IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF COLORADO

Civil Action No. 03-M-2579 (RPM)

VARCO, L.P.,

Plaintiff,

vs.

PASON SYSTEMS USA CORP.,

Defendant.

PLAINTIFF'S OPENING MARKMAN BRIEF

Plaintiff Varco, L.P. ("Varco") files this *Markman* brief as stated hereinabove and would respectfully show the Court as follows:

This is a patent case. The Court's Amended Docket Control Order [Dkt# 135] establishes January 5, 2007, as the date Varco's *Markman* brief is to be filed. This Markman brief is being filed pursuant to that order.

Respectfully submitted,

Dated: January 5, 2007

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CERTIFICATE OF SERVICE

I certify that on January 5, 2007, I served a copy of the foregoing document to the following by:

- ☐ U.S. Mail, postage prepaid with responsive documents
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I. NATURE OF THE CASE

The '142 Patent (U.S. Patent No. 5,474,142), a copy of which is attached as Exhibit 1 hereto, can generally be described as covering an automatic drilling system designed for controlling the rate of release of the drill string into a well.

Varco has identified claims 1, 11 and 14 of the '142 Patent as being infringed by Pason. Claims 1, 11, and 14 are independent claims (claims standing alone). This Court has previously addressed the claim construction of the disputed terms of Claim 14 during a preliminary injunction hearing held in July 2004. The Court denied the injunction based upon its interpretation of the terms "relaying" and "selecting"—holding that Varco could not show a likelihood of success under the Court's construction. Varco appealed and the Court of Appeals for the Federal Circuit (CAFC) reversed the Court's interpretation and remanded the case for further proceedings. *See Varco, L.P. v. Pason Sys. USA Corp.*, 436 F.3d 1368 (Fed.Cir. 2006).

To better understand the significance of claim construction issues, Varco has presented its *Markman* brief in the context of how claim construction will impact the ultimate issue of patent infringement. This is consistent with the Court's preference in that "you don't know the significance of the [claim construction] dispute until you're talking about infringement and validity." *See* Ex. 20, Pg. 9, ll. 15-16.

As the Court will recall, Pason's only basis for non-infringement of Claims 11 and 14 of the '142 Patent was its contention that its AutoDriller did not perform the step of "relaying" or "selecting." Specifically, Pason's designated technical expert witness, Mr. J. Ford Brett, conceded infringement of Claims 11 and 14 if "relaying" was interpreted broadly to mean to "convey" or "pass along" (i.e., Varco's proffered interpretation). *See* Ex. 18, Pason's technical expert's testimony provided as follows:

6-1-04 Deposition Transcript, Page 24, ll. 13-16:

> "A: If you say – if you're talking about relay in terms of the broad definition, ***Pason infringes***, so I don't know what else you want me to say about that."

6-1-04 Deposition Transcript, Page 25, ll. 10-19:

> "Q: But it's your opinion that claim 11 is infringed by Pason's AutoDriller device with that interpretation [communicate or transmit] of relaying?
>
> A: With that interpretation of relaying, which is the word there, then ***Pason infringes***, that's true.
>
> Q: How about claim 14?
>
> A: Same thing.
>
> Q: That claim 14 infringes with that same definition of relay?
>
> A: Right. Same thing.";

See also, 7-7-04 Prel. Injunction Hearing Transcript I, Page 124, lines 1-4:

Direct Examination

> "Ms. Laff: If there was a broader construction of Claim 14, where "relaying" meant communicate, is it possible that [Pason's] autodriller would then infringe Claim 14?"
>
> Mr. Brett: I don't even--I don't say possible, ***I say probable****."*;

See also, Ex. 16, Pason's Technical Expert's May 31, 2004 Report, Page 14:

> "If 'Relaying' is interpreted in the general 'convey' sense, then the ***Pason AutoDriller does indeed fall within the scope of these claims***. As mentioned above, the general 'convey' sense Claims 11 and 14, are quite broad."

Thus, Pason's designated technical expert witness, a person Pason contends is of ordinary skill in the relevant art, has testified that Pason's AutoDriller performs each and every step of Claims 11 and 14, with the exception of the "relaying" step as interpreted by Varco.

Additionally, Pason's patent counsel[1], Mr. Terry Leier, provided Pason as well as its designated technical expert an opinion that the Pason's AutoDriller indeed infringes the '142 Patent. *See* Ex. 22, which provides as follows:

> "Consequently, the technical explanation appears to be that Pason system operates within the parameters of claim 14 at least some of the time. Unless there is a basis to invalidate the claim, ***the operation of Pason system appears to fall within the scope of the claim.*** Therefore, if there is a Markman/construction hearing that affirms the claim, there does not seem to me to be any other defense issues."

Moreover, the Federal Circuit has already reviewed this language (i.e., "relaying" & "selecting") as the only disputed claim language and all discovery was taken with this isolated language in dispute.

Now, in the 11th hour of this lawsuit and contrary to the opinions and testimony provided by both Pason's patent counsel and designated expert, Pason has conjured up a new non-infringement position claiming that its AutoDriller does not include or perform at least 28 elements of the asserted claims. *See* Ex. 21—Pason's 12-13-06 Designation of terms requiring interpretation. Pason's ruse makes it necessary for this Court to construe each of the 28 terms or phrases designated by Pason for interpretation in a transparent attempt to created the "wiggle room" Pason so desperately seeks following both the Federal Circuit's and the United States Patent and Trademark Office's (PTO) rejection of Pason's prior defenses. Further, Pason has reneged on its representation to this Court that it would not waste the Court's time with the arduous task of construing nearly each and every term of the asserted claims. *See* Ex. 20, 3-21-06 Hearing Transcript Pg. 6, ll. 3-12, provided as follows:

[1] Pason has waived the attorney client privilege with respect to its patent counsel's opinions as a defense to willful infringement (35 U.S.C. § 284).

THE COURT: Yeah. And, you know, they [the CAFC] did say on remand, this Court should consider the proper interpretation of Claim 14. So, they didn't say do this. But, on the other hand, I don't see where the *wiggle room* is anymore.

MR. ATKINSON: We are looking for that [i.e., *wiggle room*] and I certainly would anticipate presenting it if we see it. And, if we don't see it, quite frankly, Your Honor, we would not waste the Court's time in terms—and, move directly into the broad issue as to whether or not the patents are infringed upon, or invalid on that construction.

Even more outrageous is Pason blind determination to maintain its position that the claims of the '142 Patent are limited to the preferred embodiment of the '142 Patent—a position wholly rejected by the CAFC. *See* Ex. 17, Pason's Technical Expert's 9-4-06 Report, Page 13 ("the [Pason] AutoDriller does not follow the teaching of Claim 14, which appears to reflect the precise control scheme of regulators and dedicated relays, producing distinct, proportionate control signals responsive to changes from calibrated values."). Furthermore, Pason's proferred interpretation flies in the face of its earlier representations in this case not only before the CAFC but also the PTO. *See Varco,* 436 F.3d at 1375 ("In addition, Pason's counsel at oral argument similarly conceded that relaying in claim 14 should not be limited to pneumatically operated valves"); *See also,* Ex. 2, Pason's 1/27/04 Ex Parte Reexamination Request ("WS 409-10") (The '142 Patent "is not drawn to the specific apparatus disclosed in the Bowden disclosure, but rather recites terms that encompass a variety of other embodiments of apparatus including electrical implementations"; and "is not drawn to method steps performed using the specific apparatus disclosed in the Bowden disclosure, but rather recites the steps using terms that may be practiced by a variety of other apparatus embodiments such as the electrical and drilling fluid pressure implementations.").

In view of Pason's admissions including positions taken before the PTO and CAFC, Varco contends that the laborious task of interpreting each and every element of the asserted claims is unnecessary. *See, e.g., Callicrate v. Wadsworth Mfg., Inc.,* 427 F.3d 1361, 1372 (Fed.Cir. 2005) (Competitor accused of infringing patents for animal castration tool was bound by admissions in final pretrial order that its accused devices included all claim limitations, even after appellate court found error in claim constructions under which admissions were made.) Nevertheless, Varco hereby provides all necessary support for its construction of these 28 newly contested elements despite Pason's admissions that most if not all of the elements of the asserted claims are contained in and/or practiced by Pason's AutoDriller.

II. CLAIM CONSTRUCTION STANDARDS

Claim construction is the first of two steps required to determine infringement. In the claim construction step, the court determines – as a matter of law – the meaning and scope of the patent claims. Following the claim construction, the judge or jury can then determine – as a matter of fact – whether the claims as properly construed read on the accused infringer's product or method; or in other words, is infringed. *Laitram Corp. v. Morehouse Indus. Inc.,* 143 F.3d 1456, 1461 (Fed.Cir. 1998).

In *Phillips v. AWH Corp.,* 415 F.3d 1303 (Fed. Cir. 2005) (*en banc*), the Federal Circuit reaffirmed principles of claim construction that it had outlined in earlier cases such as *Vitronics Corp. v. Conceptronic, Inc.,* 90 F.3d 1576 (Fed. Cir. 1996); *Innova/Pure Water, Inc. v. Safari Water Filtration Systems, Inc.,* 381 F.3d 1111 (Fed. Cir. 2004); and *Markman v. Westview Instruments, Inc.,* 52 F.3d 967 (Fed. Cir. 1995) (*en bane*), *aff'd,* 517 U.S. 370 (1996); and

clarified its decision in *Texas Digital Systems, Inc. v. Telegenix, Inc.*, 308 F.3d 1193 (Fed.Cir. 2002)[2].

When interpreting an asserted claim, "the court should look first to the intrinsic evidence of record, i.e., the patent itself, including the claims, the specification and, if in evidence, the prosecution history." *Vitronics Corp. v. Conceptronics, Inc.*, 90 F.3d 1576, 1582 (Fed.Cir. 1996); *Phillips*, 415 F.3d at 1313. Extrinsic evidence such as expert testimony may be considered, but it is less significant than the intrinsic record [*Phillips*, 415 F.3d at 1317], and in most situations "an analysis of the intrinsic evidence alone will resolve any ambiguity in a disputed claim term" [*Vitronics*, 90 F.3d at 1583].

Both the intrinsic and extrinsic evidence sources are examined in order below.

A. Claim Construction Focuses on the Meaning of the *Claim Language* to One of Ordinary Skill in the Art

Although the '142 Patent can generally be described as covering an *Automatic Drilling System*, the precise scope of the inventions covered by the patent is determined by the language of the patent's claims:

> "The claims of the patent provide the concise formal definition of the invention. They are numbered paragraphs which 'particularly [point] out and distinctly [claim] the matter which the applicant regards as his invention.' 35 U.S.C. § 112. It is to these wordings that one must look to determine whether there has been infringement. [Footnote omited]. *E.I. du Pont de Nemours & Co. v. Phillips Petroleum*, 849 F.2d 1430, 1433 (Fed.Cir. 1988).

[2] The Federal Circuit clarified its earlier decisions which stated that the first step in determining the ordinary and customary meaning of claim terms is to examine relevant dictionaries, encyclopedias and treatises, *See Texas Digital Sys., Inc. v. Telegenix, Inc.*, 308 F.3d 1193, 1205 (Fed.Cir. 2002); and held that the written description and file history should be consulted prior to examining extrinsic evidence. However, the Federal Circuit noted that the order of examination of evidence is of no consequence.

To properly construe the claims of a patent and thus the scope of the invention, claim interpretation begins with the language of the claim itself. *Bell Com. Research, Inc. v. Vitalink Com. Corp.*, 55 F.3d 615, 620 (Fed.Cir. 1995); *Smithkline Diagnostics, Inc. v. Helena Labs. Corp.*, 859 F.2d 878, 882 (Fed.Cir. 1988). The focus and starting point for the analysis is thus the claim language itself, as the Federal Circuit has stated:

> "We indulge a 'heavy presumption' that claim terms carry their full ordinary and customary meanings, *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed.Cir. 2002), unless the patentee unequivocally imparted a novel meaning to those terms or expressly relinquished claim scope during prosecution, *see Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1325-26 (Fed.Cir. 2002)." *Omega* 334 F.3d at 1324.

"It is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude.'" *Phillips,* 415 F.3d at 1312 (quoting *Innova,* 381 F.3d at 1115). The Court looks first "to the words of the claims themselves ... to define the scope of the patented invention." *Vitronics,* 90 F.3d at 1582. "The written description part of the specification itself does not delimit the right to exclude. That is the function and purpose of claims." *Markman,* 52 F.3d at 980.

Thus, "the words of a claim 'are generally given their ordinary and customary meaning,'" which is "the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention." *Phillips,* 415 F.3d at 1312-13 (citation omitted). "In some cases, the ordinary meaning of claim language as understood by a person of skill in the art may be readily apparent even to lay judges, and claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words." *Id.* at 1314. "In

such circumstances, general purpose dictionaries may be helpful." *Id.* Indeed, the Federal Circuit has "repeatedly stated that claim terms must be given their ordinary and accustomed meaning unless the patent expresses an intention to impart novel meaning to claim terms." *Sunrace Roots Enter. Co. v. SRAM Corp.*, 336 F.3d 1298, 1302 (Fed. Cir. 2003). The Court thus "indulge[s] a 'heavy presumption' that a claim term carries its ordinary and customary meaning." *CCS Fitness, Inc. v. Brunswick Corp.*, 288 F.3d 1359, 1366 (Fed. Cir. 2002) (citation omitted).

Claims "must be understood and interpreted by the court as they would be understood and interpreted by a person in [the relevant] field of technology." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed.Cir. 2005)(en banc)(citations omitted). Therefore, a claim term should be interpreted as having a meaning a person of ordinary skill in the field of the invention would give it. *Id.*

Varco asserts that the hypothetical person having ordinary skill in the art relating to the '142 Patent would possess certain specialized technical skills, would have competent technical training and familiarity in the onshore and offshore oil and gas exploration industry including some relevant and personal experience with electro-mechanical control systems. *See* Ex. 15, Expert Report of Gregg Perkin, Pg. 8, ¶19.

Varco's interpretation of the disputed claim terms is provided as they would have been understood by this hypothetical person at the time of the invention of the '142 Patent—April 1993.

B. The Specification is Often the Best Source for Determining the Meaning of a Claim Term, So Long as Limitations are Not Improperly Read Into the Claims

The patent specification "may act as a sort of dictionary, which explains the invention and may define terms used in the claims." *Markman,* 52 F.3d at 986. However, Courts must not import limitations from the specification into the claims; and claims must not be limited to a preferred embodiment absent a clear disavowal of claim scope. Courts should review the intrinsic evidence, including the remainder of the specification and the prosecution history, to clarify language that is ambiguous on its face and to see if the patentee may have used a term idiosyncratically. *Phillips,* 415 F.3d at 1314. In particular, the specification may show that the patentee used a special definition (acted as his own lexicographer), or it "may reveal an intentional disclaimer, or disavowal, of claim scope by the inventor." *Id.* at 1316. In short, claims "must be read in view of the specification, of which they are a part." *Id.* at 1315 (citation omitted).

Nevertheless, it is important to avoid "one of the cardinal sins of patent law--reading a limitation from the written description into the claims." *Id.* at 1320 (citation omitted). Thus, "particular embodiments appearing in the written description will not be used to limit claim language that has broader effect." *Innova,* 381 F.3d at 1117; *see also Phillips,* 415 F.3d at 1323 ("although the specification often describes very specific embodiments of the invention, we have repeatedly warned against confining the claims to those embodiments").

