microcontroller programmed with that specific algorithm.

4. "Means for Controlling Operation of Said Clutch Means in Response to Predetermined Conditions"

[22] Claim 59 provides, in part:

[i]n an adaptive four-wheel drive system including a torque distributing system for four-wheel drive operation having a primary drive and secondary drive line, clutch means associated with said secondary drive line, and **means for controlling operation of said clutch means in response to predetermined conditions,** a method for controlling clutch operation comprising:

determining primary drive line speed,

determining secondary drive line speed,

determining the speed difference between said primary drive line speed and said secondary drive line speed,

comparing a desired speed difference and said determined speed..

engaging said clutch at a predetermined rate ...

disengaging said clutch at a predetermined rate ...

Again, the parties are in agreement that this is a "means plus function" claim limitation under s. 112 para. 6, but differ as to the function which the claim recites.

BorgWarner:	**NVG:**
"Means for controlling operation of said clutch means in response to predetermined conditions" is circuitry within a microcontroller for controlling the operation of	A means-plus-function element, properly interpreted under s. 112 para. 6 to be the structure described in the specification that performs the recited function, or its

the modulating clutch in response to predetermined conditions. (*Plaintiff's Markman Brief,* at 25).

equivalent. The structure is a programmed microcontroller and the electromagnetic ball/ramp clutch actuator. (*Markman Brief of NVG,* at 25).

According to BorgWarner, the structure identified in the specification for performing the recited function is, again, the circuitry within the microcontroller set out in Patent '024, col. 13, ls. 52-68:

It is commonly known among those of ordinary skill in the art that the circuitry of the microcontroller stores and implements the control programs and routines, as well as facilitates the computations, analyses, and generation of output signals. (App. I, pp. 27-35, col. 13, line 52 col. 29, line 15; App. V, Ex. A, p. 10.) The specification states that "the microcontroller utilizes an interrupt driven program," during which routines are performed "which monitor the Hall effect sensors 170, 176 and 180 compute the vehicle speed, control the locking hubs 16, enable, operate and disable the electromagnetic clutch assembly 124." (App. I, p. 27, col. 13, lines 56-57, 63-66.) Further, "[t]he transfer case includes a modulating electromagnetic clutch controlled by the microcontroller." (App. I, p. 21, col. 2, lines 3 5-36.). As set forth in the specification, the "predetermined conditions" of the claim limitation include the speeds of the output shafts of the transfer case, throttle information, and brake information.

(*Plaintiff's Markman Brief,* at 25-26). The relevant portion of the specification indicates that the microcontroller determines if there is a slip condition by comparing the speeds of the output shafts and, if it exceeds the threshold amount, generates a signal that causes the clutch to begin engaging. The microcontroller again performs the comparison, repeating the process until the slip drops below the threshold amount, at which time the microcontroller then generates a signal that causes the clutch to begin disengaging. This, as BorgWarner would have it, is the function of controlling the operation of the clutch. (*Plaintiff's Markman Brief,* at 26).

NVG adds to the microcontroller the "electromagnetic ball/ramp actuator." NVG's position is based on its contention that the "means for controlling operation of said clutch" must not only perform the microcontroller computations, but must also engage and disengage the clutch. (*Markman Brief of NVG,* at 25).

BorgWarner argues that claim 59 is a "method" claim, with specific rules for its interpretation-an argument that first appears in its reply brief. (*Plaintiff's Markman Reply Brief,* at 15-16). According to BorgWarner, because the "means for controlling" element is in the preamble of the claim, it need not perform all six actions that follow, i.e., determining primary drive line speed, determining secondary drive line speed, determining the speed difference between said primary drive line speed and said secondary drive line speed, comparing a desired speed difference and said determined speed, engaging said clutch at a predetermined rate, and disengaging said clutch at a predetermined rate. BorgWarner relies on Vaupel Textilmaschinen v. Meccanica Euro Italia, 944 F.2d 870, 879-80 (Fed.Cir.1991) for the proposition that:

Structural language in the preamble of a method claim merely defines the general environment for the method and does not dictate how the steps of the method must be performed. Indeed, the steps that comprise the method need not be performed by any of the elements recited in the preamble.

(*Plaintiff's Markman Reply Brief,* at 15-16). In *Vaupel,* the court was considering the issue of infringement of a patent for a weaving method and a machine. In the preamble language of that particular patent, were the terms "breast beam" and "breast plate," which the district court concluded were used "only to fix the direction of movement of the woven fabric on the loom" and not to constitute claim limitations. 944 F.2d at 880. The appellate court agreed, finding that:

"[b]reast beam" and "breast plate" are not structural limitations of Claims 1 and 2; as used in Claims 1 and

2, they indicate a reference point to fix the direction of movement of the woven fabric from the loom.

Id. The appellate court also concluded that the weaving steps of the claim need not be carried out in the specific manner or order appearing in the preferred embodiment. *Id*.

Does this holding apply here? Unfortunately, BorgWarner does not trace the analogy from a weaving to a "means for controlling operation of said clutch means in response to predetermined conditions ..." and the court is unwilling, without more from BorgWarner, to make such a leap. We do not read *Vaupel* as holding that the preamble can never limit the claim, as that would be contrary to case law. In C.R. Bard, Inc. v. M3 Systems, Inc., 157 F.3d 1340 (Fed.Cir.1998), the court indicated that the preamble could indeed limit the scope of a claim, as well as simply state the intended use or purpose of the invention. 157 F.3d at 1350. Here, BorgWarner seems to argue that the while the first four steps following the preamble-determining primary drive line speed, determining secondary drive line speed, determining the speed difference between said primary drive line speed and said secondary drive line speed, comparing a desired speed difference and said determined speed-must be performed, the last two-engaging and disengaging the clutch-need not be. That proposition is very difficult to draw from the *Vaupel* holding to the extent that *Vaupel* stated that the steps might be performed in a different manner or order-but performed nonetheless-and BorgWarner's arguments to the contrary, both on paper and at the *Markman* hearing have been conclusory and unconvincing. As a result, we must find that the structure must perform the stated steps, and therefore, must be interpreted as a programmed microcontroller and the electromagnetic ball/ramp clutch actuator.

5. "Predetermined Rate"

[23] Claim 59 recites, in part, "engaging said clutch at a predetermined rate to transfer torque from said primary drive line to said secondary drive line" and "disengaging said clutch at a predetermined rate to substantially inhibit torque transfer from said primary driveline to said secondary driveline." The dispute regarding this claim is over the meaning of the term "rate."

BorgWarner:	**NVG:**
A "predetermined rate" is a preset time for each step of the clutch engagement and disengagement. (*Plaintiff's Markman Brief,* at 27).	A pre-set change in the clutch engagement or disengagement per pre-set time interval. (*Markman Brief of NVG,* at 27).

