UNITED STATES PATENT AND TRADEMARK OFFICE (USPTO)
OFFICE ACTION (OFFICIAL LETTER) ABOUT APPLICANT'S TRADEMARK APPLICATION

APPLICATION SERIAL NO. 76700730

MARK: VULCAN

76700730

CORRESPONDENT ADDRESS:
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GENERAL TRADEMARK INFORMATION:
http://www.uspto.gov/main/trademarks.htm

APPLICANT: Varel International Ind., L.P.

CORRESPONDENT'S REFERENCE/DOCKET NO:
368614-3299

CORRESPONDENT E-MAIL ADDRESS:

REQUEST FOR RECONSIDERATION DENIED

ISSUE/MAILING DATE:

The trademark examining attorney has carefully reviewed applicant's request for reconsideration and is denying the request for the reasons stated below. *See* 37 C.F.R. §2.64(b); TMEP §§715.03(a), 715.04(a). The requirement(s) and/or refusal(s) made final in the Office action dated May 16, 2011 are maintained and continue to be final. *See* TMEP §§715.03(a), 715.04(a).

In the present case, applicant's request has not resolved all the outstanding issue(s), nor does it raise a new issue or provide any new or compelling evidence with regard to the outstanding issue(s) in the final Office action. In addition, applicant's analysis and arguments are not persuasive nor do they shed new light on the issues. Accordingly, the request is denied.

SECTION 2(d) REFUSAL – LIKELIHOOD OF CONFUSION

Registration of the applied-for mark remains refused because of a likelihood of confusion with the mark in U.S. Registration No. 3815974. Trademark Act Section 2(d), 15 U.S.C. §1052(d); *see* TMEP §§1207.01 *et seq*.

Taking into account the relevant *du Pont* factors, a likelihood of confusion determination in this case involves a two-part analysis. *See In re E. I. du Pont de Nemours & Co.*, 476 F.2d 1357, 1361-62, 177 USPQ 563, 567 (C.C.P.A. 1973); *In re 1st USA Realty Prof'ls Inc.* , 84 USPQ2d 1581, 1584 (TTAB 2007); *see also In re Dixie Rests. Inc.*, 105 F.3d 1405, 1406-07, 41 USPQ2d 1531, 1533 (Fed. Cir. 1997). The marks are compared for similarities in their appearance, sound, connotation and commercial

impression. TMEP §§1207.01, 1207.01(b). The goods and/or services are compared to determine whether they are similar or commercially related or travel in the same trade channels. *See Herbko Int'l, Inc. v. Kappa Books, Inc.*, 308 F.3d 1156, 1164-65, 64 USPQ2d 1375, 1380 (Fed. Cir. 2002); *Han Beauty, Inc. v. Alberto-Culver Co.*, 236 F.3d 1333, 1336, 57 USPQ2d 1557, 1559 (Fed. Cir. 2001); TMEP §§1207.01, 1207.01(a)(vi).

In this case, the following factors are the most relevant: similarity of the marks, similarity of the goods and/or services, and similarity of trade channels of the goods and/or services. *See In re Dakin's Miniatures Inc*., 59 USPQ2d 1593 (TTAB 1999); TMEP §§1207.01 *et seq*. Based on these factors, the examining attorney maintains that there is a likelihood of confusion between the applied-for mark VULCAN for "High abrasion resistant polycrystalline diamond compact (PDC) cutters for installation in rotary drag bits for use in drilling oil and gas wells" in International Class 7, and the registrant's mark VULCAN and design for " drilling tools, namely, power driven diamond core drilling bits sold only to the core drilling and geotechnical industries" in International Class 7.

Applicant's Mark is Identical to the Dominant Element in Registrant's Mark

In this case, the applicant seeks to register VULCAN. The registrant's mark is VULCAN and design.

Applicant's mark is identical in sound, meaning and connotation to the dominant element in the registrant's mark. In a likelihood of confusion determination, the marks are compared for similarities in their appearance, sound, meaning or connotation, and commercial impression. *In re E. I. du Pont de Nemours & Co.*, 476 F.2d 1357, 1361, 177 USPQ 563, 567 (C.C.P.A. 1973); TMEP §1207.01(b)-(b)(v). Similarity in any one of these elements may be sufficient to find the marks confusingly similar. *In re White Swan Ltd.*, 8 USPQ2d 1534, 1535 (TTAB 1988); *see In re 1st USA Realty Prof'ls, Inc.* , 84 USPQ2d 1581, 1586 (TTAB 2007); TMEP §1207.01(b).

While applicant now contends that the design elements in the registrant's mark alter its overall commercial impression, this argument is unpersuasive.[1] Indeed, applicant has presented no evidence in support of its assertions in this regard.