In particular, "even where a patent describes only a single embodiment, claims will not be "read restrictively unless the patentee has demonstrated a clear intention to limit the claim scope using "words or expressions of manifest exclusion or restriction.'" *Innova,* 381 F.3d at 1117 (quoting *Liebel-Flarsheim Co. v. Medrad, Inc.,* 358 F.3d 898, 906 (Fed. Cir. 2004); and

Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1327 (Fed. Cir. 2002)). The Federal Circuit has "expressly rejected the contention that if a patent describes only a single embodiment, the claims of the patent must be construed as being limited to that embodiment." *Phillips,* 415 F.3d at 1323 (citing *Gemstar-TV Guide Int'l, Inc. v. Int'l Trade Comm'n,* 383 F.3d 1352, 1366 (Fed. Cir. 2004)).

C. The Prosecution History Can Both Confirm a Broad Ordinary Meaning or Reflect a Disclaimer of Claim Scope

The prosecution history contains the record of all proceedings before the Patent Office leading to the grant of the patent and may include express representations made regarding the scope of the claims. *Digital Biometrics, Inc. v. Identix, Inc.,* 149 F.3d 1335, 1344 (Fed.Cir. 1998); *Vitronics,* 90 F.3d at 1582. Courts "should also consider the patent's prosecution history, if it is in evidence," because it "provides evidence of how the PTO and the inventor understood the patent." *Phillips,* 415 F.3d at 1317 (quoting *Markman,* 52 F.3d at 980). Statements in the prosecution history are "often of critical significance in determining the meaning of the claims," as they can either confirm a broad meaning or show that the inventor disclaimed certain coverage during the course of the prosecution. *Vitronics,* 90 F.3d at 1582; *see also Phillips,* 415 F.3d at 1317). The PTO Examiner's remarks are often significant because Examiners are presumed to have experience in interpreting patents and other references and to be familiar with the level of skill in the art based upon their experience in the art. *Ultra-Tex Surfaces, Inc. v. Hill Brothers Chemical Co.,* 204 F.3d 1360, 1367 (Fed.Cir.2000).

The purpose of consulting the prosecution history in construing a claim is to "exclude any interpretation that was disclaimed during prosecution." *ZMI Corp. v. Cardiac Resuscitator Corp.,* 844 F.2d 1576, 1580 (Fed.Cir. 1988). The doctrine of "prosecution disclaimer" – which is well-established in both Supreme Court and Federal Circuit precedent –

holds that, "where the patentee has unequivocally disavowed a certain meaning to obtain his patent, the doctrine of prosecution disclaimer attaches and narrows the ordinary meaning of the claim congruent with the scope of the surrender." *Omega,* 334 F.3d at 1324. Accordingly, only "where the patentee has unequivocally disavowed a certain meaning to obtain his patent, the doctrine of prosecution disclaimer attaches and narrows the ordinary meaning of the claim congruent with the scope of surrender." *Omega Eng'g., Inc. V. Raytek Corp.*, 334 F.3d 1314, 1324 (Fed.Cir. 2003).

Such a use of the prosecution history ensures that claims are not construed one way in order to obtain their allowance and in a different way against accused infringers. *Southwall Tech., Inc. V. Carding IG Co.*, 54 F.3d 1570, 1576 (Fed.Cir. 1995).

Prosecution disclaimer applies to the determination of literal infringement by excluding from the claim construction any claim scope that has been clearly and unmistakably disavowed during prosecution. *Omega Eng'g, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1323 (Fed.Cir. 2003). The Federal Circuit has repeatedly emphasized the standard for claim interpretation under the doctrine: "[F]or prosecution disclaimer to attach, our precedent requires that the alleged disavowing actions or statements made during prosecution be both clear and unmistakable." *Id.* at 1325-26 (emphasis supplied).

The prosecution history is also significant for determining the scope or range the claim elements are entitled to under the doctrine of equivalents during the infringement analysis. *See Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 30 (1997).

D. Extrinsic Evidence Is Also Useful In Interpreting Claims

While the Federal Circuit has emphasized the importance of intrinsic evidence in claim construction, it may also be helpful to rely on extrinsic evidence, which "consists of all evidence

external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises." *Markman,* 52 F.3d at 980, *citing Seymour v. Osborne,* 78 U.S. (11 Wall.) 516, 546, 20 L.Ed. 33 (1870); *see also Vitronics,* 90 F.3d at 1583. Within the class of extrinsic evidence, Courts have observed that dictionaries and treatises can be useful in claim construction. *Phillips,* 415 F.3d at 1318 (citations omitted). These extrinsic sources may help a court "to better understand the underlying technology" and the way in which one of skill in the art might use the claim terms. *Id. citing Vitronics,* 90 F.3d at 1584 n. 6. Because dictionaries, and especially technical dictionaries, endeavor to collect the accepted meanings of terms used in various fields of science and technology, those resources have been properly recognized as among the many tools that can assist the court in determining the meaning of particular terminology to those of skill in the art of the invention. *See Id. citing Teleflex, Inc. v. Ficosa N. Am. Corp.,* 299 F.3d 1313, 1325 (Fed.Cir.2002). Such evidence may be considered if the court deems it helpful in determining "the true meaning of language used in the patent claims." *Markman,* 52 F.3d at 980.

Additionally, extrinsic evidence in the form of expert testimony can be useful to a court for a variety of purposes, such as to provide background on the technology at issue, to explain how an invention works, to ensure that the court's understanding of the technical aspects of the patent is consistent with that of a person of skill in the art, or to establish that a particular term in the patent or the prior art has a particular meaning in the pertinent field. *See Phillips,* 415 F.3d at 1318, *citing Pitney Bowes, Inc. v. Hewlett-Packard Co.,* 182 F.3d 1298, 1308-09 (Fed.Cir.1999); *Key Pharms. v. Hercon Labs. Corp.,* 161 F.3d 709, 716 (Fed.Cir.1998).

III. THE INTRINSIC EVIDENCE OF THE '142 PATENT

A. THE ASSERTED CLAIMS OF THE '142 PATENT

Varco has accused Pason of infringing independent Claims 1, 11 and 14 of the '142 Patent. Claim 1 is an apparatus claim covering an automatic drilling system that regulates the rate of release based upon drilling fluid pressure. Claims 11 and 14 are method claims that cover a method of regulating the rate of release of the drill string in response to drilling fluid pressure and drilling fluid pressure with or without weight on bit, respectively. The asserted claims are provided as follows with the disputed claim language emphasized and numbered for reference:

> 1. An automatic drilling system for automatically regulating the release of the drill string of a drilling rig during the drilling of a borehole, comprising:[3]
>
> a drilling fluid pressure sensor[4];
>
> [1] ***a drilling fluid pressure regulator*** [2] ***coupled*** to said drilling fluid pressure sensor, said [1] ***drilling fluid pressure regulator*** [3] ***measuring*** [4] ***changes in drilling fluid pressure*** and [5] ***outputting a signal*** [6] ***representing*** those [4] ***changes***;

[3] Pason has admitted that its AutoDriller falls within the scope of this element. *See* Ex. 19, Pason's 8-25-06 Responses to Plaintiff's First Set of Admissions Nos. 1 & 2.

[4] Pason has admitted that its AutoDriller falls within the scope of this element. *See* Ex. 19, Pason's 8-25-06 Responses to Plaintiff's First Set of Admissions No. 4.

a [7] ***relay*** [2] ***coupled*** to said [1] ***drilling fluid pressure regulator***, said [7] **relay** responsive to [5] ***the output signal*** of said [1] ***drilling fluid pressure regulator*** to supply a [8] ***drill string control signal*** [9] ***at an output thereof***; and

[10] ***a drill string controller*** [2] ***coupled*** to said [7] ***relay*** wherein [11] ***a decrease in drilling fluid pressure*** results in said [7] ***relay*** supplying a [8] ***drill string control signal*** that [12] ***operates*** said [10] ***drill string controller*** to effect an [13] ***increase in the rate of release of said drill string*** and an [14] ***increase in drilling fluid pressure*** results in said [7] ***relay*** supplying a [8] ***drill string control signal*** that [12] ***operates*** said [10] ***drill string controller*** to effect a [15] ***decrease in the rate of release of said drill string***.

Ex. 1, '142 Patent, Col. 24, ll. 37-58

11. A method for automatically regulating the release of the drill string of a drilling rig drill, comprising the steps of[5]:

measuring drilling fluid pressure[6];

[5] Pason has admitted that its AutoDriller falls within the scope of this element. *See* Ex. 19, Pason's 8-25-06 Responses to Plaintiff's First Set of Admissions No. 3.

[6] Pason has admitted that its AutoDriller falls within the scope of this element. *See* Ex. 19, Pason's 8-25-06 Responses to Plaintiff's First Set of Admissions Nos. 4 & 5.

[16] ***producing a signal in response to*** [4] ***changes in drilling fluid pressure***, [17] ***said signal*** [6] ***representing*** the [4] ***changes in drilling fluid pressure***;

[18] ***relaying*** [17] ***said signal*** to a [10] ***drill string controller***; and

[19] ***controlling*** said [10] ***drill string controller*** to [13] ***increase the rate of release of said drill string*** when [17] **said signal** [6] ***represents*** [11] ***a decrease in drilling fluid pressure*** and to [15] ***decrease the rate of release of said drill string*** when [17] ***said signal*** [6] ***represents*** [14] ***an increase in drilling fluid pressure.***

Ex. 1, '142 Patent, Col. 27, ll. 44-56

14. A method for automatically regulating the release of the drill string of a drilling rig drill, comprising the steps of[5]:

[3] ***measuring*** drilling fluid pressure[6] and [20] ***bit weight***;

[16] ***producing a first signal in response to*** [4] ***changes in drilling fluid pressure***, [17] ***said first signal*** [6] ***representing*** the [4] ***changes in drilling fluid pressure***;

[21] ***producing a second signal in response to*** [22] ***changes in bit***

weight, [23] ***said second signal*** [6] ***representing*** the [22] ***changes in bit weight***;

[24] ***selecting*** [25] ***any one*** of [17] ***said first signal***, [23] ***said second signal***, [25] ***and both*** [17] ***said first*** and [23] ***said second signals*** to [26] ***control the release of said drill string***; and

[18] ***relaying*** [27] ***said selected signal or signals*** to a [10] ***drill string controller*** which [28] ***regulates the release said drill string in response to*** [27] ***said selected signal or signals.***

Ex. 1, '142 Patent, Col. 28, ll. 23-38

B. THE SPECIFICATION OF THE '142 PATENT

The '142 Patent relates to an automatic drilling system that controls the rate of release of the drill string in response to any one, any combination of, or all of bit weight, drilling fluid pressure, drill string torque, and drill string RPM to achieve an optimal rate of bit penetration. Ex. 1, '142 Patent, Abstract. These drilling parameters are measured with sensors that output signals representing the individual properties being measured. Ex. 1, '142 Patent, Col. 1, ll. 51-67. One or more of these signals are then used by the automatic driller to direct the operation of a draw works of a drilling rig to control the rate of release of the drill string associated with the drilling rig. Figure 1 of the '142 Patent (shown below) illustrates the general arrangement of a drilling rig (10) that is controlled by this automatic driller (33).

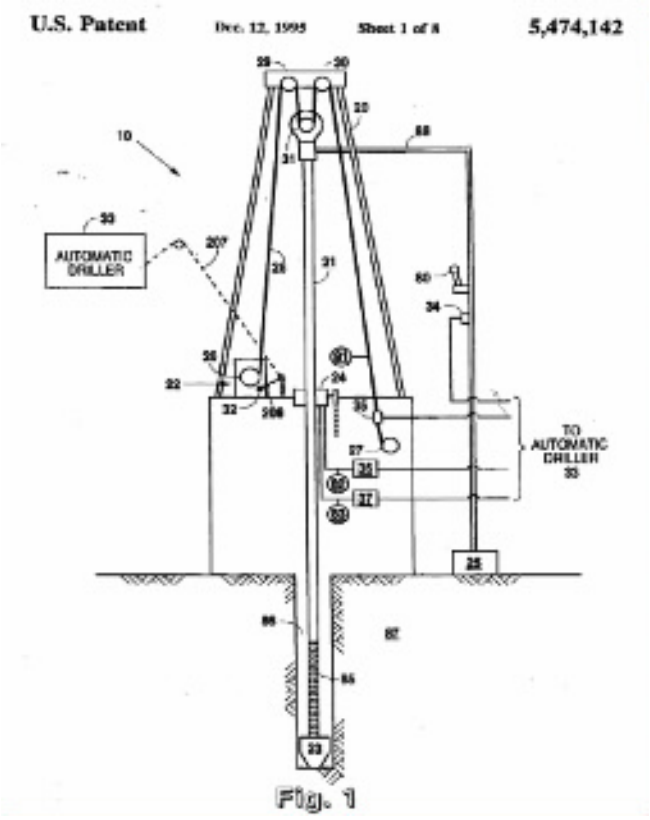


Fig. 1

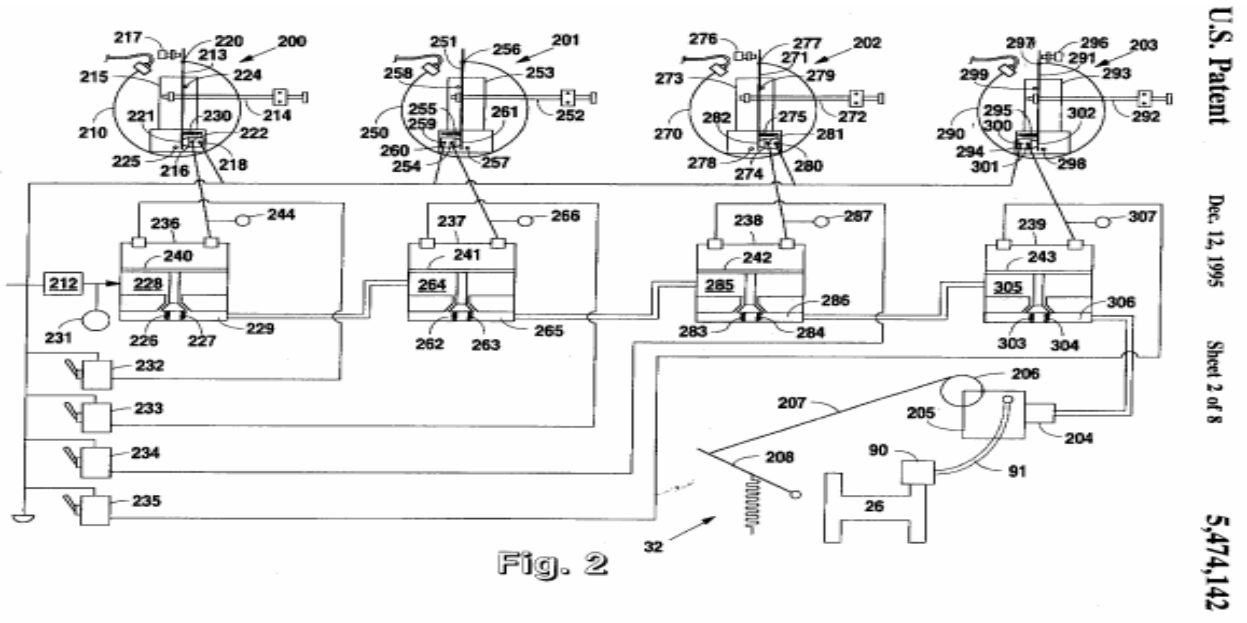
The drilling rig is equipped with several sensors. A pressure sensor (34) measures the drilling fluid pressure. Ex. 1, '142 Patent, Col. 3, l. 55 – Col. 4, l. 56. In Figure 1, the pressure sensor is located on the standpipe, which is the length of pipe that stretches from the mud pump (25) to the flexible hose that attaches to the drill string (21). Other sensors include a bit weight sensor (35) attached to the drilling cable (28) near the cable anchor (27), a torque sensor (36) connected to the rotary table (24) of the drilling rig, and an RPM sensor (37) connected to the rotary table. Ex. 1, '142 Patent, Col. 6, ll. 12-65. Each of these sensors is connected to the automatic driller in the manner described below with reference to Figure 2 of the '142 Patent.