Here, the parties claim to agree that a rate is defined as a relationship between two variables, but apparently disagree as to what those two variables are. BorgWarner contends that they are the number of times the clutch engagement is changed-a potential number of steps-and a period of time. NVG, on the other hand, argues that the rate must involve the force or pressure of clutch engagement and a period of time.

BorgWarner defines "predetermined rate" as a pre-set number of steps that can occur per a unit of time. In the specification, it is explained each step lasts 30 milliseconds before the engagement level can be changed. As a result, in BorgWarner's interpretation, the clutch engagement may be changed *at a rate* of 200 times per minute. NVG adds to this ratio the "amount of clutch engagement," interpreting the rate to involve the act of engagement, the pressure or force of the engagement, and the time period. At the same time, NVG allows that the term "rate" refers to a relationship between only two variables. (*Post Markman Hearing Brief of NVG,* at 12). This would allow for BorgWarner's interpretation: the variables would be the number of engagement steps and the period of time. Clutch force or pressure would be a third variable. Accordingly, we construe this claim as the number of engagement steps that can occur per a unit of time.

B. *Patent '894:*

"*A Plurality of Predetermined Values*"

[24] Claim 17 recites of Patent '894 recites, in part:

a microcontroller for determining operating values including the difference between the speeds of said primary drive line and said secondary drive line and the identity of one of said drive lines overrunning the other of said drive line, **comparing said operating values with a plurality of predetermined values and** engaging said clutch in increments when said predetermined values are exceeded by said operating values and disengaging said clutch in increments when said predetermined values exceed said operating values.

Claim 11 recites a microcontroller that performs substantially the same operations.

BorgWarner:	**NVG:**
"Plurality of predetermined values" is a predetermined difference between the speeds of the output shafts and a determination of which shaft is overrunning (i.e., rotating the fastest), and the microcontroller causes the clutch to engage when the slip is greater than the amount of the predetermined difference. (*Plaintiff's Markman Brief,* at 20).	A microcontroller having circuitry and predetermined information (i.e., determined beforehand) to (1) determine operating values, (2) perform a comparison between at least two operating values with at least two pre-set values and based on this comparison, (3) engage the clutch assembly when both pre-set values are judged to exceed said both operating values; and (4) disengage the clutch assembly when both operating values exceed both pre-set values. (*Markman Brief of NVG,* at 29).

The parties had some difficulty, on paper and at the hearing, with this particular dispute, to the extent that it is unclear exactly what the dispute is about. Certainly, even in a patent claim, that meaning of the phrase "plurality of predetermined values" is self-evident. In ordinary language, at least, it would refer to at least two values that are set prior to comparison with operating values. Once the parties begin arguing over the interpretation, however, the problems begins.

BorgWarner's interpretation of the disputed claim term starts with the "operating values," which BorgWarner says are determined by the microcontroller, and include (1) the speed difference between the output shafts and (2) a determination of which shaft is overrunning. (*Plaintiff's Markman Brief,* at 29 (citing Patent '894, col. 30, ls. 33-42)). BorgWarner then explains that these operating values are compared with a "plurality" of "predetermined values," meaning, not surprisingly, "two or more predetermined values." (*Plaintiff's Markman Brief,* at 29-30). NVG argues that "a person of ordinary skill in the art would understand from the plain wording of the claim language that at least two 'operating values' must be compared with at least two 'predetermined values.' " (*Markman Brief of NVG,* at 29-30). After the initial round of briefing, it was difficult to grasp exactly what was in dispute.

The *Markman* hearing was of little help in this regard, as the parties went back and forth in a similar manner:

BorgWarner: We believe that the predetermined values, your Honor, are the different speed differences that are calculated-or, I'm sorry, the different allowed speed differences that are determined based on the different operating conditions.

Court: Yes.

BorgWarner: And I'm not sure what NVG believes what the predetermined values are. They haven't identified what they believe the predetermined values to be.

* * * * * *

As [NVG] said, as the vehicle is moving, the operating conditions are changing. The predetermined values will change.

Court: Predetermined values is going to change predicated on the operating conditions which include utilization of the brakes, steering angle compensation; there are some others.

BorgWarner: Identity of the shaft that is overrunning.

* * * * * *

Court: [NVG], where is the difference here? I don't see it. I'm just having trouble understanding where the dispute lies with respect to understanding this term.

NVG: What BorgWarner is saying is that it says, "... operating values including the difference between the speeds of the said primary drive line and said secondary drive line ...,"

* * * * * *

And those are all the values he's talking about. That's one operating value.

* * * * * *

But the key I guess for us is understanding the microcontroller has to compare more than one operating value with more than one predetermined value. And if you look at the yellow sheet ...

Court: Well, BorgWarner, you disagree with that?

BorgWarner: I'm not sure I understood. I think what it has to do, your Honor, it has to determine the predetermined values, whatever they may be, based on the operating conditions -

Court: And it's a plurality of them.

BorgWarner: Right. It could be many.

Court: It's a predetermined value. As I understand the "predetermined value," the predetermined value of allowable slippage, and there is a plurality of those because you're computing more than one factor. You're computing a number of different factors that have changing values within themselves that give different, and this computer takes into account and comes up with the answer, what the single predetermined value is of the plurality. Am I missing something?

NVG: Well, the way we understand their argument, and it's based on their claim interpretation, is that there is one single difference. And we say there has to be two single differences.

* * * * * *

BorgWarner: Well, the microprocessor constantly computes different predetermined values.

Court: Yes, a plurality of them.

BorgWarner: Right.

Court: And takes them into account a bunch of different operating values.

BorgWarner: Yes.

Court: So where are we, then, on this thing?

* * * * * *

NVG: ... We see their interpretation as requiring only one comparison, ours talks about plural comparisons. And if they don't have a problem with ours, we ask that you adopt ours and we'll move on.

BorgWarner: Theirs doesn't identify what the predetermined values are, your Honor. That's the problem. With predetermined values-

Court: The predetermined value is constantly changing.

BorgWarner: That's right.

Court: That's why you have a plurality of predetermined values.

BorgWarner: Exactly.

* * * * * *

Court: First of all, the term "plurality of predetermined values," again, to me, the microprocessor I guess, maybe has to be included, but to me it means a computation of a number of predetermined values from a number of operating values. That's all it means to me, with or without a microprocessor.

NVG: And that there has to be this comparison of more than one.

* * * * * *

BorgWarner: I think we're almost on the same page here, your Honor. I think that what it is is that there is a plurality of predetermined values of speed differences based on different operating conditions.

Court: Yes.

BorgWarner: And that is as the system is functioning -

Court: All right, [NVG] suggests that your definition is in the singular, that the microprocessor reviews one operating value only and comes out with a plurality of predetermined values. He says that's not correct, a plurality of predetermined values is something that emanates from the analysis of more than one, several different operating values.

BorgWarner: Right, there are several operating values and you come up with different predetermined values.

Court: I don't think you guys have a dispute.

NVG: Then I ask that you accept ours and adopt ours.

Court: ... I want you two fellows to meet because I don't get the problem here.

NVG: I guess I'm the only one who sees it as a difference between plural and singular.

Court: ... whatever it is, certainly the plurality of predetermined values comes from more than one, and indeed several, operating factors. Can that be the definition?

NVG: That is the definition.

BorgWarner: Your honor, I would agree that the plurality of predetermined values, those values are the plurality as determined based on different operating conditions.

(*Markman Hearing Transcript,* at 345-53). Nevertheless, the parties could not agree on a definition, or on exactly what was in dispute. (*Id.* at 357-58; *Plaintiff's Post Markman Hearing Brief,* at 17; *Post Markman Hearing Brief of NVG,* at 14-15).

A review of the parties' somewhat jejune presentation on this claim dispute leaves the court where it was to begin with. "Plurality of predetermined values" means more than one pre-set value. To the extent that the dispute is over the phrase "operating values," that, too is plural. As is stated in the claim, "includ[es] the difference between the speeds of said primary drive line and said secondary drive line and the identity of one of said drive lines overrunning the other of said drive line." That "operating values" is said to "include" these two conditions, we would think, means that operating values is not limited to these two conditions. That is as far as the court can go on this record. A "plurality of pre-determined values" means that the "said operating values" must be compared with at least two values that are set prior to that comparison.

C. *Patent '488*

1. "A Modulating Electromagnetic Clutch Assembly"

[25] [26] Claims 10 and 17 recite, in part:

a modulating electromagnetic clutch assembly defining a sole torque transfer path between said primary output and said secondary output, said modulating clutch including a first plurality of clutch plates coupled to said primary output interleaved with a second plurality of clutch plates coupled to said secondary output.

The dispute over this claim is multi-faceted. Essentially, it involves whether the term "electromagnetic" can be read apart from the term "clutch." That is, whether "electromagnetic" is an adjective simply modifying "clutch" or "electromagnetic clutch" is, itself, a term of art with its own meaning. It would also seem to involve whether "electromagnetic clutch" can be read apart from the terms "modulating" and "assembly."

BorgWarner:	**NVG:**
A "modulating electromagnetic clutch assembly" is a clutch that can transfer different amounts of torque from the primary output shaft to the secondary output shaft and that is actuated using an actuator that uses the principles of electromagnetism to convert electric current into a magnetic force. The modulating	A disk-type clutch that is actuated by the electromagnetic attraction between a current carrying coil and a ferromagnetic clutch plate, i.e., armature. An electric motor actuated clutch is not an "electromagnetic clutch" because it does not use magnetic attraction between a coil and clutch plate, i.e., armature, to actuate the clutch. (

electromagnetic clutch assembly includes a disk-pack-friction-plate clutch. The actuator can be any electromagnetic actuator including a coil and armature or an electric motor. (*Plaintiff's Markman Brief,* at 31; *Plaintiff's Post Markman Hearing Brief,* at 17).

Markman Brief of NVG, at 32).

In this claim dispute, the parties give a passing nod to claim interpretation and bolt ahead to infringement. Throughout the portion of the *Markman* hearing devoted to this claim, the argument was mostly over whether this patent claim reads on an electric motor actuator. (*Markman Hearing transcript,* at 379-458). Indeed, NVG's counsel admitted that NVG's arguments were focused on the issue of whether its device, which included an electric motor, infringed on the patent. (*Id.,* at 422). This is, of course, beyond the scope of a *Markman* proceeding. "In claim construction the words of the claims are construed independent of the accused product." Embrex, Inc. v. Service Engineering Corp., 216 F.3d 1343, 1347 (Fed.Cir.2000). Only after claim construction does the fact finder compare the properly construed claims to the accused device or process. Catalina Marketing International, Inc. v. Coolsavings.com, Inc., 289 F.3d 801, 812 (Fed.Cir.2002). While there are case where the issues of construction and infringement may collapse within one another, neither party has argued that such is the case here. The court will, therefore, focus on the interpretation of the claim rather than the issue of infringement.

According to BorgWarner:

The ordinary meaning of the term "clutch" is a device that provides an interruptible torque connection between two rotating elements. The term "modulating" further limits "clutch" to mean a clutch that can transfer different amounts of torque ranging from none to full lock up. Accordingly, the "modulating clutch assembly" refers to a modulating clutch. The ordinary meaning of the term "electromagnetic" is a device that operates on the principles of electromagnetism. In the context of a clutch, an electromagnetic device converts electricity into an actuation force using magnetism. Accordingly, the electromagnetic portion of this claim limitation refers to an electromagnetic actuator.

(*Plaintiff's Markman Brief,* at 32(citing Patent '488, col. 8, ls. 5-19; App. V, Ex. A, at 7)).

BorgWarner continues its argument by noting-or stating the obvious-that [t]he ordinary meaning of the term "electromagnetic" is a device that operates on the principles of electromagnetism. (*Plaintiff's Markman Brief,* at 33). A bit more helpfully, BorgWarner goes on to explain that:

[i]n the context of a clutch, an electromagnetic device converts electricity into an actuation force using magnetism. (Patent '488, col. 8, ls. 5-19; App. V. Ex. A, p. 7). Electrical actuators use the principles of electromagnetism to convert electric current into a magnetic force. (Patent '488, col. 8, ls. 5-19; App. V, Ex. A, p. 7). Such actuators can be linear, using a coil of wire to generate magnetic forces to push and pull along a straight line, or rotary. (App.V, Ex. A, p. 7). Electric motors are by far the most common electromagnetic actuators of the rotary type. (App.V, Ex. A, p. 7). They use coils of wire to generate magnetic fields that pull the armature of the motor in a circular motion. (App. V, Ex.A,p. 7; Ex. 17).

(*Plaintiff's Markman Brief,* at 33)

NVG argues that the term "electromagnetic clutch" is a term of art, and relies on the definition from the McGraw-Hill Encyclopedia of Science and Technology (1992 edition):

Magnetic coupling between conductors provides a basis for several types of clutches. The magnetic attraction between a current carrying coil and a ferromagnetic clutch plate serves to actuate a disk type clutch ... multiple interleaved disks alternately splined to the driving and driven shafts provide a compact

structure. There are three basic types of electromagnetic clutches: magnetic fluid and power, eddy-current,FN8 and hysteresis.

FN8. At the *Markman* hearing, Borg Warner briefly argued that an eddy-current clutch was defined as employing a motor. It also conceded, however, that had no application to the patent. (*Markman Hearing Transcript,* at 412).