Figure 1 also shows that the automatic driller is connected to a brake handle (208) of a draw works (22). The draw works is a system used to lower the drill string into the bore hole. In a typical draw works (and as shown and/or illustrated in the '142 Patent), the drill string is at

least partially suspended by cables from the derrick of the drilling rig. The cables are spooled by a cable drum, which may be powered by a motor. The motor is used to wind the cables on the drum and thereby lift the drill string. The drill string is lowered by the force of gravity, but a brake controls the rotational speed of the drum, thereby controlling the rate at which the drill string is lowered into the bore hole. As the bit drills through the earth, the drum must release cable to permit the drill string to be lowered into the bore hole. "Rate of release" refers to the rate or speed at which the drill string is lowered into the bore hole. The brake handle controls the amount of braking force applied to the drum (26) of the draw works, and thereby regulates the rate of release of the cables suspending the drill string. An automatic driller utilizes the signals sent from the sensors to the automatic driller to maintain the rate of release of the drill string near an optimum value. *See* Ex. 1, '142 Patent, Col. 4, ll. 15-31, which provides as follows:

> "Drawworks 22 must adjust drill string 21 vertically along derrick 20 in order to retain dill bit 23 'on bottom' (i.e., on the bottom of borehole 86) and maintain the progression of borehole 86 though formation 87. As long as drill string 21 maintains a constant pressure on drill bit 23, drill bit 23 will gouge borehole 86 from formation 87 at an optimal rate of penetration chosen based upon the composition of formation 87. Rates of penetration vary from as little as four feet per hour to as much as one hundred and eighty feet per hour. If, however, drawworks 22 did not adjust drill string 21, drill bit 23 would rise 'off bottom' (i.e., off the bottom of borehole 86) and the progression of borehole 86 through formation 87 would cease. Accordingly, brake 32 must be manipulated to permit drum 26 to release cable 28 and adjust drill string 21, thereby providing the constant pressure on drill bit 23 required to maintain the optimal rate of penetration."

Figure 2 of the '142 Patent (shown below) illustrates the automatic driller of the preferred embodiment.



The automatic driller of the preferred embodiment (Figure 2 of the Bowden Patent) includes a series of pneumatic pressure regulators: drilling fluid pressure regulator (200), bit weight pressure regulator (201), drill string torque pressure regulator (202), and drill string RPM pressure regulator (203). Each of these pressure regulators receives a signal from its corresponding sensor. The automatic driller also includes an air motor (204) that drives a differential gear (205). The differential gear (205) manipulates a cable reel (206) that raises and lowers the brake handle of the draw works. The brake handle adjusts the braking force applied to the drum, thereby controlling the rate of release of the drill string. Ex. 1, '142 Patent, Col. 7, Lines 16-25.

Each of the pressure regulators includes a corresponding valve (236-239) that act as a relay that provide pneumatic signal(s) to an air motor. The air motor controls the rate of release of the drill string based on the pneumatic signal received from the valves. A compressed air source provides the compressed air that controls the motor. A flow regulator (212) limits the maximum pressure delivered to the valves, thereby limiting the maximum rate of release of the

drill string. Ex. 1, '142 Patent, Col. 7, Lines 26-48.

Each of the valves regulates the flow of air to the air motor based on the signal that each valve receives from its corresponding regulator, which is in turn based on the signal that each regulator receives from its corresponding sensor. Therefore, after calibration of a regulator to maintain a desired value (a set-point value) of the associated drilling parameter (*see, e.g.*, Ex. 1, '142 Patent, Col. 8, l. 52 – Col. 10, l. 3), a regulator will control its associated valve so as to modify the rate of release of the drill string to maintain the set-point value of the associated parameter. *See, e.g.*, Ex. 1, '142 Patent, Col. 8, ll. 16-31.

More specifically, each regulator includes a Bourdon tube (210, 250, 270, 290) that connects to the sensor associated with the regulator. In response to a change in the parameter that is measured by the sensor, the Bourdon tube drives a flapper (213, 251, 271, 291) that changes the amount of air flowing from an air nozzle (216, 254, 274, 294) of the regulator to the valve associated with the regulator. This output air flow from the nozzle is thus the output signal from the regulator to the associated valve. Based on this output signal, a piston (240, 241, 242, 243) of the valve moves up or down, thereby changing the amount of air from the air source that is allowed to flow through the valve to the air motor. *See, e.g.*, Ex. 1, '142 Patent, Col. 10, ll. 4-32. In this manner, one or more of the measured drilling parameters may be maintained at or near a desired value determined to optimize the rate of penetration of the drill bit.

In another embodiment of the '142 Patent (Figure 14), the specification describes a hydraulic coil tubing system. *See* Ex. 1, the '142 Patent, Col. 21, l. 56 – Col. 24, l. 26. This alternative embodiment teaches the same concept of increasing and decreasing the rate of release (ROR) of the drill string in response to changes in drilling fluid pressure and/or weight on bit (WOB) through a different system that does not include a draw works, hoisting system, brake

handle, etc. Further, this alternative embodiment teaches the use of electrical transducers for measuring drilling parameters including WOB and a hydraulic drill string control signal for controlling a controller versus a pneumatic signal as described above.

C. THE PROSECUTION FILE HISTORY OF THE '142 PATENT

A copy of the prosecution history of the '142 Patent is attached to this brief as Exhibit 2. Pertinent aspects of the prosecution history are summarized below.

The application that ultimately issued as the '142 Patent was filed on April 19, 1993 and issued as a patent on December 12, 1995.

The PTO examiner mailed a first office action on March 11, 1994. In this office action, the examiner objected to the specification under 35 U.S.C. § 112, ¶1 for failing to adequately teach how to make and use the claimed invention. Specifically, the examiner did not understand how the automatic driller could operate with more than one drilling parameter controlling the release of the drill string. All of the claims were rejected for the same reason. Furthermore, the examiner rejected all the claims under 35 U.S.C. § 103 as being unpatentable over U.S. Patent No. 4,662,608 to Ball ("Ball", Ex. 3), in view of U.S. Patent No. 4,165,789 to Rogers ("Rogers", Ex. 4), and further in view of portions of *Petroleum Engineering: Drilling and Well Completion*, by Carl Gatlin ("Gatlin", Ex. 5). The examiner also identified other prior art references that were the result of the examiner's search in the office action's Notice of References Cited as follows:

U.S. Patent No. 4,491,186 to Alder, Ex. 6;

U.S. Patent No. 4,606,415 to Gray, Jr. et al., Ex. 7;

U.S. Patent No. 4,639,868 to Tanakda et al., Ex. 8;

U.S. Patent No. 4,793,421 to Jasinski, Ex. 9; and

U.S. Patent No. 4,875,530 to Frink et al., Ex. 10.

In response to this office action, the applicant provided arguments as to why the objections and rejections were improper and also added four new claims. The added claims were dependent claims drawn to a specific configuration of a regulator (and which issued unamended as Claims 5-8, respectively).

The applicant responded to the objections and rejections by briefly describing how the invention works while using more than one parameter to control the release of the drill string, with the most restrictive parameter (*e.g.*, the parameter that creates the signal that causes the brake handle to move the least) being the limiting parameter. The applicant also responded that, although the Ball Patent discloses a bit-weight-controlled drilling system, it does not disclose using any factor other than bit weight for controlling the release of the drill string. The applicant also argued that the other cited references failed to teach or suggest using any other parameter to control the rate of release of the drill string. Furthermore, the applicant argued that the Rogers Patent and the Gatlin Reference did not address the issue of controlling the release of a drill string and, as a result, their combination constituted impermissible hindsight.

The PTO examiner mailed a second (final) office action on August 10, 1994 in which his previous objections and rejections were reiterated. Specifically, the examiner again objected to the specification as failing to meet the requirements of 35 U.S.C. § 112, ¶1, and again rejected the claims for failing to meet the requirements of 35 U.S.C. § 112, ¶1 and 35 U.S.C. § 103. The Section 112 claim rejections included both the previously rejected claims and the four claims added by the applicant in the previous response (the new claims were not rejected under section 103).

The applicant filed a response to this second office action on November 7, 1994. In the response, the applicant amended Claims 3, 4, 8 and 9 of the application (these claims, as

amended, correspond to issued Claims 3, 4, 12 and 13, respectively). Claims 3 and 4 of the application, which had been independent claims directed to an automatic drill string controller that controls the rate of release of a drill string based on drill string torque and drill string RPM, respectively, were amended to depend from Claim 1 of the application (which is Claim 1 of the issued patent). Claims 8 and 9 of the application, which were independent method claims directed to methods for regulating the release of the drill string based on drill string torque and drill string RPM, respectively, were amended to depend from Claim 7 of the application (which is Claim 11 of the issued patent).

In accordance with the examiner's request during one or more telephone interviews with the applicant and in order to overcome the Section 112 rejections, the applicant submitted a daily drilling record that evidenced a use of a commercial embodiment of the invention. The applicant argued that the daily drilling record illustrated that the described embodiment could operate using multiple drilling parameters to control the rate of release of the drill string and further argued why the invention as described was operable.

With respect to the Section 103 rejections, the applicant also argued that none of the cited references taught the use of drilling fluid pressure as a parameter to control the rate of release of the drill string. The applicant emphasized that although the Gatlin Reference teaches that the hydraulic pressure of the drilling fluid affects the rate of penetration, it does not disclose or suggest that this pressure can be used as a parameter to automatically control the rate of release of the drill string. The applicant argued that all of the pending claims were allowable since they recite controlling the rate of release of a drill string using drilling fluid pressure (or depend from a claim that recites such a limitation).

Based on the amendments and arguments made in applicant's November 7, 1994

response, the examiner mailed a Notice of Allowance on March 9, 1995. The issue fee was timely paid, and the '142 Patent issued on December 12, 1995.

After the commencement of this litigation, Defendant Pason filed an Ex Parte Reexamination Request of the '142 Patent in view of U.S. Patent No. 3,223,183 to Varney ("Varney", Ex. 11) on January 26, 2004. In its Ex Parte request Pason asserted that Claims 1 and 11 of the '142 Patent were invalid under (1) 35 U.S.C. § 102 as being anticipated and thus unpatentable over the Varney Patent; and (2) 35 U.S.C. § 103 as being obvious and thus unpatentable over the Varney Patent in view of the other prior art cited during prosecution of the '142 Patent.

On April 15, 2004 the PTO examiner granted Pason's Ex Parte request and ordered reexamination of Claims 1 and 11 of the '142 Patent.

The applicant filed a response to the examiner's order granting Pason's Ex Parte Reexamination Request on June 8, 2004. In response the applicant pointed out, among other things, that Varney failed to teach the regulation of the rate of release of the drill string as recited by the '142 Patent's claims.

On August 9, 2004, Pason filed a Reply to applicant's response whereby Pason asserted that Claim 14 in addition to Claims 1 and 11 of the '142 Patent were invalid under (1) 35 U.S.C. § 102 as being anticipated and thus unpatentable over the Varney Patent; (2) 35 U.S.C. § 103 as being obvious and thus unpatentable over the Varney Patent in view of the other prior art cited during prosecution of the '142 Patent; and (3) 35 U.S.C. § 112, ¶¶1 & 2 for failing to adequately teach how to make and use the claimed invention and that the patent claims fail to particularly point out and distinctly claim the subject matter which the applicant regards as his invention.

Based on arguments made in applicant's June 8, 2004 response, the examiner mailed a

Notice of Intent to Issue Ex Parte Reexamination Certificate on November 23, 2005. In the examiner's notice, the examiner confirmed the patentability of the '142 Patent's claims as issued on December 12, 1995. The examiner reasoned that "Varney does not teach or suggest effecting an 'increase in the rate of release' and a 'decrease in the rate of release' as it pertains to Claims 1-15 of the '142 Patent. On July 4, 2006, the PTO issued an Ex Parte Reexamination Certificate confirming the patentability of Claims 1-15 of the '142 Patent.

IV. VARCO'S CLAIM CONSTRUCTION

Varco's *Markman* brief details its interpretation of the claim terms Pason contends are disputed. Unless otherwise indicated, Varco's interpretation of the claim terms is entitled to a full range of equivalents for the purpose of a determination of infringement under the doctrine of equivalents. Varco's interpretation is supported by the written description or specification of the '142 Patent, including its Reexamination Certificate in combination with '142 Patent's prosecution file history (Ex. 2) including the cited prior art (Ex. 3-11) as well as the following extrinsic evidence sources which support how the words and phrases of the claims would be understood by a person of ordinary skill in the relevant art:

(1) *A Dictionary for the Oil and Gas Industry*, by the University of Texas at Austin Petroleum Extension Service (PETEX), 1st Ed. (2005), (hereinafter referred to as "PETEX", Ex. 13);

(2) Webster's New World Collegiate Dictionary, 4th Ed., MacMillan U.S.A. (1999) (herinafter referred to as "Webster's", Ex. 14);

(3) McGraw-Hill Dictionary of Scientific and Technical Terms, 6th Ed., McGraw-Hill (2003), (hereinafter referred to as "McGraw-Hill Scientific", Ex. 12);

(4) Report of Varco's Technical Expert – Gregg Perkin (hereinafter referred to as "Perkin Report", Ex. 15);

(5) Reports of Pason's Techical Expert – J. Ford Brett (hereinafter referred to as "Brett Reports", Exs. 16 & 17);

(6) Testimony of Pason's Technical Expert – J. Ford Brett (hereinafter referred to as "Brett Testimony", Ex. 18)

These sources describe how a person having ordinary skill in the art of the '142 Patent would understand the terms of the asserted claims. Varco contends that this hypothetical person of ordinary skill would possess certain specialized technical skills and would have competent technical training and familiarity in the onshore and offshore oil and gas exploration industry including some relevant and personal experience with electro-mechanical control systems. *See* Ex. 12, Perkin Report at ¶¶17-19.

Varco has provided certain tables within this brief comparing the parties' respective interpretations on certain claim terms which Pason has previously provided its proffered construction. For example, Pason has only disclosed its interpretation of the following claim terms: "regulator"; "coupled"; "relay"; and "relaying."

A. [1.] "**a drilling fluid pressure regulator**"**:** (Claim 1 of the '142 Patent)

Varco's Interp.: *a drilling fluid (i.e., mud) pressure regulator, e.g., a device that is capable of detecting and responding to electrical, mechanical, hydraulic or pneumatic signal(s).*

1. "Drilling Fluid Pressure"

Drilling fluid is a term of art in the drilling industry that refers to the fluid, often called mud, pumped down the drill string. The specification of the '142 Patent describes drilling fluid, the pressure of said fluid, and the function it performs in drilling a well as follows:

> "Pump 25 pumps drilling fluid (i.e., mud) into drill string 21 via drilling fluid line 88, where it travels down drill string 21 to mud motor 85 and drill bit 23. The drilling fluid drives mud motor 85, provides pressure within drill bit 23 to prevent blowouts, and caries drilled formation materials from borehole 86." Ex. 1, '142 Patent, Col. 4, ll. 10-15.

Both "drilling fluid" and "pressure" are defined by the drilling industry PETEX dictionary as follows:

***PETEX* (Ex. 13):**

> **"Drilling fluid –** circulating fluid, one function of which is to lift cuttings out of the wellbore and to the surface. It also serves to cool the bit and to counteract downhole formation pressure. Although a mixture of barite, clay, water and other chemical additives is the most common drilling fluid, wells can also be drilling using air, gas, water, or oil-based mud as the drilling mud. Also called circulating fluid, drilling mud.";
>
> **"Pressure** – the force that a fluid (liquid or gas) exerts uniformly in all directions within a vessel, pipe, hole in the ground, and so forth, such as the force exerted against the inner wall of a tank or that exerted on the bottom of the wellbore by a fluid. Pressure is expressed in terms of force exerted per unit area, as pounds per square inch, or in kilopascals."