(*Markman Brief of NVG,* at 32-33). NVG's expert interpreted an "electromagnetic clutch" to be a clutch actuated by the translation of an armature towards an energized electromagnetic coil due to the magnetic field caused by that coil. He submitted that:

the term 'modulating electromagnetic clutch assembly' requires at least an electromagnetic coil, a linearly translatable armature, and first and second pluralities of clutch plates, the plates being specifically recited in the claim. The electromagnetic coil, when energized with electric current, creates a magnetic field that attracts and causes linear translation of an armature, which in turn causes frictional engagement of the first and second plurality of clutch plates.

(*Markman Brief of NVG,* at 33; Ex. 9a, para. 95).

When the issue of whether NVG's device, which apparently includes an electric motor, infringes on BorgWarner's patent is set aside, it is clear that the parties' definitions are not at all that dissimilar. Had the parties focused on the interpretation of the claim, rather than whether it construed to read on an electric motor, this question could have been resolved more convincingly. Their presentations and the record leave the court with the conclusion that "electromagnetic clutch" must be interpreted only as a disk-type clutch that can transfer different amounts of torque from the primary output shaft to the secondary output shaft and is actuated by the magnetic attraction between a current carrying coil and an armature.

2. "Operator"

[27] Claim 10 recites, in part:

a dog clutch disposed for rotation with said primary output for selectively coupling said primary output to said planet carrier or said input shaft, an operator for translating said dog clutch, and a modulating electromagnetic clutch assembly ...

Here, again, the parties apparently could not determine what the dispute over this claim was about. BorgWarner assumed it was over the meaning of the term "operator," but it would seem that the parties agree that the "operator" for the dog clutch assembly requires a clutch actuator, and that the "modulating electromagnetic clutch assembly" includes a clutch actuator, which must be "electromagnetic." Near the conclusion of the *Markman* hearing, it became apparent that the dispute was over whether the claim requires two separate actuators.

BorgWarner:	**NVG:**
"An operator for tranlating[sic] said dog clutch" and "a modulating electromagnetic clutch assembly" do not require separate and distinct actuators. (*Plaintiff's Post Markman Hearing Brief,* at 19).	Two separate and distinct actuators: (1) an actuator for the dog clutch; and (2) an electromagnetic actuator of the modulating electromagnetic clutch assembly. (*Markman Brief of NVG,* at 35).

This dispute would seem to be readily resolved by reference to the claim language alone. There is a

reference to an "operator" for "translating a dog clutch," and there is a separate reference, separated by comma, to "a modulating electromagnetic clutch assembly." The parties agree that the "operator" for the dog clutch requires a clutch actuator. (*Plaintiff's Markman Brief,* at 35; *Markman Brief of NVG,* at 35). The parties also agree that an "electromagnetic clutch assembly requires an actuator." (*Plaintiff's Markman Brief,* at 32; *Markman Brief of NVG,* at 35). The manner in which the claim is drawn, with two separate references, indicates that two separate actuators are involved: one for the "dog clutch" and a second as part of the "modulating electromagnetic clutch assembly." It would certainly have been simple enough to suggest otherwise, by claiming an "operator for a dog clutch and a modulating electromagnetic clutch assembly," without a comma separating the elements, thereby suggesting one operator or actuator for both.

The source of the dispute over the interpretation of this term, we believe, can be traced to BorgWarner's characterization of the use, or misuse, of grammar as merely "fortuitous." (*Markman Hearing Transcript,* at 481). BorgWarner's argument against the simple application of the rules of ordinary language-in other words, common English grammar-to this claim are essentially conclusory and unsupported. According to BorgWarner:

NVG's attempt to interpret the terms 'modulating electromagnetic clutch assembly' and 'an operator for translating said dog clutch' as requiring two separate and distinct actuators is baseless. There is nothing in the claim language, the specification, or the prosecution history that states this claim requires two separate and distinct operators.

(*Plaintiff's Markman Reply Brief,* at 19). On the contrary, the claim language itself suggests it, and rather strongly, from a grammatical standpoint. BorgWarner's only support for its position is reference to a single, unpublished, district court case, Abbott Labs. v. Mead Johnson & Co., No. 93 C 6596, 1996 WL 332449 (N.D.Ill. June 12, 1996). In that case, the court interpreted the words "associated with" to mean that the two limitations at issue there may be joined together and need not exist as separate structures. 1996 WL 332449 at *6. While BorgWarner reiterates this holding in its brief, it gives no inkling as to its application here, where there is no similar language and the claim actually lists the two structures as separate items. (*Plaintiff's Markman Reply Brief,* at 19). As a result, we are left to draw one interpretation from the claim language: that the "dog clutch" and "the modulating electromagnetic clutch assembly" each require a separate actuator.

D. *Patent '330* FN9

FN9. Patent '330 is related to the Patent '024, meaning it gets the benefit of the earlier filing date of Patent '024. 35 U.S.C. s.s. 120; 121. The specification of Patent '330 is identical to Patent '024, but its claims are different. This nuance fuels much of the dispute over the interpretation of the Patent '330 claims that are in dispute, but is only addressed peripherally by the parties.

1. "Electrically Powered Mover" and "Electric Operator"

[28] Claim 1 of the '330 patent recites, in part:

an **electrically powered mover** adapted to be activated by the output of the microcontroller in response to the sensed speed difference, the **electrically powered mover** including a rotatable output member and at least one cam assembly adapted to move the clutch plates into driving engagement.

Claims 7, 15, 20, and 30, of the '330 patent all recite similar claim limitations, which are referred to interchangeably as an "electrically powered mover" or an "electric operator" (hereinafter collectively referred to as "electric operator").

BorgWarner:	NVG:
"Electric operator" is an actuator that receives electrical inputs and generates mechanical power and delivers the mechanical power to a drive that provides force and/or motion so that a clutch can be engaged or disengaged. (*Plaintiff's Markman Brief,* at 37).	An electromagnetic clutch assembly, which includes a coil and armature actuator. (*Markman Brief of NVG,* at 38).

The dispute over this claim appears to go far beyond the interpretation of the claim language, and involves two competing legal theories upon which the parties respectively rely. At first blush, it could be said that the dispute is over whether the specificationcan support BorgWarner's somewhat broad definition, or can only support the very narrow interpretation of NVG.

BorgWarner asserts that the claim language itself explains that an "electric operator" is an electric actuator and a drive. As an example, BorgWarner cites claim 1 as stating that the electrically powered mover receives an output from a microcontroller, and in response to such input, activates a friction clutch assembly. (Patent '330, col. 28, lines 52-57). BorgWarner further explains that this mover includes a rotatable output member and a cam assembly that is able to move the clutch plates of the friction clutch into engagement. (Patent '330, col. 28, lines 52-57). As BorgWarner would have it, "this language describes the exact functions of an electric actuator and a drive." (*Plaintiff's Markman Brief,* at 38).

BorgWarner continues by asserting that the specification sets forth an "operator" is an actuator and a drive and that the operator can be electric, hydraulic, or pneumatic. (*Plaintiff's Markman Brief,* at 38). The portion of the specification to which the plaintiff cites reads:

It should be understood that while the preferred clutch assembly 124 and the alternate embodiment clutch assembly 125 described above incorporate electromagnetic activation means, they may also be operated in the same incremental (step-wise) manner by hydraulic or pneumatic operators provided with incrementally controlled pressurized hydraulic fluid or incrementally controlled by pressurized air, respectively.

(Patent '330, col. 9, ls. 7-14). The cited language, then, more accurately, refers to *electromagnetic,* hydraulic, or pneumatic actuators. Use of the term "electric" or "electrically" would seem to be a bit too broad given the specification. In at least one portion of the expert report upon which BorgWarner relies, that of Dr. Starkey, appears to employ the terms "electrical" and "electromagnetically" interchangeably. (*Plaintiff's Markman Brief,* App. V, at 7-8). This, again, highlights the advantage of the use expert testimony at the *Markman* hearing; an advantage this court was left without.

BorgWarner goes on to assert that the specification describes the use of two "electric operators": (1) an electromagnetic coil, a drive member, and a ball-ramp cam assembly to actuate a friction clutch (citing Patent '330, col. 7, l. 42-col. 8, l. 55); and (2) an electric motor, shaft, and cam assembly that is used to actuate the dog clutch for shifting the range of the transfer case (citing Patent '330, col. 6, l. 66-col. 8, l.41). (*Plaintiff's Markman Brief,* at 38). According to BorgWarner, "these embodiments specifically disclose an electric actuator and drive being used to actuate a clutch." This may or not be the case, as BorgWarner does not direct the court to any evidence from one skilled in the art that these two embodiments do indeed disclose what would be considered an electric actuator used to activate the clutch. The first, again, is electromagnetic. The second makes reference to an "electric shift control motor" which commands the position of the dog clutch. This electric shift control motor then rotates a drive shaft, which terminates in an arm coupled to a spring assembly. But, the question remains as to whether this does indeed constitute an "electric actuator."

Again, the arguments between the attorneys at the *Markman* hearing-often conclusory, at times vociferous-were of little assistance in this dispute.

Court: They have an example of-well, the coil and armature is their figure. But their claim says electrical powered mover.

NVG: There's no support for that.

Court: What do you mean "no support for that."

NVG: The specification must describe.

Court: Must describe an electrically powered mover?

NVG: Yes

Court: All right. Well, [BorgWarner]. Where are you? Would you show me in the specification a description of an electrically powered mover other than coil and armature.

NVG: And this is for friction clutch assembly to transfer torque.

Court: And that relates to a clutch that powers a gearbox for the transmission of power between the primary and secondary drive.

BorgWarner: Yes, I'd be happy to. The first thing I want to say is if [NVG] is suggesting the exact words "electrically powered mover" have to be in the specification, then he is wrong on that point, because those exact words do not have to appear in the specification. I just want to clear that point up first.

NVG: Well, just to clear it up, there is no dispute that the words don't appear in the specification.

Court: In the specs we'll not find an "electrically powered mover."

NVG: Absolutely nowhere.

BorgWarner: You will see the words "electrically powered operator."

Court: In the specs?

BorgWarner: Maybe not verbatim ...

* * * * * *

Court: ... But do the specs describe the electrically powered mover other than the EMC arrangement you have in figure four.

* * * * * *

And don't count on the electrical motor for your dog clutch, as an example, for the dog clutch.

BorgWarner: Okay. That was one of the examples I was going to give you.

* * * * * *

NVG: They absolutely cannot answer your question, your Honor.

* * * * * *

BorgWarner: I would if I'd be given a chance.

Court: Go ahead, you've got the chance now.

(*Markman Hearing Transcript,* at 576-80). At that point in the hearing, BorgWarner returned to the topic of the dog clutch. Then, it suggested that electric operators were discussed in column 9-the portion of the patent describing the electromagnetic, hydraulic, and pneumatic actuators. (*Id*. at 582-587). Finally, the Court again asked:

Court: All right, show me an electrically powered mover other than the [electromagnetic coil].

BorgWarner: I think we've been through that.

Court: Where, where do I find it?

BorgWarner: We have the electric motor, we have the electric coil.

Court: What?

BorgWarner: The electric motor and the electric coil are the two types of electric movers, electric actuators that we've disclosed. Now I know [NVG] will say the electric motor is only for the dog clutch ...

(*Id*. at 587). Discussion then cycled right back to the previous dispute. BorgWarner was never able to give the example sought. Instead, it cited Rexnord Corp. v. Laitram Corp., 274 F.3d 1336, 1344 (Fed.Cir.2001) for the proposition that an applicant is not required to describe in the specification every conceivable and possible future embodiment of his invention.

According to NVG, BorgWarner's definition construes the electrically powered mover without reference to the specification, resulting in an overly broad interpretation that includes an electric motor to actuate the torque transfer clutch. (*Markman Brief of NVG,* at 39). Although BorgWarner's claim interpretation makes no mention of "electric motor," what we suppose NVG might be arguing is that an "electric motor" can fit within the definition BorgWarner uses, thus harkening back to the jump ahead to the issue of infringement. In any event, NVG goes on to argue that the:

specification fails to disclose or describe actuating a torque transfer with an electric motor. If the named inventors actually invented the breadth of the subject matter that BorgWarner alleges, they were required to describe it in detail. 35 U.S.C. s. 112 para. 1. But they did not.

The specification makes no mention of "electrically powered mover," or "electrical operator," or an "electric actuator" in its lengthy (29 column discussion) of the invention. Likewise, the specification neither mentions nor describes BorgWarner's broad interpretation of the terms-an electric motor actuator for the torque transfer assembly.

(*Markman Brief of NVG,* at 39). In addition, NVG cites the testimony of BorgWarner's expert, Mr. Starkey, that an "electric motor" was "not given as an example of an embodiment." (*Markman Brief of NVG,* App.,

Ex. 11 at 157-58). The only examples given were, according to NVG, were "hydraulic" or "pneumatic" activators. (*Markman Brief of NVG,* at 39-40). As noted above, however, "electromagnetic" was also given as an example.