Thus, drilling fluid pressure is the pressure or force (per unit area) exerted by the drilling fluid, e.g., the air, gas, water, or oil-based mud pumped down the drill string.

2. "Regulator"

The following table compares the party's respective interpretations of "regulator."

Varco's Construction	Pason's Construction
"a device that is capable of detecting and responding to electrical, mechanical, hydraulic or pneumatic signal." *See* 7-21-06 Perkin Report (Ex. 15), Pages 10-11, ¶¶ 26-27.	"a device used to control the flow of gases, liquid or electric current." *See* 9-4-06 Brett Report (Ex. 17), Page 2.

As described in the Specification, the regulators "receive their respective signals to measure changes in those signals and produce an output signal representative of any changes." Ex. 1, '142 Patent, Col. 2, ll. 4-6. One of the purposes of the "signal representative of any changes" is to identify a change in the related drilling parameter from a set-point value such that

rate of release may be controlled to bring the drilling parameter back to the set-point value. The regulator(s) output this signal representing a change in the associated drilling parameter to another device (a valve operating as a relay) which then supplies a control signal to a drill string controller in response to the output signal from the regulator (the drill string controller controls the rate of release of the drill string). Ex. 1, '142 Patent, Col. 2, ll. 15-20.

The "regulator" element of Claim 1 of the '142 Patent is described as performing specific functions, namely *measuring changes in drilling fluid pressure* and *outputting a signal representing those changes.* Ex. 1, '142 Patent, Col. 4, ll. 43-45.

Additionally, during the prosecution of the '142 Patent the PTO Examiner[7] concluded that the "regulator" language of Claim 1 of the '142 Patent encompassed computer microprocessors and the like. *See* File History (Ex. 2), 8-10-94 Office Action ("WS 140"):

> (PTO Examiner): "Rogers [Ex. 4] discloses a drilling optimization control system (Figs 1-3) which comprises a computer control system for optimizing the penetration rate. In which the drilling rpm and the thrust (or bit weight) are ***monitored and manipulated by the computer*** to achieve the optimal penetration conditions (Col. 4, lines 16+)." (emphasis supplied).

Moreover, Pason itself has represented to the PTO that the "regulator" of Claim 1 of the '142 Patent is not limited to pneumatic control devices. Specifically, Pason stated that a "drilling fluid pressure regulator" includes devices that "produce an electrical signal that changes with drilling fluid pressure." *See* Ex. 2, '142 Patent File History, 1/26/04 Pason's Ex Parte Reexamination Request ("WS 403-11").

Further, Varco's interpretation of "regulator" is consistent with the ordinary meaning as

[7] Examiners are presumed to have experience in interpreting patents and other references and to be familiar with the level of skill in the art based upon their experience in the art. *Ultra-Tex Surfaces, Inc. v. Hill Brothers Chemical Co.,* 204 F.3d 1360, 1367 (Fed.Cir.2000).

provided by the following dictionaries:

***McGraw-Hill Scientific* (Ex. 12):**

***"Regulator* -** a device that maintains a desired quantity at a predetermined value or varies it according to a predetermined plan."

"*Automatic regulator* *– See Automatic Controller"*

***"Automatic controller* –** An instrument that continuously measures the value of a variable quantity or condition and then automatically acts on the controlled equipment to correct any deviation from a desired preset value. Also known as an automatic regulator; controller."

***Webster's* (Ex. 14):**

"**regulator –** a mechanism for controlling or governing the movement of machinery, the flow of liquids, gases, electricity, steam, etc."

B. [**2.**] "**coupled**"**:** (Claim 1 of the '142 Patent)

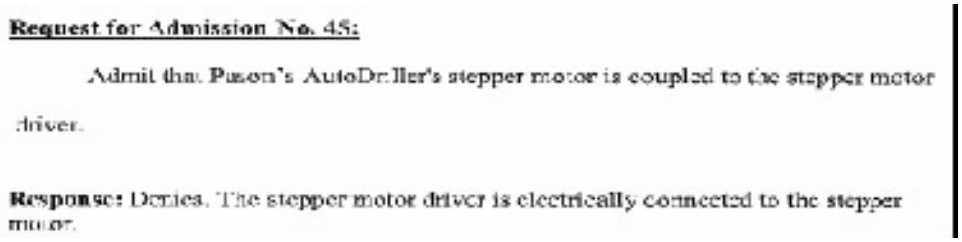
Varco's Interp: *Connected*

The following table compares the party's respective interpretations of "coupled."

Varco's Construction	Pason's Construction
"connected"	"I further note that the language of element C [of Claim 1] uses the word coupled, which has an ordinary meaning of attaching by means of a coupler (which would be appropriate for transmitting a regulated flow), rather than the more generic term 'connected," which appears later." *See* 9-4-06 Brett Report (Ex. 17), Page 2.

Claim 1 of the '142 Patent uses the term "coupled" to describe how the various elements are interconnected so that signaling can be communicated between them. In the preferred embodiments of the '142 Patent, various components are "coupled" via tubes, lines or pipes that transmit either hydraulic or pneumatic signals. Pason would have this Court limit the term "coupled" to the apparatus of the preferred embodiment as set forth above in the table and denies

that any scope that would encompass for example electrical connections. *See* Ex. 19, Pason's 8-25-06 Responses to Plaintiff's First Set of Admissions No. 3:



Request for Admission No. 45:

Admit that Pason's AutoDriller's stepper motor is coupled to the stepper motor driver.

Response: Denies. The stepper motor driver is electrically connected to the stepper motor.

The specification of the '142 Patent (Ex. 1) describes the various components of an automatic being "coupled" as "attached" and "connected", used interchangeably, as follows:

> "Each of the regulators ***attaches*** to a relay…The relays ***connect*** in series…The drill string controller ***attaches*** to the relays to receive a drill string control signal…the relay ***connected*** to the drilling fluid pressure regulator." (Col. 2, ll. 15-30).

The specification further describes an alternative embodiment (Fig. 14) whereby an WOB sensor comprises an electrical transducer that is coupled or connected through a suitable conductor such as a wire. *See* Ex. 1, Col. 22, ll. 20-23 ("the electrical output of the transducer…").

Varco's construction is further supported by the ordinary meaning as provided in the following dictionaries:

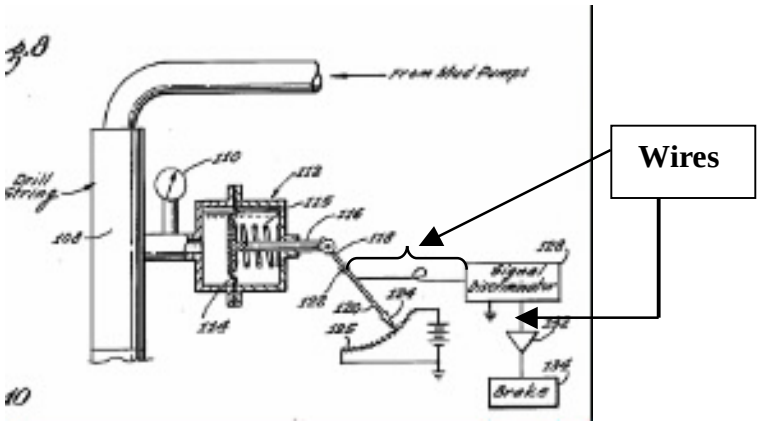
***McGraw-Hill* (Ex. 12):**

> *"**couple** [ELEC]* To connect two circuits so signals are transferred from one to the other; [*ENG]* To connect with a ***coupling***, such as of two belts or two pipes.";
>
> "***coupler** [ELEC]* A component used to transfer energy from one circuit to another";
>
> "***coupling** [ELEC]* 1. A mutual relation between two circuits that permits energy transfer from one to another, through a wire, resistor, transformer, capacitor, or other device."

***Webster's* (Ex. 14):**

> "***couple*** *1.* anything joining two things together; bond; link; [*ELEC*] To join (two or more circuits) by a common magnetic or electric field or by direct connection."

Moreover, Varco relies upon Pason's admission that the term "coupled" includes electrical connections. For example in its *Ex Parte Reexamination* request Pason represented to the PTO that the term "coupled" of Claim 1 of the '142 Patent includes electrical connections. *See* Ex. 2, '142 Patent File History, 1/26/04 Ex Parte Reexamination Request ("WS 409") ("Varney provides …drilling fluid pressure regulator *coupled* to said drilling fluid pressure sensor."). The PTO examiner further stated that the claim term "coupled" included electrical connections. *See* Ex. 2, '142 Patent File History, 4/15/04 Order Granting Ex Parte Reexamination Request ("Power transformer 132 drives a brake 134 that is considered the controller *coupled* to the relay"). As shown in Figure 8 of the Varney Patent (Ex. 11), to which both Pason and the PTO Examiner were referring, the regulator (124 & 125) are connected to the "signal discriminator 128" via an electrical connection—a wire. Similarly, the "signal discriminator 128", i.e., the relay, is connected to the "power transformer 132" via an electrical connection—a wire. Figure 8 of the Varney Patent is provided below for reference.



U.S. Patent No. 3,223,183 to Varney (Ex. 11, Fig. 8):

Similarly the term "coupled" was at issue in *Johnson Worldwide Associates, Inc. v. Zebco Corp.,* 175 F.3d 985 (Fed.Cir. 1999). In *Johnson* the Federal Circuit rejected the defendant's proffered construction overly limiting the term "coupled" to a special, limited mechanical or physical coupling that was taught by the preferred embodiment (the exact position taken by Pason in this case), and properly interpreted the term "coupling" to mean a "connection."

C. [3] "**measuring":** (Claims 1, 11 and 14 of the '142 Patent)

Varco's Interp.: *finding out, determining, calculating, ascertaining*

The specification of the '142 Patent discloses various commercially available sensors for measuring drilling parameters including: (1) drilling fluid pressure; (2) bit weight; (3) torque; and (4) RPM. These devices sense or "measure" these parameters as described by Figures 4-13 and Col. 4, l. 57 – Col. 7, l. 15 & Col. 22, ll. 13-24. Each of these devices take measurements at the drilling rig or surface of the borehole being drilled. For example, the specification teaches measuring the drilling fluid pressure from the rig's standpipe, i.e., the vertical pipe that extends from the rig floor to the mud hose for carrying mud from the pumps to the drill string. Also, the weight on bit or bit weight is measured from the rig's hoisting system's dead line cable or the dead line cable's anchor as a proxy of tension on the dead line cable. In the preferred embodiment these sensors measure the actual values for these parameters (e.g., drilling fluid pressure and/or bit weight) and transmit the measured values to regulators

Varco's construction is consistent with the ordinary meaning as provided by the following dictionaries:

***PETEX* (Ex. 13):**

> **"measured signal** – the electrical, mechanical, pneumatic, or other variable applied to the input of a device."

"**measuring means** – in process control, the elements of a controller that sense, measure, and transmit to the controlling means either the value of the controlled variable or its deviation from the desired point."

Webster's* (Ex. 14)*:

"measuring – to find out or estimate the extent, dimension, etc."

"***measured*** – 1. determined, ascertained or proportioned by a standard;
4. calculated;"

Further, Pason's designated technical expert witness has admitted that that Pason's AutoDriller *measures* drilling parameters. *See* Ex. 16, Brett Report, Pg. 16 ("the Pason system measures drilling parameters").

Moreover, the CAFC has clarified the proper interpretation of "measuring" on numerous occasions. For example, in *Robotic Vision Sys., Inc. v. View Eng., Inc.,* 19 F.3d 1370 (Fed.Cir. 1999), the Federal Circuit determined that calculating and measuring are analogous. *Id.* at 1371 FN1. In *Moll v. Northern Telecom, Inc.*, 119 F.3d 17 (Fed.Cir. 1997), the Federal Circuit similarly found that measuring and detecting are analogous.

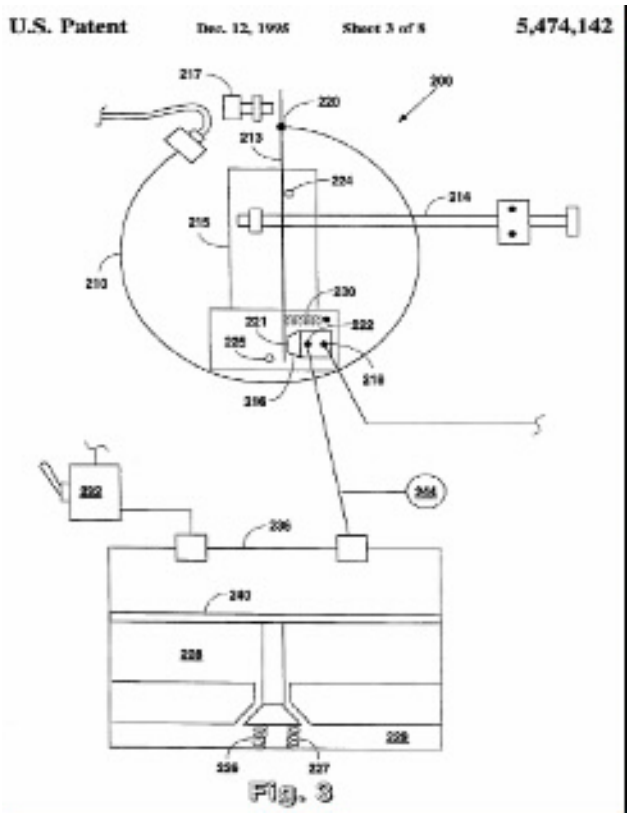
D. [4] "changes in drilling fluid pressure": Claims 1, 11 and 14 of the '142 Patent

Varco's Interp.: *a difference between values in drilling fluid pressure*

1. "Changes"

The '142 Patent teaches two types of "changes": (1) the difference between a current measured value and the set-point value; and (2) the difference between current measured value and a previous measured value.

Figure 3 of the '142 Patent (shown below) illustrates the regulator (200) and the valve (operating as a relay) of the preferred embodiment.



The operation of the preferred embodiment discloses a hydraulic signal corresponding to the drilling fluid pressure is communicated to the Bourdon tube (210) from a pressure sensor (34) (*See, e.g.*, sensors at Figs. 4-6). The Bourdon tube extends or contracts according to the hydraulic pressure communicated to it. In response, the flapper's (213) position changes with the degree of deflection of the Bourdon tube. Therefore, the position of the flapper (213) which controls the amount of air deflected or output from the nozzle (216) to the valve (236) changes as the pressure of the drilling fluid changes. Thus, the nozzle (216) outputs a signal that varies with a corresponding change in the measured drilling fluid pressure. For example, if the drilling fluid pressure in the standpipe was 2500 pounds per square inch (psi) and it increased to 2600 psi, the output signal from the drilling fluid pressure regulator would also change to represent the change in pressure. Any measured change in drilling fluid pressure necessarily causes a new or different signal to be outputted from the nozzle. Similarly, when the drilling fluid pressure is at the set-

point or desired pressure, and is not changing for a given interval of time, the output signal will remain the same, representing a change of "0" to maintain the current position of the brake handle. In that case, the currently measured pressure and the desired or set-point pressure are the same. Any subsequent change in the measured pressure represents a change from both the set-point pressure and the previously measured pressure; and the change in pressure causes the nozzle (216) of the regulator to output a signal representing the change. This interpretation is consistent with the description of the '142 Patent:

> "Nozzle 216 mounts on plate 215 to deliver variable amounts of compressed air from the air supply to diaphragm 240 of valve 236 in response to changes in drilling fluid pressure." Ex. 1, '142 Patent, Col. 8, ll. 42-44; and
>
> "In normal operation, Bourdon tube 210 manipulates flapper 213 in response to changes in drilling fluid pressure to vary the amount of compressed air nozzle 216 delivers to valve 236. That variable amount of compressed air alters the opening of valve 236 and, thus, the force with which the compressed air drives air motor 204." Ex. 1, '142 Patent, Col. 8, ll. 52-57.