NVG seems to respond to BorgWarner's reference to the "electric shift control motor" by arguing it is unrelated to the torque transfer clutch. We say seemingly, because in its brief, NVG addresses, confusingly, BorgWarner's arguments regarding "predetermined values." (*Markman Brief of NVG* at 40, citing *Plaintiff's Markman Brief,* at 30). In any event, NVG argues that:

[t]he dog clutch merely shifts the planetary gear assembly from high to low, similar to shifting gears on a bicycle. Dr. Starkey, BorgWarner's expert, accurately noted in his report that dog clutches cannot transmit varying amounts of torque. A dog clutch generally is an irrelevant component in an on-demand system and, in fact, several NVG products (those that are in single speed) do not include it. By contrast, the torque transfer clutch must transmit varying amounts of torque between the front and rear wheels. As BorgWarner effectively concedes, a dog clutch could *never* perform the required functions of the torque transfer clutch.

(*Markman Brief of NVG,* at 41). Accordingly, distilling these contentions to something wieldy, even if "electric shift control motor" equated to "electric actuator," because it actuates the dog clutch, this portion of the specification cannot provide support for BorgWarner's interpretation.

We are left with this interpretation of BorgWarner's argument: that the portion of the specification describing the dog clutch actuator and the portion of the specification describing the torque transfer clutch actuator could be combined by a person of ordinary skill in the art to render an electric motor actuator for a torque transfer clutch. Indeed, BorgWarner's expert reported:

It is clear from the claims and the specification that the inventors understood that clutches could be actuated by a variety of methods. They chose to disclose in the specification their preferred embodiment of the invention, which included a ball-ramp type of mechanical cam to actuate the friction clutch, and an electric motor driving through a cylindrical cam to actuate the dog clutch. A person of ordinary skill in the art would recognize that the operators could be interchanged, or that electrical operators could be substituted, and still fall within the scope and spirit of the claimed invention.

(*Markman Brief of NVG,* Ex. 26, at 5).

The first paragraph of s. 112 states that "[t]he specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same." 35 U.S.C. s. 112. The requirement ensures that, as of the filing date, the inventor conveyed with reasonable clarity to those of skill in the art that he was in possession-that is to say, intellectual possession-of the subject matter of the claims. Union Oil Co. of California v. Atlantic Richfield Co., 208 F.3d 989, 997 (Fed.Cir.2000). In Tronzo v. Biomet, 156 F.3d 1154 (Fed.Cir.1998), the court explained that "[a] disclosure in a patent application that merely renders the later-claimed invention obvious is not sufficient to meet the disclosure requirement; the disclosure must describe the claimed invention with all its limitations." 156 F.3d at 1158. BorgWarner's interpretation of this claim seeks to do the opposite: it is arguing that the interchange of the operators or actuators would be obvious.

NVG's argument against BorgWarner's interpretation of these terms would seem to be that, if BorgWarner's interpretation were given credence, it would render the patent invalid under s. 112 para. 1. It relies on C.R. Bard, Inc. v. M3 Systems, Inc., 157 F.3d 1340, 1360 (Fed.Cir.1998), for the proposition that claim term cannot be interpreted so broadly as to raise validity issues because the broad interpretation lacks support in the specification. (*Markman Brief of NVG,* at 38; *Markman Hearing Transcript,* at 569-74). There, the

court held that "claims must be construed in accordance with the rest of the specification of which they are a part, and not contrary to it." Bard, 157 F.3d at 1360.FN10 We are not completely convinced that the *Bard* court announced the hard and fast rule that NVG claims it did.

FN10. The portion of the case which NVG quotes is not a holding, but a statement of the position of the plaintiff in that case. While the court assessed it as "correct," it is somewhat misleading for NVG to quote the language as that of the court.

According to BorgWarner, however, this is a question of validity, which is outside the scope of a *Markman* hearing. Rhine v. Casio, Inc., 183 F.3d 1342, 1346 (Fed.Cir.1999); Lampi Corp. v. American Power Prods., Inc., 228 F.3d 1365, 1378 (Fed.Cir.2000). In *Rhine,* the defendant argued that the Federal Circuit's construction of a claim rendered the plaintiff's patent invalid. The court determined that the defendant "cannot avoid a full-blown validity analysis by raising the specter of invalidity during the claim construction phase." 183 F.3d at 1346. We will not go into such an analysis here, either, but we will endeavor to interpret the claim in a manner consistent with the patent statute.

Examination of the other case upon which BorgWarner relies, *Lampi,* does not support BorgWarner's position so much as reveal that position's flaws. The dispute in *Lampi,* in which the patent was for a miniature florescent lamp, focused on the lamp's housing which was described as "two separable half-shells." The patent noted that: "[t]o enable particularly easy and cost effective manufacture of these two half-shells and to ensure especially easy assembly, and, in particular, by technicallyinexperienced individuals, both half-shells are identically shaped so that they are interchangeable." 228 F.3d at 1378. The preferred embodiment was one of identical half-shells, but the court found that the patent was not so limited and allowed for non-identical half-shells. *Id*. The specification referred to both "half-shells" and "identical half-shells." *Id*. Clearly, as the court concluded, the disclosure reasonably conveyed to one skilled in the art that the inventor had "possession" of an invention employing either identical or non-identical half-shells. *Id*.

It is quite a leap from *Lampi* to the instant case. Here, the claims require that the electric operator or mover engage the clutch plates of the torque transfer clutch assembly. The patent specification discloses only an electromagnetic actuator to perform that function. We are not convinced by BorgWarner or the record that one skilled in the art would be convinced that the inventor had possession of an electric motor actuator to perform this function as well. It is simply not the same, or even vaguely similar to a lamp maker figuring the inventor in *Lampi* knew the half-shells could be non-identical. Accordingly, we are left with this interpretation of the claim: an electromagnetic clutch assembly, which includes a coil and armature actuator.

2. "Rotatable Output Member", "Rotating Member", and "Rotating Output Member"

and

3. "Cam Assembly"

[29] Claim 1 recites, in part,

An electrically powered mover adapted to be activated by the output of the microcontroller in response to the sensed speed difference, the electrically powered mover including a **rotatable output member** and at least one **cam assembly** adapted to move the clutch plates into driving engagement.

Claims 15 and 23 recite similar limitations, such as "a rotating member" and "rotating output member." Claim 30 recites a "bi-directionally rotating output member." These claim terms are collectively referred to

as a "rotatable output member."

BorgWarner:	NVG:
"Rotatable output member" is a shaft, cam, sprocket, or gear that rotates. A "rotatable output member" that rotates in two directions is a "bi-directionally rotating output member." (*Plaintiff's Markman Brief,* at 39).	A ball and ramp device, comprising two opposing members each have[sic] a ramped surface, and at least one ball inserted in between the two ramped surfaces. (*Markman Brief of NVG,* at 44).

Claims 15, 23, and 30, also all contain similar claim limitations that include a "cam assembly" limitation.

BorgWarner:	NVG:
"Cam assembly" is a cam and a cam follower. A cam is a moving piece of machinery shaped to cause an eccentric or alternating motion and a cam follower is a component designed to follow a surface of the cam. (*Plaintiff's Markman Brief,* at 41).	A ball and ramp device, comprising two opposing members each have[sic] a ramped surface, and at least one ball inserted in between the two ramped surfaces. (*Markman Brief of NVG,* at 44).

This dispute begins with the fact that the parties disagree as to whether "rotatable output member" and "cam assembly" can be interpreted together. According to NVG, the "rotatable output member" and "cam assembly" together form the "ball and ramp device." BorgWarner interprets the two items separately but, as noted above, indicates that a "rotatable output member" could be a "cam." The remainder of the dispute relates back to the previous issue over the term "electric operator" and the involvement of the dog clutch as opposed to the torque transferring clutch. The parties' arguments, in this regard, are much the same as those advanced regrading the previous interpretation issue.

BorgWarner submits that the claim language itself explains that the term "rotatable output member" is a drive output, relying on several claims:

For example, claim 1 states that an electrically powered mover, which is an electric actuator and a drive, includes an output member that rotates. (Patent '330, col. 28, ls. 52-57). Likewise, claim 15 states that an electric operator, which is an electric actuator and a drive, includes a member that rotates to drive a cam assembly. (Patent '330, col. 30, ls. 51-54). In addition, claim 23 states that an electric operator, which is an electric actuator and a drive, includes an output member that rotates. Accordingly, these terms mean a drive output. (Patent '330, col. 31, ls. 37-40). Claim 30 states that an electric operator, which is an electric actuator and a drive, includes an output member that bi-directionally rotates. (Patent '330, col. 32, ls. 4 1-44.)

(*Plaintiff's Markman Brief,* at 40). Turning to the specification, BorgWarner returns to the "dog clutch" portion of the text upon which it relied in regard to its interpretation of the "electric operator" issue. It argues that the specification:

explicitly states that an output portion of an actuator (drive members 126, 134) rotates. (Patent '330, col. 7, lines 41-65). The specification also describes a rotatable drive shaft that is an output of an electric motor. (Patent '330, col. 6, line 66-col. 7, line 6). Cams and gears are also described as rotatable outputs. (Patent '330, col. 6, line 66-col. 7, line 6; col. 7, lines 26-41.) Further, the specification makes clear that a rotatable output member, such as a shaft, that rotates in both directions is a "bi-directionally rotating output member." (Patent '330, col. 7, lines 26-41.)

(*Plaintiff's Markman Brief,* at 40-41).

According to BorgWarner, "cam assembly" is a cam and a cam follower. Citing *Webster's Ninth Collegiate Dictionary,* BorgWarner notes that a cam is defined as "a rotating or sliding piece that imparts motion to a roller moving against its edge or to a pin free to move in a groove on its face or that receives motion from such a roller or pin." (*Plaintiff's Markman brief,* at 42; Ex. 17). It further explains that "[a] cam is a moving piece of machinery shaped to cause an eccentric or alternating motion and a cam follower is a component designed to follow a surface of the cam." (*Plaintiff's Markman Brief,* at 41). Claims 1 and 15 of the patent state that the "cam assembly" is driven by a rotating member to engage the clutch plates of the clutch assembly.

BorgWarner also relies on the specification to support its interpretation of "cam assembly." It points out that the specification:

describes a ball-ramp "cam" that is used to actuate a clutch. (Patent '330, col. 7, lines 55-58). The specification also describes a cylindrical cam and a cam follower that is used for engaging and disengaging a dog clutch. (Patent '330, col. 7, lines 26-34).

(*Plaintiff's Markman Brief,* at 42). Thus, again, we have the involvement of a clutch assembly other than the one transferring torque. As already noted, however, the "dog clutch" does not transfer torque.

NVG points out, however, that the claims require that the "rotatable output member" and the "cam assembly" be part of the "electrically powered mover" which transfers torque to the drives. And, as before, there is one description of such a mechanism, capable of transferring torque, in the specifications: a ball and ramp device. More specifically, the patent discloses:

The oblique side walls of the recesses 130A and 130B function as *ramps or cams* and cooperate with the *balls* 132 to drive the circular members 126 and 134 apart in response to relative *rotation* therebetween[sic].

(Patent '330, col. 7, 1. 66-col. 8, 1.2). We were unwilling to allow BorgWarner's exchange between the torque transferring clutch and the dog clutch in the previous claim dispute and, toward an end of internal consistency, we remain unwilling to do so here. Thus, the only possible interpretation of the "rotatable output member" and cam assembly must be: a ball and ramp device, comprising two opposing members each having a ramped surface, and at least one ball inserted in between the two ramped surfaces.

4. "Means for sensing ... and Providing an Output"

[30] Claim 1 recites, in part:

means for sensing a rotational speed difference between the primary output arrangement and the secondary output arrangement, the means for sensing including at least a first speed sensor associated with the primary output arrangement, a second speed sensor associated with the secondary output arrangement and a microcontroller for receiving speed information from the speed sensors and providing an output ...

Claim 7 recites essentially the same limitation, except Claim 7 recites a "plural mode output" instead of an "output." This is another "means-plus-function" dispute, with the parties arguing over the applicability of s. 112 para. 6.

BorgWarner:	**NVG:**
"Means for sensing a rotational speed difference..., and	A means plus function element, according to s. 112 para.

providing an output" is a first speed sensor, a second speed sensor, and a microcontroller that can provide an output. "Means for sensing a rotational speed difference..., and providing a plural mode output" is a first speed sensor, a second speed sensor, and a microcontroller that can provide an output that enables at least two of the following modes of operation: (1) neutral; (2) two-wheel drive; (3) on-demand; (4) four-wheel drive low; and (5) four-wheel drive high. (*Plaintiff's Markman Brief,* at 43).

6, interpreted as the structure disclosed in the specification for performing the claimed function. That structure is a microprocessor with circuitry (i.e., programmed with an algorithm) that provides an incremental output. (*Markman Brief of NVG,* at 45).

According to BorgWarner, these limitations should not be interpreted as "means plus function" claim limitations under s. 112 para. 6 because the claims recite sufficient structure to perform the recited functions. Allen Engineering, 299 F.3d at 1347 (even if the claim recites a function, if it also recites sufficient structure or material for performing that function, s. 112 para. 6 does not apply). In regard to this claim, BorgWarner submits that the recited functions are: "sensing a rotational speed difference between the primary output arrangement and the secondary output arrangement." It argues that the presumption is conclusively rebutted because the claims recite sufficient structure to perform the recited function, namely, speed sensors and a microcontroller. (*Plaintiff's Markman Brief,* at 44).