The '142 Patent also describes changes as the increase and decrease in the measured drilling fluid and/or bit weight (WOB) as follows:

> "even under optimal drilling conditions drill bit 23 will rise 'off bottom', thus requiring drilling fluid pressure regulator 200 to readjust the release of cable 28 from drum 26. Any time drill bit 23 rises even slightly 'off bottom', drilling fluid pressure within drill string 21 decreases. Drilling fluid pressure sensor 34 measures that decrease and supplies Bourdon tube 210 with a hydraulic signal representing that decrease [i.e., change]." Ex. 1, '142 Patent, Col. 10, ll. 5-12.

Thus, the patent's description plainly supports an interpretation of claim language requiring a signal "representing the ***changes in drilling fluid pressure***" as encompassing signals representing any change in drilling fluid pressure, whether as a change from a set-point or

desired pressure, or a change from a previously measured pressure, or both.

The prosecution file history similarly describes what causes changes in drilling fluid pressure. *See* Ex. 2, 11-7-94 Office Action Response, ("WS 151") ("Any changes in drilling fluid pressure registered by the claimed invention occur due to changes in the position of the drill string relative to the bottom of the borehole.").

Varco's construction is consistent with the ordinary meaning as provided by the following dictionary:

***Webster's* (Ex. 14):**

> **"change –** *n.* 1. the act or process of substitution, alteration, or variation; *vi.* 1 a) to become different; alter; vary; b) to undergo alteration or replacement. *vt.* 3 a) to cause to become different; alter; transform; convert, b) to undergo a variation of; *n.* 1. the act or process of substitution, alteration, or variation."

2. "Drilling Fluid Pressure" – *See* Section IV. A. 1., above.

E. [5] "**outputting a signal": (**Claim 1 of the '142 Patent)

Varco's Interp.: *to produce, deliver, transfer, generate, and/or transmit a signal (e.g., information, variable, entity, etc.) from something*

1. "Outputting"

The term "outputting" as used in the phrase "outputting a signal", refers to the generation or production of a signal from a device. With respect to Claim 1 of the '142 Patent, it is the pressure regulator that outputs a signal—that is it produces a signal.

The preferred embodiment of the '142 Patent outputs a pneumatic signal from the nozzle 216 of the drilling fluid pressure regulator 200 to the diaphragm 240 of valve 236. Ex. 1, '142 Patent, Col. 8, ll. 40-44.

Varco's construction is consistent with the ordinary meaning as provided by the

following dictionaries:

***McGraw-Hill Sci.* (Ex. 12):**

"output – 3. (*v.*) The activity of transmitting the generated information. [ELECTR.] 1. (*n.*) The current, voltage, power, driving force or information which a circuit or device delivers."

***PETEX* (Ex. 13):**

"output (*n.*) – a signal transmitted from a device."

***Webster's* (Ex. 14):**

"outputting (*v.*) – to deliver or transfer."

2. "Signal"

The '142 Patent teaches three types of signals: (1) pneumatic (Figs. 2, 3); (2) hydraulic (Figs. 4-8); and (3) electrical (Col. 22, l. 22 "the electrical output"; Col. 7, l. 1 "generates a voltage signal"). The signal production element of Claim 1 may be interpreted as including both (1) producing an intermediate signal, and (2) production of the actual control signal—said signal that represents a change from a set-point pressure or a previous measured pressure as explained above in Section IV. D. 1.

Varco's construction is consistent with the ordinary meaning as provided by the following dictionaries:

***PETEX* (Ex. 13):**

"signal - information about a variable that can be transmitted."

"measured signal – the electrical, mechanical, pneumatic, or other variable applied to the input of a device."

***McGraw-Hill Scientific* (Ex. 12):**

"signal – an entity that signifies some other thing, and may be interpreted."

F. [6] "representing" or "represents": (Claims 1, 11 and 14 of the '142 Patent)

Varco's Interp.: *to be a sign or symbol for; to stand for; symbolize; equivalent of; correspond to; indicative of; directly related to; a reasonable proxy for*

The preferred embodiment of the specification of the '142 Patent discloses an output signal from the nozzle (216) that represents, i.e., stands for, symbolizes, corresponds to, indicative of, or directly related to, the current measured pressure, band signal also inherently represents a change from the set-point pressure and the previously-measured pressure since a change in measured pressure causes a change in the output of the nozzle (216) of the regulator. For example, a change from the set-point pressure has the same meaning as a change from the previously measured pressure when the previously measured pressure equals the set-point pressure. Any change in the output of the nozzle (216) is caused by a change in the actual value of the measured pressure. Therefore, any change in the output of the nozzle (216) is directly related to any one or any combination of (1) a change in measured pressure; (2) a change from the set-point pressure; or (3) a change from the previously measured pressure. The greater the change in pressure is signified by a greater change in the output signal produced or outputted. This interpretation is consistent with the description in the '142 Patent:

(1) that the signal explicitly identifies (quantifies) the change; and/or

(2) that the signal inherently signifies the change.

An example of the first interpretation is, given a current measured pressure of P_2 and a set-point pressure or a previously measured pressure of P_1, an output signal from the air nozzle (216) of the regulator (200) that explicitly identifies the quantity $P_2 - P_1$. *See* Ex. 1, Col. 10, ll. 4-61.

An example of the second interpretation is that the output signal from the air nozzle (216) represents the current measured pressure, and that signal inherently represents a change from the set-point pressure or the previously-measured pressure since a change in measured pressure causes a response or change in the output of the air nozzle (216) of the regulator (200). Thus, the air nozzle (216) output signal represents a change in drilling fluid pressure to cause an appropriate response in the valve (236) operating as a relay representative of the pressure change. This is also described in the '142 Patent as follows:

> "even under optimal drilling conditions drill bit 23 will rise 'off bottom', thus requiring drilling fluid pressure regulator 200 to readjust the release of cable 28 from drum 26. Any time drill bit 23 rises even slightly 'off bottom', drilling fluid pressure within drill string 21 decreases. Drilling fluid pressure sensor 34 measures that decrease and supplies Bourdon tube 210 with a hydraulic signal ***representing that decrease*** [i.e., change]." Ex. 1, '142 Patent, Col. 10, ll. 5-12; and
>
> "Drilling fluid pressure sensor 34, bit weight sensor 35, torque sensor 36, and RPM sensor 37 mount onto oil drilling rig 20 to provide signals representative of drilling fluid pressure, bit weight, drill string torque, and drill string RPM to automatic driller 33." Ex. 1, Col. 4, ll. 44-48.

Varco's construction is consistent with the ordinary meaning as provided by the following dictionary:

***Webster's* (Ex. 14):**

> **"represent –** 4. to be a sign or symbol for; stand for; symbolize; 5. to be the equivalent of; correspond to."

Thus, Varco's interpretation of "representing" is consistent with the ordinary meaning of the term and supported by the specification of the patent. In similar circumstances, the CAFC construed the term "representing" as "broad enough to include 'symbolizing' or 'to stand for'"; "directly related to"; "indicative of" and/or "a reasonable proxy for" and rejected defendant's

overly-narrow "equivalent to" interpretation. *See, e.g., Tehrani v. Hamilton Med., Inc.,* 331 F.3d 1351, 1361 (Fed.Cir. 2003).

G. [7] "**relay": (**Claim 1 of the '142 Patent)

Varco's Construction	Pason's Construction
"a device that communicates, conveys, or imparts an electrical, mechanical, hydraulic or pneumatic signal to, e.g., control the movement (neutral, up or down) of the rig's hoisting system's brake handle." *See* 7-21-06 Perkin Report (Ex. 15), Pages 5 and 13-18.	"a variably controlled flow device that responds to a change in an input signal by communicating a control signal to a switch or other device."; or "a device that responds to a change in an input signal by communicating a control signal to a switch or other control device" *See* 9-4-06 Brett Report (Ex. 17),Table 1,Page 4

The preferred embodiment of the '142 Patent teaches a pneumatic valves that "operate as relays." The specification of the '142 Patent describes the operation of the relay of the preferred embodiment as follows:

> "Each of the regulators attaches to a relay which is responsive to that regulators output signal to supply a drill string control signal to a drill string controller." ('142 Patent, Col. 2, ll. 15-18);
>
> "As shown in FIG. 2, automatic driller 33 comprises drilling fluid pressure regulator 200, bit weight regulator…which receive the drilling signals developed by drilling fluid pressure sensor 34, bit weight sensor 35…Automatic driller 33 further comprises air motor 204 which drives differential gear unit 205. Differential gear unit 205 manipulates cable real 206 to raise and lower brake handle 208 via cable 207, thereby adjusting the braking force brake 32 applies against drum 26. Regulators 200-203 connect to valves 236-239, respectively, to output a pneumatic signal to air motor 204 which drives air motor 204 to control brake 32 and, thus, the release of cable 28 from drum 26. Although regulators 200-203 may be used concurrently to control brake 32, they may also be utilized individually or in any combination to control the release of cable 28 from drum 26.
>
> In the preferred embodiment, valves 236-239 are pneumatic valves that operate as relays to supply compressed air to air motor 204.

> Specifically, valves 236-239 connect in series to deliver compressed air from an air supply (not shown) to air motor 204. That is, the air supply delivers the compressed air to valve 236 through flow regulator 212. Air pressure gauge 231 registers the air pressure supplied to valve 236 and displays the value for the automatic driller operator. Flow regulator 212 functions to limit the pressure of the compressed air delivered to air motor 204 will drive cable reel 206. Flow regulator 212, therefore, determines the maximum rate at which drill bit 23 could penetrate into formation 87." ('142 Patent, Col. 7, ll. 16-48).
>
> "The drill string controller attaches to the relays to receive a drill string control signal from the regulator or regulators controlling the drilling operation. Illustratively, when the relay connected to the drilling fluid pressure regulator receives a decrease in drilling fluid pressure signal, it supplies a drill string control signal that operates the drill string controller to effect an increase in the rate of release of the drill string. Conversely, an increase in drilling fluid pressure results in the relay supplying a drill string control signal that operates the drill string controller to effect a decrease in the rate of release of the drill string.
>
> If, however, the relay connected to the bit weight regulator receives a decrease in bit weight signal, it supplies a drill string control signal that operates the drill string controller to effect an increase in the rate of release of the drill string. Conversely, an increase in bit weight results in the relay supplying a drill string control signal that operates the drill string controller to effect a decrease in the rate of release of the drill string." ('142 Patent, Col. 2, ll. 25-43).

The '142 Patent describes a preferred embodiment that contains valves which operate as relays by communicating a variable signal in response to changes in a measured parameter to the actuating device. This is explicitly described in the '142 Patent (Ex. 1) at Col. 8, ll. 42-44, as follows:

> "Nozzle 216 mounts on plate 215 to deliver variable amounts of compressed air form the air supply to diaphragm 240 of valve 236 [operating as a relay] in response to changes in drilling fluid pressure.";

And at Col. 8, ll. 52-57:

> "In normal operation, Bourdon tube 210 manipulates flapper 213 in response to changes in drilling fluid pressure to vary the amount of compressed air nozzle 216 delivers to valve 236 [operating as a relay]. That variable amount of compressed air alters the opening of valve 236 [e.g., relay] and, thus, the force with which the compressed air drives air motor 204."

Thus, the relays valves (236 through 239) disclosed in the '142 Patent are not merely switches as Pason improperly contends, but operate as a variable control flow device, e.g. a choke. For example, an adjustable choke is a common flow device that can "vary the volume of fluid, such as a flowing gas and/or liquid, to pass through it as a result of changes to a drilling parameter. Thus, the relay valves (236 through 239) are not limited to simple on and off switches but include widely variable openings, orifices and/or flow-through diameters to control the amount of compressed air or hydraulic fluid (i.e., the signal) which is passed on by the valves.

Additionally, the CAFC ruled that the specification of the '142 Patent did not limit the claims to the pneumatically operated preferred embodiment having pneumatic valves as "relays". *Varco,* 436 F.3d at 1370. The Court was quite clear on this point:

> "As outlined above, nothing in the claim language requires or even suggests the use of pneumatically operated valves in performing the relaying step. Rather, the only discussion of pneumatically operated valves in the intrinsic record comes from the specification: "In the *preferred embodiment*, valves 236-239 are pneumatic valves *that operate as relays* to supply compressed air to air motor 204. "'142 patent, col. 7, ll. 35-37. This disclosure and corresponding Figures do not limit the invention as a whole to the use of pneumatically operated valves; rather they merely list such valves as but one example of relays operable in the present invention. *See C.R. Bard, Inc. v. U.S. Surgical Corp.*, 388 F.3d 858, 864 (Fed.Cir.2004) ("Statements that describe the invention as a whole, rather than statements that describe only preferred

> embodiments, are more likely to support a limiting definition of a claim term.") (citing *Digital Biometrics, Inc. v. Identix, Inc.*, 149 F.3d 1335, 1347 (Fed.Cir.1998)); *SanDisk Corp. v. Memorex Prods., Inc.*, 415 F.3d 1278, 1286 (Fed.Cir.2005) ("References to a preferred embodiment, such as those often present in a specification, are not claim limitations." (Quoting *Laitram Corp. v. Cambridge Wire Cloth Co.*, 863 F.2d 855, 865 (Fed.Cir.1988)); *Gillette*, 405 F.3d at 1374 ("This court has cautioned against limiting the claimed invention to preferred embodiments or specific examples in the specification.") (quoting *Texas Instruments, Inc. v. U.S. Int'l Trade Comm'n*, 805 F.2d 1558, 1563 (Fed.Cir.1986)); *Gart v. Logitech, Inc.*, 254 F.3d 1334, 1342 (Fed.Cir.2001) (noting that "drawings [depicting the preferred embodiment] are not meant to represent 'the' invention or to limit the scope of coverage defined by the words used in the claims themselves."); *see also* '142 patent, col. 24, ll. 27-35 (stating the present invention is not limited to the preferred embodiment)." *Id* at 1370.

For these reasons, the relays disclosed in the preferred embodiment of the '142 Patent "transmit or pass along" signals (e.g., pneumatic or hydraulic signals) to the drill string controller consistent with Varco's proposed construction.

Furthermore, during the reexamination of the '142 Patent the PTO concluded that the *relay* of claims 1 and 9 included devices responsive to the output of the pressure transducer including such devices as an electrical signal discriminator. *See* Ex. 2, 4/15/04 Order Granting Reexamination ("Varney disclosed a "[d]iscriminator 128 is a relay responsive to the output signal of the pressure transducer.").

In fact, Pason has itself previously taken the position that the "relay" of Claim 1 of the '142 Patent should be interpreted in this way—devices that "pass through" a signal. *See* Ex. 2, Pason's Reexamination Request ("WS 407-8"), which, provided as follows:

> "The signal produced by elements 124 [pressure transducer] and 125 [potentiometer] ***PASS THROUGH*** a signal discriminator 128 and power transformer 132 produce a signal that controls the

> operation of the drill string brake 134 as described in Varney at column 10 lines 3 through 25." (emphasis supplied)

Additionally, during the prosecution of the '142 Patent the PTO considered prior art references which taught electrical *relays* that included transducers, computer controls, microprocessors and signal discriminators; e.g. conditioners; amplifiers; filters; and/or comparators and initially rejected Claim 1 in view of such relays taught by the prior art. See File History (Ex. 2), PTO Office Action ("WS 140") which provided as follows:

> "Rogers discloses a drilling optimization control system (Figs 1-3) which comprises a computer control system for optimizing the penetration rate. In which the drilling rpm and the thrust (or bit weight) are monitored and manipulated by the computer to achieve the optimal penetration conditions (Col. 4, lines 16+)."