NVG contends that the claim must be interpreted as a means-plus-function element. NVG argues that:

Although some structure is included, the "means for sensing" elements do not state how and when the circuitry of the microcontroller "provid[es] an output." The claim does not state whether the microcontroller contains circuitry to calculate wheel slip, or compare it to a predetermined threshold. It also fails to recite the type of "output"-i.e., whether it is incremental. Moreover, claim 7 requires a "plural output," but fails to recite the manual selector switch necessary to determine which "plural output" is provided. The means-plus-function presumption cannot be rebutted.

(*Markman Brief of NVG,* at 45-46). NVG was able to make its position a bit clearer at the *Markman* hearing.

Essentially, the parties' dispute concerns the recitation of the function. While BorgWarner interprets the function as "sensing a rotational speed difference between the primary output arrangement and the secondary output arrangement," NVG sees it as "sensing a rotational speed difference between the primary output arrangement and the secondary output arrangement and providing an output." Based on the context, and the parties' arguments, we can rule out the possibility that the "secondary speed sensor" was intended to be associated with the two other items-a "secondary output arrangement" and "a microcontroller"-although, grammatically, this is how the claim was written. *See* n. 11, *infra at* 55. Both sides agree that the structures are two sensors and a microcontroller. (*Plaintiff's Post Markman Brief,* at 24; *Markman Hearing Transcript,* at 700-702). The question is what to do with the phrase following "a microcontroller for receiving speed information from the speed sensors": the phrase "and providing an output." While NVG provides a suggestion, BorgWarner does not.

First, BorgWarner seemed to say that "providing an output" was part of the function. Its interpretation, after all, begins with: " 'means for sensing a rotational speed difference.., and providing an output' is a first speed sensor, a second speed sensor, and a microcontroller *that can provide an output*." (*Plaintiff's Markman Brief,* at 43). It argued that the microcontroller: (1) receives the signals from the sensors, (2) computes the speed difference between the output arrangements, and (3) subsequently *outputs* a signal that can enable the use of different operating modes. (*Plaintiff's Markman Brief,* at 44). The first two activities are arguably part of BorgWarner's asserted function of "sensing a rotational speed difference," but the third goes beyond

that function.

Next, BorgWarner argued that:

NVG's attempt to make "and providing an output" part of the function defies basic rules of grammar. The language clearly applies to an output provided by the microcontroller and is not in any way related to the means for sensing function. Indeed, the presence of 38 words between the recited function and the phrase "and providing an output" belies NVG's interpretation. (*Plaintiff's Markman Reply Brief,* at 22).

Nevertheless, "providing an output" is a function, and it would seem it must have some place, some meaning, in this claim. This is what BorgWarner seems unable to explain.

At the *Markman* hearing, BorgWarner seemed to suggest that the phrase "and providing an output" was mere surplusage to be ignored:

BorgWarner: ... I'm guessing they're going to tell you that the function that I laid out for you, sensing a rotational speed difference between the primary output arrangement and the secondary output arrangement, they'll say that's not the function, or that's only part of the function. Because what they'll have you believe is, if you read the last line of this paragraph here, it says:

"... a microcontroller for receiving speed information from the sensors in providing an output ...,"

Now, remember, these are talking about the structural components that actually make up the means for sensing.

* * * * * *

And these are recited long after we get done talking about what the function is up front. This thing lays out up front: here's what the function is, sensing a rotational speed difference. And they'll tell you: well, you have to throw this providing an output, the last three words in this paragraph, you got to throw that back up at the top and cobble them together to have this long function.

And I say hat just doesn't make any sense as a matter of grammar.FN11 It clears the means for sensing, which you point out grammar-wise separated by a comma, which then goes on to give some more detail, those are not intertwined in the fashion that they'll have you believe.

FN11. BorgWarner's criticism of grammar is somewhat ironic, given that BorgWarner is on record as considering grammar "fortuitous", and that this claim is an example of shoddy drafting, or an unfamiliarity with grammar.
The claim begins by reciting "a means for sensing a rotational speed difference between the primary output arrangement and the secondary output arrangement"-so there is term "means" and a function. The claim goes on to describe the means, stating that it must include, at least:
a first speed sensor associated with the primary output arrangement,
a second speed sensor associated with the secondary output arrangement
and a microcontroller for receiving speed information from the speed sensors and providing an output;
The problem is the patent's use of the word "and" without a preceding comma. With a preceding comma, we would obviously have a series of three things: first speed sensor, second speed sensor, microcontroller. Without it, what we have is not so clear. Had the patent employed the word "and" after the first item-"a first speed sensor ... output arrangement"-it would be more clear that it was a list of two items, where the second item-"a secondary speed sensor"-was associated with two further items-a "secondary output arrangement" and "a microcontroller." As it stands, the draftsmanship leaves us somewhere in between, and leaves a lot to

be desired.

(*Markman Hearing Transcript,* at 690-91). We are still left with no indication of the purpose of the phrase "providing an output." BorgWarner continues to ignore the phrase in its final submission to the court. (*Plaintiff's Post Markman Hearing brief,* at 24).

As a result, we are left with NVG's explanation. The phrase is part of the function. In order to "provide the output" the microcontroller requires specific programing with an algorithm. WMS Gaming, 184 F.3d at 1348-49. The structure of the means for sensing ... and providing an output then, must include a microcontroller programmed with the algorithm disclosed in the specification, as NVG argues.

IV. *CONCLUSION*

The court has interpreted the claims at issue, with whatever help the parties were able to provide, according to law governing these exercises. As the Federal Circuit has admitted, however, that law is often misleading. Alternately, cases refer to claim language *and* specification language as dispositive. Claim language is controlling when the terms employed are intended to have their ordinary and accustomed meaning, but specification language can demonstrate that the patentee intended to deviate from ordinary and accustomed meaning. But the specification may not be consulted as a threshold step to determine if this is the case. And so on. *See* Texas Digital Systems, Inc. v. Telegenix, 308 F.3d 1193 (Fed.Cir.2002)

All that the law requires the patentee to do, is to disclose the invention in terms and language understood by those skilled in the art. Ordinary and accustomed word meaning, then, give way to a specialized vocabulary necessitating a great deal of specialized education and experience. In those cases, the "requirement" that the patentee employ such specialized language becomes more of an "allowance," from the perspective of the court charged with construing the patent. While industry and technology may be well served, in the end, patentees, innovators, and putative infringers all come to court for interpretation of claims drawn so that the court can only comprehend them through expert testimony. Most of the claims here were so drawn, and the court has interpreted them with the guidance of the voluminous record the parties have provided, albeit one including minimal expert testimony. The result reflects the confident efforts of the court and the best efforts of the parties in what was a somewhat daunting task.