Furthermore, the prior art made of record by the USPTO during the prosecution of the '142 Patent, e.g., Ball, Rogers, Alder, Gray, Jr. et al., Tanaka et al., Jasinski and Frink et al. (Exs. 3-11), each disclosed relay(s) that were electronic in design which included transducers for measuring certain parameters coupled to computer components that constituted regulators that produced signaling that was transmitted or passed along to a drill string controller. Nowhere in the prosecution history did the applicant for the '142 Patent distinguish his invention from the prior art of record based upon the physical structure of the relay or the function that it performed. For these reasons, the relay language of Claim 1 is not limited as referring to only a pneumatic valve relay or a binary-type relaying device.

Varco's construction is consistent with the ordinary meaning as provided by the following dictionaries:

***PETEX* (Ex. 13):**

> **"relay** – a device in an electric circuit that senses electrical variations in the circuit and then makes or breaks one or more connections in the same or another circuit."

***McGraw-Hill Scientific* (Ex. 12):**

> "**relay –** a microwave or other radio system used for passing a signal from one radio communication link to another. A device that is operated by a variation in the conditions in one electric circuit and serves to make or break one or more connections in the same or another electric circuit. Also known as electric relay."

***Webster's* (Ex. 14):**

> **"relay –** 4. an act or instance of conveying or transmitting by or as by relays; 6. an electromagnetic or electrical switching device activated by a signal and usually used to control a large current or to activate another device or circuit."

If the Court were to limit the "relay" element of Claim 1 to the "electric relay" definition provided by these dictionaries, such a construction would be improper because it would exclude the preferred embodiment of the specification. *See Primos, Inc. v. Hunter's Specialties, Inc.*, 451 F.3d 841, 848 (Fed.Cir. 2006) ("While we are mindful that we cannot import limitations from the preferred embodiments into the claim, we also should not normally interpret a claim term to exclude a preferred embodiment." (citation omitted)).

The specification makes it clear that the Applicant acted as his own lexicographer to define a "relay" as not limited to an "electric relay" or a binary device, but any device including pneumatic valves, hydraulic valves, electromagnetic or solid state relays, and the like which convey or pass along a variable signal as described in the specification of the '142 Patent.

H. [8] "a drill string control signal": Claim 1 of the '142 Patent

Varco's Interp.: *a signal used to control the rate of release of the drill string*

In the preferred embodiment of the specification the "drill string control signal" is the relative amount of compressed air delivered to an air motor a drill string controller. The amount of compressed air controls the rotational speed and thus the direction of the cable wheel (206) of the motor which in turn lifts and lowers the draw work's brake handle (208) via a cable (207) connected between the wheel (206) and handle (208)—increasing and decreasing the braking force applied to the drum—and thereby increasing or decreasing the rate of release of the drill string.

In another embodiment (Figure 14) of the '142 Patent, the drill string control signal is a hydraulic signal delivered to a coil tubing unit that unspools and drives tubing into the bore hole. This controller includes various motors (505, 506, 510, 511) driven by the hydraulic fluid, i.e., a drill string control signal, which control the speed at which the drill string (503) advances into the borehole, i.e., rate of release.

Thus, a "drill string control signal" is a signal used to control the rate of release of a drill string.

1. "A Drill String"

The preferred embodiment of the specification identifies the "drill string (21)" as the pipe interconnected with the mud motor (85) and drill bit (23) that is suspended from the rig and which transmits the rotational motion and drilling fluid from the drilling rig to the drill bit (23).

A "drill string" is understood by a person having ordinary skill in the relevant art as follows:

***PETEX* (Ex. 13):**

> "***drill string*** – the column, or string, of drill pipe with attached tool joints that transmits fluid and rotational power from the kelly to the drill

collars and the bit. Often, especially in the oil patch, the term is loosely applied to include both drill pipe and drill collars."

2. Control

The modifier "control" as used in Claim 1 describes the signal that is outputted from the "relay" and the purpose of the signal—controlling the drill string controller.

In the preferred embodiment, the drill string control signal is a pneumatic signal that drives the air motor or controller as described herein. In another embodiment, the drill string control signal is a hydraulic signal that drives the coil tubing unit or controller as described herein.

The ordinary meaning of the term "control" as found in a common dictionary is provided as follows:

***Webster's* (Ex. 14):**

"control – 2. to regulate; 4. to exercise authority over, direct, command; 5. to operate or regulate *[this knob controls the volume of sound]"*

***PETEX* (Ex. 13):**

"control – 1. manual or automatic regulation of a process. A means or device to direct and regulate a process or sequence of events."

Thus, the modifier "control" merely describes the purpose of the "signal", e.g., a signal having the purpose of controlling, regulating, commanding, operating, etc. the drill string controller.

3. Signal—*See* Section IV. E. 2., above.

I. [9] "at an output thereof"—(Claim 1 of the '142 Patent)

The claim terms "at an output thereof" refers to a place where the "relay" supplies the drill string control signal. In the preferred embodiment of the specification, the "output thereof"

of the valve (236) operating as a "relay" is the output of the valve from cavity (229). The specification describes this as follows: "The opening of valve 236 allows compressed air [control signal] from the air supply to flow from cavity 228 into cavity 229 and out from valve 236" to the air motor 204. *See* Ex. 1, '142 Patent, Col. 9, ll. 35-37. Thus, the phrase "at an output thereof" is construed as at the output or exit of something, e.g., the relay, through which something (e.g., a signal) may pass or is produced. *See, e.g.*, excerpt from Fig. 3 reproduced below:

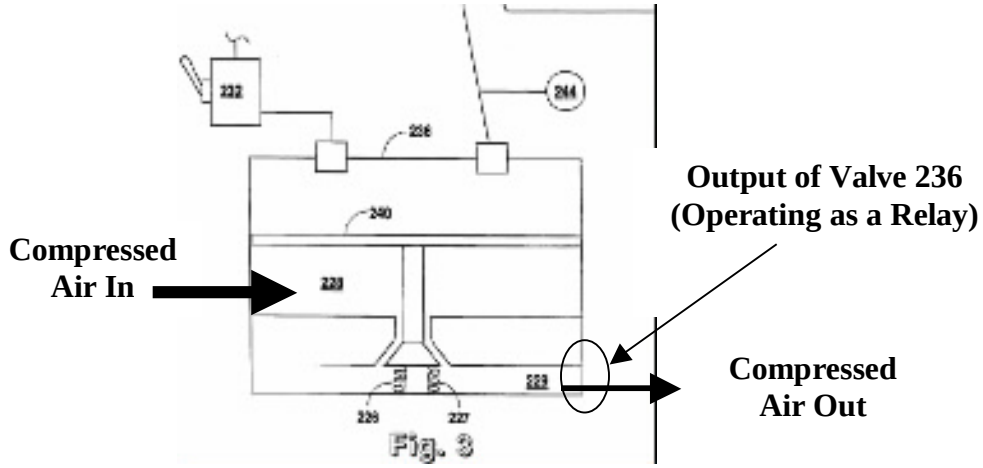


Figure 3 of the '142 Patent (Ex. 1):

J. [10] "<u>a drill string controller</u>": (Claim 1 of the '142 Patent**)**

Varco's Interp: *A device that controls the rate of release of the drill string*

1. "<u>Drill String</u>"—*See* Section IV. H. 1., *above.*

2. "<u>Controller</u>"

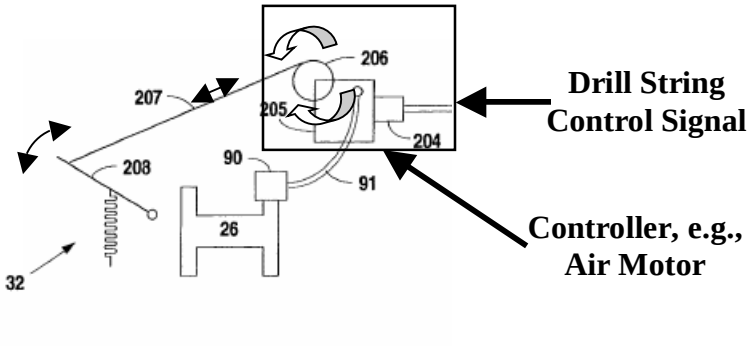
The drill string controller of the preferred embodiment is an air motor (204) which is driven by the force of compressed air supplied to it. As described by the specification:

> "Automatic driller 33 further comprises air motor 204 which drives differential gear unit 205. Differential gear unit 205 manipulates cable reel 206 to raise and lower brake handle 208 via cable 207, thereby adjusting the braking force brake 32 applies against drum

> 26. Regulators 200-203 connect to valves 236-239, respectively, to output a pneumatic signal to air motor 204 which drives air motor 204 to control brake 32 and, thus, the release of cable 28 from drum 26." (Col. 7, ll. 23-30);
>
> "The compressed air then flows through valves 237-239 to air motor 204 … The compressed air entering air motor 204 activates it and begins it rotating. As air motor 204 rotates, differential gear unit 205 transfers that motion to cable wheel 206 which picks up brake handle 32 via cable 207 to lessen the braking force brake 32 exerts on drum 26. Consequently, drum 26 releases cable 28 to place more weight of drill string 21 on drill bit 23 causing an increasing in drilling fluid pressure." (Col. 9, ll. 37-47);
>
> "With valve 236 opened further, air motor 204 receives an additional amount of compressed air which increases the speed with which it rotates. In response, cable reel 206 raises brake handle 208 causing brake 32 to further disengage from drum 26. Consequently, drum 26 releases cable 28 an additional amount, thus lowering drill string 21." (Col. 10, ll. 23-31);
>
> "Consequently, valve 236 closes slightly to deliver less compressed air to air motor 204 causing it to rotate more slowly. In response, differential gear unit 205 releases cable reel 206 to that brake handle 208 lowers…The slowing down of the first shaft removes the driving force from cable reel 206, thus allowing it to unspool cable 207 to lower brake handle 208. With brake handle 208 lowered, brake 32 increases its braking of drum 26, resulting in the release of cable 28 slowing to its calibrated value." (Col. 10, ll. 42-61).

Therefore the relative amount of compressed air delivered to the air motor (i.e., the controller) controls the rotational speed and thus the direction of the cable wheel (206) which lifts and lowers the draw work's brake handle (208)—increasing and decreasing the braking force applied to the drum—and thereby increasing or decreasing the rate of release of the drill string.

Excerpt of Figure 2 of the '142 Patent:



Thus, the '142 Patent teaches a controller, e.g., a motor having a cable wheel or spool that is attached to the draw work's brake handle via a cable, that receives and responds to a drill string control signal by lifting or lowering the draw work's brake handle which in turn increases or decreases the braking force applied to the drum and hence increases or decreases the rate of release of the drill string.

In another embodiment (Figure 14) of the '142 Patent, the drill string controller comprises a hydraulically driven coil tubing unit that unspools and drives tubing into the bore hole. This controller includes various motors (505, 506, 510, 511) which control the speed at which the drill string (503) advances into the borehole, i.e., rate of release.

K. [11] "a decrease in drilling fluid pressure": Claims 1 and 11 of the '142 Patent

Varco's Interp: *a drilling fluid pressure becomes less than another drilling fluid Pressure*

1. "Decrease"

The Specification of the '142 Patent describes an example of what causes the drilling fluid pressure to decrease—the bit rises off bottom. "Rising off bottom" is a term of art used in the drilling industry that describes the process of the bit cutting away at the bottom of the borehole, i.e., digging, faster than the drill bit is advanced, i.e., released, into the borehole. Thus, if the bit is cutting faster than the bit is being released then the bit will eventually cut away the formation to the point that the bit is no longer in contact with the formation, i.e., it rises off the bottom of the hole—hence the expression. This is explained in the specification as follows:

> "Unfortunately, even under optimal drilling conditions drill bit 23 will rise 'off bottom', thus requiring drilling fluid pressure regulator 200 to readjust the release of cable 28 from drum 26. Any time drill bit 23 rises even slightly 'off bottom', drilling fluid pressure within drill string 21 decreased. Drilling fluid pressure sensor 34 measures that decrease and supplies Bourdon tube 210

> with a hydraulic signal representing that decrease. Any decrease in drilling fluid pressure registered by Bourdon tube 210 causes it to contract." Ex. 1, '142 Patent, Col. 10, ll. 6-15.

Varco's construction is consistent with the ordinary meaning as provided in the following dictionary:

***Webster's* (Ex. 14):**

> **"decrease –** to become or cause to become less, smaller, etc.; diminish; 1. a decreasing; lessening; diminution."

Thus, a decrease in drilling fluid pressure exists when a measured value of drilling fluid pressure (P_2) has become less than another drilling fluid pressure (P_1) to which it is compared.

2. "Drilling Fluid Pressure" – *See* Section IV. A. 1.

L. [12] "Operates" (Claim 1 of the '142 Patent)

Varco's Interp.: *to be in action so as to produce an effect, act, function, work*

The '142 Patent describes how a signal "operates" the drill string controller as follows:

> "Consequently, valve 236 closes slightly to deliver less compressed air to air motor 204 causing it to rotate more slowly. In response, differential gear unit 205 releases cable reel 206 so that brake handle 208 lowers." Ex. 1, '142 Patent, Col. 10, ll. 43-46.

> "The delivery of compressed air by nozzle 216 opens valve 236, thereby allowing the actuation of air motor 204." (Col. 9, ll. 2-4); "The compressed air entering air motor 204 activates it and begins it rotating. As air motor 204 rotates, differential gear unit 205 transfers that motion to cable wheel 206 which picks up brake handle 32 via cable 207 to lessen the braking force brake 32 exerts on drum 26. Consequently, drum 26 releases cable 28 to place more weight of drill string 21 on drill bit 23 causing an increase in drilling fluid pressure." Ex. 1, Col. 9, ll. 41-47);

> "That variable amount of compressed air alters the opening of valve 236 and, thus, the force with which the compressed air drives air motor 204." Ex. 1, Col. 8, ll. 55-58.

In another embodiment (Figure 14) the controller or coil tubing unit is operated by hydraulic fluid. *See* Ex. 1, Col. 21, l. 56 – Col. 24, l. 27.

The ordinary meaning of "operates" as defined by a dictionary is provided as follows:

***Webster's* (Ex. 14):**

> **"operates –** 1. to be in action so as to produce an effect; act; function; work; 2. to bring about a desired or appropriate effect."

M. [13] "Increase in the rate of release of said drill string" (Claims 1 and 11 of the '142 Patent)

Varco's Interp.: *the rate (i.e., speed or change over time) of release (lowering) of a drill string becomes greater than another rate of release*

1. "increase"

The Specification of the '142 Patent describes an example of what causes the drilling fluid pressure to increase—the bit is forced against the bottom of the bore hole, i.e., on bottom. "On bottom" is a term of art used in the drilling industry that describes the process of the bit asserting weight or pressure against the bottom of the borehole necessary for the teeth of the bit to drill the formation. This is explained in the specification as follows:

> "Drum 26 lowers drill string 21 until drill bit 23 again resides 'on bottom' so that an increase in the pressure of the drilling fluid within drill string 21 may be effected. As the drilling fluid pressure returns to its optimal value, drilling fluid pressure sensor 34 registers that increase and supplies Bourdon tube 210 with a hydraulic signal representing that increase." Ex. 1, Col. 10, ll. 29-36.

> "Consequently, drum 26 releases cable 28 to place more weight of drill string 21 on drill bit 23 causing an increase in drilling fluid pressure." Ex. 1, Col. 9, ll. 45-47.

The drilling fluid pressure increases because of the increase in resistance of the drilling fluid motor caused by the of force or weight the drill string applies to the bit. Because the

drilling fluid or mud drives the mud motor (to causes bit rotation) any increase in resistance to turn (torque) of the motor causes a corresponding increase in the pressure of the drilling fluid.

The ordinary meaning of an increase as defined in a dictionary is provided as follows:

***Webster's* (Ex. 14):**

"increase – 1. to become greater in size, amount, degree, etc.; grow."

Thus, an increase in drilling fluid pressure exists when a parameter (P_2) has become greater as compared to another parameter (P_1).

2. "Rate of Release"

Rate of Release (ROR) is a term of art in the drilling industry. In the specification the ROR is described as follows:

> "Brake 32 controls the ***release*** of cable 28 from drum 26 to ***adjust*** the vertical position of drill string 21 with respect to derrick 20." Ex. 1, Col. 3, ll. 63-65.
>
> "Drawworks 22 must ***adjust*** drill string 21 vertically along derrick 20 in order to retain drill bit 23 'on bottom' (i.e., on the bottom of borehole 86) and maintain the progression of borehole 86 through formation 87." Ex. 1, Col. 4, ll. 16-19;
>
> "As air motor 204 rotates, differential gear unit 205 transfers that motion to cable wheel 206 which picks up brake handle 32 via cable 207 to ***lessen the braking force*** brake 32 exerts on drum 26. Consequently, drum 26 releases cable 28 to place more weight of drill string 21 on drill bit 23 causing an increase in drilling fluid pressure." Ex. 1, Col. 9, ll. 44-48.
>
> "Accordingly, brake 32 must be manipulated to permit drum 26 to release cable 28 and adjust drill string 21" Ex. 1, Col. 4, ll. 28-30.
>
> "Automatic driller 33 senses when drill bit 23 is "off bottom" and manipulates brake 32 to release cable 28 and lower drill string 21 until drill bit 23 is again 'on bottom.'" Ex. 1, Col. 4, ll. 36-38.
>
> "With valve 236 opened further, air motor 204 receives an additional amount of compressed air which ***increases the speed***

> with which it rotates. In response, cable reel 206 raises brake handle 208 causing brake 32 to further disengage from drum 26. Consequently, drum 26 releases cable 28 an additional amount, thus lowering drill string 21." Ex. 1, Col. 10, ll. 23-30;
>
> "The slowing down of the first shaft removes the driving force from cable reel 206, thus allowing it to unspool cable 207 to lower brake handle 208. With brake handle lowered, brake 32 increases its braking of drum 26, resulting in the release of the cable 28 ***slowing to its calibrated value***." Ex. 1, Col. 10, ll. 56-61.

In the preferred embodiment, the amount of braking force the brake (32) exerts on drum (26) is proportional to the rate or speed at which the drum (26) turns. The drill string is lowered into the borehole via gravity acting upon it. The upper end of the drill string is connected to the rig's hoisting system, and therefore the degree of braking force applied to drum (26) determines the speed or rate that cable (28) is unspooled and hence the rate at which the drill string moves vertically with respect to the derrick (20).

In another embodiment, the rate of release (speed of lowering of the drill string) is controlled by the speed of the motors and chains of the coil tubing unit (500) which are driven by the hydraulic fluid supplied. This is not unlike the speed or rate at which the wheels rotate to move a vehicle, e.g., the faster the motors and chains rotate the faster the drill string will be inserted or lowered into the well.

The prosecution file history of the '142 Patent describes ROR as follows:

> "valve 236 controls air motor 204 to release the drill string at a rate that maintains the drilling fluid pressure at 2000 psi." *See* Ex. 2, 11-7-94 Office Action Response, Pg. 5 ("WS 147").

The ordinary meaning of "rate" is provided in the following dictionaries:

McGraw-Hill Scientific **(Ex. 12):**

> **"rate –** The amount of change of some quantity during a time interval divided by the length of time interval."

***Webster's* (Ex. 14):**

"rate – 4. speed of movement or action; 5. the amount of time gained or lost by a timepiece within a specified period"

The ordinary meaning of "release" is provided in the following dictionary:

***Webster's* (Ex. 14):**

"release – 1. to set free, as from confinement; 2. to let go"

Thus, the rate of release is the speed or change in distance per time (e.g., miles per hour (MPH); feet per second (fps)) of the release of drill string (lowering via, e.g., rig's hoisting system).

3. **"Drill String"** – *See* Section IV. H. 1., above.

N. **[14]** **"an increase in drilling fluid pressure"** (Claims 1 and 11 of the '142 Patent)

Varco's Interp.: *a drilling fluid pressure becomes greater than another drilling fluid pressure*

1. **"Increase" –** *See* Section IV. M. 1., above.

2. **"Drilling Fluid Pressure" –** *See* Section IV. A. 1., above.

O. **[15]** **"a decrease in the rate of release of said drill string"; "decrease the rate of release of said drill string" (**Claims 1 and 11 of the '142 Patent)

Varco's Interp.: *the rate (i.e., speed or change over time) of release (lowering) of a drill string becomes less than another rate of release*

1. **"Decrease"**—*See* Section IV. K. 1., above;

2. **"Rate of Release" –** *See* Section IV. M. 2., above;

3. **"drill string"** – *See* Section IV. H. 1., above.

P. **[16]** **"producing a signal in response to"; "producing a first signal in response to" (**Claims 1, 11 and 14 of the '142 Patent)

Varco's Interp.: *creating, generating, producing a signal in response to, e.g., a reaction to, something*

1. "Producing"

The specification describes embodiments whereby "regulators" produce, generate or create a drill string control signal, e.g., a pneumatic or hydraulic signal, that controls a controller, e.g., an air motor 204 or coil tubing unit 500, which alters the rate of release of the drill string.

The term "producing", as in "producing a signal" is defined in accordance with its ordinary meaning as provided by the following dictionary:

***Webster's* (Ex. 14):**

"producing—3. b. to bring into being, create; 7. to create; to bear, yield."

2. "A Signal"; "First Signal" —*See* Sections IV. E. 2. & IV. Q., respectively.

3. "In Response To"

The term "in response to", as in "producing a signal in response to" is described in the specification as responsive to a change as described above. *See* Section IV. D. 1. The regulators of the preferred embodiment react or respond to changes in drilling parameters by create varying signals.

Varco relies upon the ordinary meaning provided in the following dictionaries:

***McGraw-Hill Scientific* (Ex. 12):**

"response – a quantitative expression of the output of a device or system as a function of the input. Also known as system response. The value of some measurable quantity after a treatment has been applied."

***Webster's* (Ex. 14):**

"responsive – that gives or serves as an answer or response"

Q. [17] "said signal" or "**said first signal": (**Claims 11 and 14 of the '142 Patent)

Varco's Interp.: *the signal representing changes in drilling fluid pressure*

1. "Said"; "Said First"

"Said" and "Said First" refer to the "signal representing changes in drilling fluid pressure" under the claim drafting doctrine of antecedent basis. That is, terms such as "said" and "the" are used to refer back to an earlier recitation of an element of the claim—in this case the signal representing changes in drilling fluid pressure. The term "first" is used to differentiate from another signal, i.e., the "second."

2. "Signal" —*See* Section IV. E. 2. above

R. [18] "relaying" (Claims 11 and 14 of the '142 Patent)

Varco's Construction	Pason's Construction
"to convey" or "transmitting", i.e., passing on or passing through. *See* Perkin Report, Ex. 15, ¶¶46-47.	"to control or retransmit by means of a relay—i.e., a device that responds to a small current or voltage change by activating switches or other devices in an electrical circuit." *See* May 31, 2004 Brett Report (Ex. 16), Page 2; A binary switch relay *See* 9-4-06 Brett Report (Ex. 17).

The claim term "relaying" as used in the phrases "relaying said signal..." and "relaying said selected signal..." of Claims 11 and 14 are generally understood by a person of ordinary skill in the relevant art to mean conveying or transmitting, i.e., passing on or passing through.

Pason continues to maintain its position that "relaying" is limited to the pneumatic valves of the preferred embodiment of the '142 patent. *See* Ex. 17, Pason's Technical Expert's 9-4-06 Report, Page 13 ("the teaching of Claim 14, which appears to reflect the precise control scheme of regulators and dedicated relays, producing distinct, proportionate control signals responsive to changes from calibrated values.").

Pason has maintained this position despite its representations to the PTO that the *relaying* step of claims 11 and 14 of the '142 Patent should not be interpreted in this way. *See* Pason's Reexamination Request Ex. 2 ("WS 407-8") ("The signal produced by elements 124 [transducer] and 125 [potentiometer] ***pass through*** a signal discriminator 128 and power transformer 132 which control the operation of the drill string brake 134 as described in Varney at column 10 lines 2 through 25" and "***supplying the output*** of the movable contact 124 to a signal discriminator 128 and transformer 132 that operate to control the drill string brake 134".). Further, Pason's own counsel conceded during the recent appeal that the claims of the '142 patent are not limited to pneumatically operated control systems. The Federal Circuit noted:

> "In addition, Pason's counsel at oral argument similarly conceded that relaying in claim 14 should not be limited to pneumatically operated valves**.**" *Varco,* 436 F.3d at1375.

Although the embodiments described in the patent specification are described as "relaying" one or more signals in a hydraulic or pneumatic system, the Federal Circuit ruled that the claims of the '142 patent are not limited to pneumatic or hydraulic devices. *See Varco,* 346 F.3d at 1370. The CAFC was quite clear on this point:

> ''As outlined above, nothing in the claim language requires or even suggests the use of pneumatically operated valves in performing the relaying step. Rather, the only discussion of pneumatically operated valves in the intrinsic record comes from the specification: "In the *preferred embodiment*, valves 236-239 are pneumatic valves *that operate as relays* to supply compressed air to air motor 204. "'142 patent, col. 7, ll. 35-37. This disclosure and corresponding Figures do not limit the invention as a whole to the use of pneumatically operated valves; rather they merely list such valves as but one example of relays operable in the present invention. *See C.R. Bard, Inc. v. U.S. Surgical Corp.*, 388 F.3d 858, 864 (Fed.Cir.2004) ("Statements that describe the invention as a whole, rather than statements that describe only preferred embodiments, are more likely to support a limiting definition of a claim term.") (citing *Digital Biometrics, Inc. v. Identix, Inc.*, 149

> F.3d 1335, 1347 (Fed.Cir.1998)); *SanDisk Corp. v. Memorex Prods., Inc.*, 415 F.3d 1278, 1286 (Fed.Cir.2005) ("References to a preferred embodiment, such as those often present in a specification, are not claim limitations." (Quoting *Laitram Corp. v. Cambridge Wire Cloth Co.*, 863 F.2d 855, 865 (Fed.Cir.1988)); *Gillette*, 405 F.3d at 1374 ("This court has cautioned against limiting the claimed invention to preferred embodiments or specific examples in the specification.") (quoting *Texas Instruments, Inc. v. U.S. Int'l Trade Comm'n*, 805 F.2d 1558, 1563 (Fed.Cir.1986)); *Gart v. Logitech, Inc.*, 254 F.3d 1334, 1342 (Fed.Cir.2001) (noting that "drawings [depicting the preferred embodiment] are not meant to represent 'the' invention or to limit the scope of coverage defined by the words used in the claims themselves."); *see also* '142 patent, col. 24, ll. 27-35 (stating the present invention is not limited to the preferred embodiment)." *Id* at 1370.

Despite its prior representations, and the Federal Circuit's ruling, Pason's current approach in developing this case is to focus on the pneumatic preferred embodiment of the '142 patent. Pason appears to be attempting to set up an argument that because its device works electronically, rather than pneumatically, it is "different" than the Wildcat (pneumatic) device and therefore does not infringe the '142 patent. Such a contention is expressly precluded by judicial estoppel, the Federal Circuit's decision in this case, and United States Patent Law. *See e.g., Johnson & Johnson Assoc. Inc. v. R.E. Serv. Co.*, 285 F.3d 1046, 1052-53 (Fed.Cir. 2002) (reiterating that infringement analysis compares accused products to claims, not patentees' commercial embodiments).

S. [19] "controlling": (Claim 11 of the '142 Patent)

Varco's Interp.: *exercising authority over; directing; commanding; operating; or regulating*

The term "controlling" as used in Claim 11 refers to a signal "controlling" the drill string controller, i.e., directing, commanding and/or operating the drill string controller. The controllers of the preferred embodiments of the '142 Patent are controlled by both hydraulic and

pneumatic signals which exercise authority over; direct; command; or operate the controller to control the rate of release of the drill string.

Varco's construction is consistent with the ordinary meaning provided by the following dictionaries:

***Webster's* (Ex. 14):**

> **"control –** 2. to regulate; 4. to exercise authority over, direct, command; 5. to operate or regulate *[this knob controls the volume of sound]"*

***PETEX* (Ex. 13):**

> **"control –** 1. manual or automatic regulation of a process. A means or device to direct and regulate a process or sequence of events."
>
> "**controlling means –** elements of a controller that produce a corrective action. Information is sent back from the process, compared to the desired set point, and corrective action of the controlled variable is taken if deviation exists."

T. [20] "**bit weight": (**Claim 14 of the '142 Patent)

Varco's Interp.: *The sensed weight of the drill string placed upon the drill bit*

It is Varco's position that the term "bit weight" as in *measuring bit weight* is not in dispute. Pason only recently made an issue by suggesting that its AutoDriller does not "measure bit weight" because, bit weight (sometimes called weight on bit or "WOB") is a calculated variable—not measured. *See* Ex. 17, Brett 9-4-06 Report, Page 13 ("Pason's AutoDriller …calculates bit weight (as a product of hook load off bottom minus hook load during drilling)"). However, Mr. Brett had already admitted that Pason's AutoDriller does in fact "measure bit weight", and thus the term is undisputed, as follows:

Brett 11-16-06 Tesimony (Ex. 18): Page 117, ll. 13-25:

> A: "Okay. Weight on bit. Okay, there is a system for measuring weight on bit with the Pason deal."

Brett 11-16-06 Tesimony (Ex. 18): Page 309, ll. 2-16:

> "Q: Does it [the Pason's AutoDriller] also involve a measurement of bit weight?
>
> A: Yes, on occasion, Yes.
>
> Q: And that's through the hook-load sensor?
>
> A: Yes. Bit weight as measured by the hook load.
>
> Q: Okay, fair enough. Does then –
>
> A: Indicated bit weight.
>
> * * *
>
> Q: Does the hook-load sensor send a signal relating to bit weight as measured?
>
> A: Yes."

Brett 6-1-04 Testimony (Ex. 18); Page 71, l. 21 – Page 72, l. 19.

> "what we have here is the measured weight on bit which we call 'hook load.' And so when we're – the description of weight on bit we have here is the measured weight on bit at the surface."
>
> * * *
>
> "There is the weight on bit as measured on the surface. That is a measured signal, and that's the inferred weight on bit."
>
> * * *
>
> "what the Wildcat patent ['142 Patent] teaches is, using the weight on bit in the Wildcat patent is the same weight on bit we're talking about here, which is the weight on bit measured at the surface."

Brett's admissions that the Pason measures WOB as required by claim is hardly surprising. It is in fact beyond dispute that every rig mounted device ever used to determine, display or use WOB has measured WOB in exactly the same way: as the mathematical difference between stringweight and hookload—both of which are determined by sensing the

tension in the rig's hoisting system's dead line. Thus a person having ordinary skill in the art understands that WOB is the mathematical difference between stringweight and hookload.

The prior art cited in the '142 Patent further describe how a person having ordinary skill in the art understands how "bit weight" is "measured." Specifically, the following cited prior art references describe how WOB is measured and how a person having ordinary skill in the art understands these terms:

U.S. Patent No. 4,491,186 to Alder (Ex. 6):

> "the weight imposed on the drill depends on the tension in the drilling lines from which the drill string is suspended in the derrick." Ex. 6, Col. 1, ll. 40-42;

U.S. Patent No. 4,662,608 to Ball (Ex. 3):

> "As the pipe is lowered into the well during drilling, the weight of the pipe string on the drill bit is measured by the tension in the drill line. The tension in the drill line is commonly measured by a pressure sensor which converts tension to weight indication through a hydraulic line extending to a bit weight gauge on the drilling console." Ex. 3, Col. 1, ll. 25-31;
>
> "When the bit weight, as indicated by hydraulic pressure from the hydraulic line 36 and measured by pressure transducer 108." Ex. 3, Col. 8, ll. 24-26;

U.S. Patent No. 4,875,530 to Frink et al. (Ex. 10):

> "To determine the weight on bit, the drill string is weighed and the total weight information is stored in memory just prior to the bit touching downhole and resuming drilling operation. The total weight display continues to monitor the total weight of the string and a second display monitors the weight on bit. As soon as the bit touches down, the drill string weight is reduced since the tension in the drill string is reduced by the weight on bit. Thus, the total weight indicator decreases in value as this occurs. The reduction in total weight represents the weight on bit." Ex. 10, Col. 2, ll. 23-34.

The specification of the '142 Patent discloses at least four industry standard weight indicators that are "utilized to supply a weight on bit signal to automatic driller 33." Ex. 1, '142 Patent, Col. 6, ll. 13-14. These sensors include (1) a clipper weight indicator (as shown in Figure 7 "a Martin-Decker clipper weight indicator that mounts onto cable 28 to provide a hydraulic signal representative of the weight drill string 21 applies on top of drill bit 23") Ex. 1, '142 Patent, Col. 6, ll. 13-37; (2) an anchor weight indicator (as shown in Figure 8 "a Martin-Decker anchor weight indicator implements bit weight sensor 35 to provide the hydraulic signal to automatic driller 33 representing the weight drill string 21 applies to drill bit 23") *Id.*; (3) a hydraulic load cell ("bit weight sensor 522 may be a Martin-Decker hydraulic load cell") Ex. 1, Col. 22, ll. 115-23; and (4) a pressure transducer ("Alternatively, a pressure transducer could be substituted for the Martin-Decker hydraulic load cell. In such a case, the electronic output of the transducer…") *Id.* Each of these sensors produce signals indicative of the tension of the rig's hoisting system dead line. The sensors utilize the tension to enable determination of the weight of the drill string suspended from the rig's hoisting system. For example, as the weight of the drill string increases the tension of the dead line will have a proportional increase in tension. The use of this tension is described in the '142 Patent as follows:

> "regulator 201 regulates bit weight by releasing cable 28 from drum 26 in response to hook load weight (i.e., tension) increases experienced by cable 28. The release of cable 28 lowers drill string 21 to place drill bit 23 'on bottom', thereby reducing the hook load weight of cable 28." Col. 11, ll. 40-50
>
> "FIGS. 7 and 8 illustrate two standard weight on bit sensors that may be utilized to supply a weight on bit signal to automatic driller 33. Specifically, FIG. 7 depicts a Martin-Decker clipper weight indicator that mounts onto cable 28 to provide a hydraulic signal representative of the weight drill string 21 applies to the top of drill bit 23. A hydraulic hose (not shown) connects clipper weight indicator 142 to automatic driller 33 to provide automatic driller 33

> with a hydraulic representation of the weight drill string 21 applies on bit 23. That is, cable 28 applies pressure against deflection plug 140 which, in turn, applies pressure against diaphragm 141. As a result, diaphragm 141 contracts to pressurize the hydraulic fluid within the hydraulic hose to deliver a hydraulic pressure signal to automatic driller 33.
>
> In FIG. 8, a Martin-Decker anchor weight indicator implements bit weight sensor 35 to provide the hydraulic signal to automatic driller 33 representing the weight drill string 21 applies to drill bit 23. Anchor weight indicator 145 also substitutes for cable drum anchor 27. That is, anchor weight indicator anchors cable 28 to drilling rig 10 with drilling cable drum 146. In operation, as the tension on cable 28 varies, arm 147 applies pressure to diaphragm 148 which, in turn, compresses hydraulic fluid within hydraulic line 149 to supply a hydraulic fluid signal to automatic driller 33 via hydraulic line 149." Col. 6, ll. 13-37.
>
> "bit weight sensor 522 may be a Martin-Decker hydraulic load cell. Alternatively, a pressure transducer could be substituted for the Martin-Decker hydraulic load cell. In such a case, the electrical output of the transducer would be input into an electrical…" Col. 22, ll. 18-23.

Thus, a person having ordinary skill in the relevant art understands that the tension in the hoisting system's dead line is used to measure "hookload", i.e., the total weight of everything suspended by the rig's hoisting system including the drill string, bit, lifting blocks, etc. To enable the signal from a dead line tension sensor to be used for determining WOB, the signal is adjusted or calibrated when the drill string is suspended completely "off bottom" to correspond to "0" WOB, i.e., the entire weight of the drill string (100%) is completely suspended by the hoisting system and therefore zero "0" weight is placed upon the bit. During drilling the drill string is lowered to bring the drill bit into contact with the bottom of the borehole ("on bottom"). As the drill bit is set down on the bottom of the borehole during drilling the tension in the dead line is reduced because the rig's hoisting system is now suspending less than the entire weight of the drill string (< 100%) because some of the weight is now resting on the bit. This difference

between the sensed tension (indicative of weight) of the hoisting system when the drill bit is "off bottom" versus "on bottom" is the WOB.

Varco's construction is consistent with the ordinary meaning as provided in the following dictionary:

***PETEX* (Ex. 14):**

> **"weight on bit (WOB) –** the amount of downward force placed on the bit by the weight of the drill [string]"
>
> **"weight indicator –** an instrument near the driller's position on a drilling rig that shows both the weight of the drill stem that is hanging from hook (hookload) and the weight that is placed on the bit by the drill collars (weight on bit)."

U. [21] "producing a second signal in response to": (Claim 14 of the '142 Patent)

Varco's Interp.: *creating, generating, producing a signal in response to, e.g., a reaction to, something*

1. "Producing"—*See* Section IV. P. 1., above

2. "A Second Signal"

The terms "said second" refer to the "signal representing changes in bit weight" under the claim drafting doctrine of antecedent basis. That is, terms such as "said" and "second" are used to refer back to an earlier recitation of an element of the claim—in this case the signal representing changes in bit weight.

3. "In Response To"—*See* Section IV. P. 3., above.

V. [22] "Changes in bit weight": (Claim 14 of the '142 Patent)

Varco's Interp.: *differences between values of WOB*

1. "Changes"—*See* Section IV. D. 1., above.

2. "Bit Weight"—*See* Section IV. T., above.

W. [23] "said second signal" (Claim 14 of the '142 Patent)

Varco's Interp.: *the second signal, i.e., the signal representing changes in WOB*

The term "said" refers to the "signal representing changes in bit weight" under the claim drafting doctrine of antecedent basis. That is, terms such as "said" and "second" are used to refer back to an earlier recitation of an element of the claim—in this case the signal representing changes in bit weight. *See* Section IV. U. 2., above

X. [24] "selecting": (Claim 14 of the '142 Patent**)**

Varco's Interp.: *automatic selecting, i.e., choosing*

The Federal Circuit has already interpreted the "selecting" step of Claim 14 of the '142 Patent. *See Varco,* 436 F.3d 1368. In its Opinion the CAFC stated that the claim language expresses that the "*selecting*" step is a step performed automatically as follows:

> "The preamble recites that the method steps are to be performed automatically by the drilling rig. This language suggests that the selecting step is not limited to manual operation of valve selectors and/or manual calibration of regulators as construed by the district court." *See Varco,* 436 F.3d at 1373;
>
> "Hence, the language of claim 14 (particularly the preamble) does not support the district court's construction of this step." *Id;*
>
> "the specification does not limit the selecting step to the manual operation of valve selectors or the manual calibration of regulators." *Id;*
>
> "In effect, the district court erred by reading the initial setup or calibration step into the claimed selecting step." *Id;*
>
> "Notably, the specification also describes a conflict resolution process automatically performed by the drilling rig after the initial setup or calibration; i.e., once the drilling rig is up and running." *Id.*
>
> "…the Examiner did not understand the drilling system's method for resolving conflicts between the 'primary' and 'secondary'

> controls . . . In response, the applicant explained to the Examiner that the operator, as part of the initial setup procedure can adjust the level for override of the primary control, thus ensuring that only undesirable conditions will trigger intervention." *See Varco,* 436 F.3d at 1374;
>
> "With this initial adjustment in place [initial setup or calibration], the drilling system then automatically selects between the primary and secondary controls during operation. Thus, the prosecution history confirms that selecting in claim 14 does not encompass the initial setup or calibrate of the drilling system, but rather the conflict resolution process between primary and secondary controls during operation." *Id;*
>
> "In sum, claim 14 does not suggest that the selecting step requires a two-part manual process as interpreted by the district court. Moreover, the specification and prosecution history confirm that the two-part manual process relied upon by the district court is distinct from the claimed selecting step." *Id;*
>
> "'selecting' in claim 14 must refer to the conflict resolution process that occurs between controlling parameters." *Id.*

Thus, the CAFC interpreted the "selecting" step to mean the automatic selection accomplished by the automatic driller that resolves the conflict resolution process that occurs between controlling parameters.

Y. [25] "any one… and both": Claim 14 of the '142 Patent

Varco's Interp.: *any one of the three signals, i.e., first (or) second (or) both first and second.*

The phrase or terms "any one … and both" should be construed to mean one of or both in accordance with the ordinary and accepted meaning of the plain language of the term. The preferred embodiment of the specification discloses valves connected in series whereby the variable amount of compressed air or hydraulic fluid permitted to pass there through, i.e., the drill string control signal, controls the rate of release of the drill string. In the preferred embodiment, the valve (236-239) that allows the least amount of air or fluid to pass (signal) to

the drill string controller will control the rate of release of the drill string. However, if two or more valves (236-239) are open equal amounts (allowing identical signals to pass) then it is possible for these two or more identical signals to control the rate of release of the drill string. In these embodiments the valves (236-239), operating as relays, do not combine values of the identical signals to create the sum of the two or more signals. Instead, the respective signals are compared with one another and the selected "signal" or "signals" that controls the rate of release is the signal or signals causing the controller to increase the rate of release the least.

Z. [26] "control the release of said drill string": (Claim 14 of the '142 Patent)

Varco's Interp.: *to exercise authority over; direct; command; over the release, e.g., the lowering of the drill string*

1. "Control"

The term "control" as used in Claim 11 refers to a signal which controls the drill string controller, i.e., directing, commanding and/or operating the drill string controller. The controllers of the preferred embodiments of the '142 Patent are controlled by both hydraulic and pneumatic signals which exercise authority over; direct; command; or operate the controller to control the rate of release of the drill string.

Varco's construction is consistent with the ordinary meaning provided by the following dictionaries:

***Webster's* (Ex. 14):**

> **"control –** 2. to regulate; 4. to exercise authority over, direct, command; 5. to operate or regulate *[this knob controls the volume of sound]"*

***PETEX* (Ex. 13):**

> **"control –** 1. manual or automatic regulation of a process. A means or device to direct and regulate a process or sequence of events."

"**controlling means –** elements of a controller that produce a corrective action. Information is sent back from the process, compared to the desired set point, and corrective action of the controlled variable is taken if deviation exists."

2. "Release"—*See* Section IV. M. 2., above.

3. "Drill String"–*See* Section IV. J. 1., above.

AA. [27] "said selected signal or signals": (Claim 14 of the '142 Patent)

Varco's Interp.: *the chosen signal or chosen signals*

1. "Selected"

The term "selected" refers to the signal or signals that are automatically selected as described in Section IV. X., above.

Varco's construction is consistent with the ordinary meaning as provided by the following dictionaries:

***McGraw-Hill Scientific* (Ex. 12):**

"select – 1. to choose a needed subroutine from a file of subroutines; 2. To take one alternative if the report on a condition is of one state, and another alternative if the repor on the condition is of another state";

***Webster's* (Ex. 14):**

"select – chosen in preference to another or others; picked out; choice"

2. "Signal or Signals"

The term "signal" refers via antecedent basis to either (1) the signal representing changes in drilling fluid pressure; or (2) the signal representing changes in WOB. The term "signals" refers to both (1) the signal representing changes in drilling fluid pressure; and (2) the signal representing changes in WOB.

The term "or" is readily understood as "either"—introducing any one the possibilities.

BB. [28] "regulates the release said drill string": (Claim 14 of the '142 Patent)

Varco's Interp.: *to adjust (increase or decrease) the rate, i.e., the speed, of the lowering of the drill string*

1. "Regulates"

The specification of the '142 Patent describes how a drill string controller "regulates" the release of the drill string as follows:

> "Brake 32 controls the ***release*** of cable 28 from drum 26 to ***adjust*** the vertical position of drill string 21 with respect to derrick 20." Ex. 1, Col. 3, ll. 63-65.
>
> "Drawworks 22 must ***adjust*** drill string 21 vertically along derrick 20 in order to retain drill bit 23 'on bottom' (i.e., on the bottom of borehole 86) and maintain the progression of borehole 86 through formation 87." Ex. 1, Col. 4, ll. 16-19;
>
> "As air motor 204 rotates, differential gear unit 205 transfers that motion to cable wheel 206 which picks up brake handle 32 via cable 207 to ***lessen the braking force*** brake 32 exerts on drum 26. Consequently, drum 26 releases cable 28 to place more weight of drill string 21 on drill bit 23 causing an increase in drilling fluid pressure." Ex. 1, Col. 9, ll. 44-48.
>
> "Accordingly, brake 32 must be manipulated to permit drum 26 to release cable 28 and adjust drill string 21" Ex. 1, Col. 4, ll. 28-30.
>
> "Automatic driller 33 senses when drill bit 23 is "off bottom" and manipulates brake 32 to release cable 28 and lower drill string 21 until drill bit 23 is again 'on bottom.'" Ex. 1, Col. 4, ll. 36-38.
>
> "With valve 236 opened further, air motor 204 receives an additional amount of compressed air which ***increases the speed*** with which it rotates. In response, cable reel 206 raises brake handle 208 causing brake 32 to further disengage from drum 26. Consequently, drum 26 releases cable 28 an additional amount, thus lowering drill string 21." Ex. 1, Col. 10, ll. 23-30;
>
> "The slowing down of the first shaft removes the driving force from cable reel 206, thus allowing it to unspool cable 207 to lower brake handle 208. With brake handle lowered, brake 32 increases

> its braking of drum 26, resulting in the release of the cable 28 ***slowing to its calibrated value***." Ex. 1, Col. 10, ll. 56-61.

In the preferred embodiment, the amount of braking force the brake (32) exerts on drum (26) is proportional to the rate or speed at which the drum (26) turns. The drill string is lowered into the borehole via gravity acting upon it. The upper end of the drill string is connected to the rig's hoisting system, and therefore the degree of braking force applied to drum (26) determines the speed or rate that cable (28) is unspooled and hence the rate at which the drill string moves vertically with respect to the derrick (20).

In another embodiment, the release of the drill string is regulated (adjusting the speed of lowering of the drill string) by the speed of the motors and chains of the coil tubing unit (500) which are driven by the hydraulic fluid supplied. This is not unlike the speed or rate at which the wheels rotate to move a vehicle, e.g., the faster the motors and chains rotate the faster the drill string will be inserted or lowered into the well.

Varco's construction is consistent with the ordinary meaning as provided by the following dictionary:

***Webster's* (Ex. 14):**

> **"regulate** – 1. to control, direct, or govern according to a rule, principle, or system; 2. to adjust to a particular standard, rate, degree amount, etc. *[regulate the heat]*; 3. to adjust so as to make operative accurately."

2. "Release"—*See* Section IV. M. 2., above**.**

3. "Drill String"–*See* Section IV. J. 1., above.

V. CONCLUSION

Varco requests from this Honorable Court a ruling consistent with the Federal Circuit's decision in this case, specifically, that the claims in the '142 Patent are in no way limited to the

pneumatic or hydraulic embodiments described in the patent and that this Court adopt Varco's proffered claim construction set forth herein.