It is well-established that when a mark consists of a word portion and a design portion, the word portion is more likely to be impressed upon a purchaser's memory and to be used in calling for the goods and/or services; therefore, the word portion is normally accorded greater weight in determining whether marks are confusingly similar. *In re Dakin's Miniatures, Inc.* , 59 USPQ2d 1593, 1596 (TTAB 1999); TMEP §1207.01(c)(ii); *see CBS Inc. v. Morrow*, 708 F. 2d 1579, 1581-82, 218 USPQ 198, 200 (Fed. Cir 1983); *In re Kysela Pere et Fils, Ltd*., 98 USPQ2d 1261, 1267-68 (TTAB 2011). As such, applicant's mark is **identical** to the dominant element in the registrant's mark: VULCAN vs. VULCAN.

Thus, the marks are confusingly similar.

Goods are Related

Where the marks of the respective parties are identical or virtually identical, the relationship between the relevant goods and/or services need not be as close to support a finding of likelihood of confusion. *See In re Shell Oil Co.*, 992 F.2d 1204, 1207, 26 USPQ2d 1687, 1689 (Fed. Cir. 1993); *In re Davey Prods. Pty Ltd.*, 92 USPQ2d 1198, 1202 (TTAB 2009); *In re Thor Tech, Inc.*, 90 USPQ2d 1634, 1636 (TTAB 2009); TMEP §1207.01(a).

In the present case, applicant seeks to register its mark for "High abrasion resistant polycrystalline diamond compact (PDC) cutters for installation in rotary drag bits for use in drilling oil and gas wells" in International Class 7. The registrant uses its mark for " drilling tools, namely, power driven diamond core drilling bits sold only to the core drilling and geotechnical industries" in International Class 7 ."

According to the Academic Press Dictionary of Science and Technology, the term "bit" is defined as "[a] removable boring head used on certain kinds of drills, such as a rock drill"; the term "bit drag," or "drag bit," is defined as "[a] bit with serrated teeth, used in rotary drilling." http://www.credoreference.com/entry/apdst/bit; http://www.credoreference.com/entry/apdst/bit_drag. Please also see the attached definitions of "bit," "cutters," "diamond bit," "PDC bit" and "polycrystalline diamond compact" from A Dictionary for the Petroleum Industry, Third Edition (1999).

As previously discussed, applicant's and registrant's goods are related in function. That is, the goods of the parties are both used for drilling. This is supported by the identification of goods in the cited registration ("drilling tools") as well as by applicant's own description of its goods ("Applicant's goods are high abrasion resistant polycrystalline diamond compact (PDC) cutters for installation in rotary drag bits for use in drilling oil and gas wells." Response, pp. 2-3 (emphasis added)).

Moreover, the evidence of record demonstrates the relatedness of the parties' goods and the overlap in the channels of trade. *See* evidence from previous Office actions, incorporated herein by reference. While attempts to "discredit" three pieces of evidence presented by the examining attorney in the final Office action, it fails to address the other eighteen, all of which show the relatedness of, and overlap in the parties' respective goods. *See, e.g.*, Attachments to Final Office Action, p. 11 (from *Wikipedia* article, Synthetic diamond: "Polycrystalline diamond consists of numerous small grains, which are easily seen by the naked eye through strong light absorption and scattering; it is unsuitable for gems and is used for industrial applications such as mining and cutting tools."); p. 32 (US Synthetic Bearings website, stating that US Synthetic plans to apply its polycrystalline diamond technology to "a broad range of applications," including oil and gas PDCs, and mining).

The fact that the registrant's goods are used in the core drilling and geotechnical industries, while applicant's goods are used in the oil and gas industry, is not determinative. Indeed, applicant itself makes both PDC cutters for the oil and gas industry, and drill bits for oil and gas, mining and industrial uses. *See* *http://www.varelintl.com/Oil_and_Gas_Home/PDC_Drill_Bits/Specialty_Bits/;* *http://www.varelintl.com/Oil_and_Gas_Home/PDC_Drill_Bits/;* *http://www.varelintl.com/Mining_and_Industrial_Home/Roller_Cone_Bits/Reverse_Circulation_Bits/;* *http://www.varelintl.com/Mining_and_Industrial_Home/Roller_Cone_Bits/Minerals_Exploration_Bits/;* *http://www.varelintl.com/Mining_and_Industrial_Home/Roller_Cone_Bits/Pilot_Hole_Bits/;* *http://www.varelintl.com/Mining_and_Industrial_Home/Roller_Cone_Bits/Industrial_Bits/*

Applicant contends that no likelihood of confusion exists because of the differences in the parties' respective goods. However, the goods and/or services of the parties need not be identical or directly competitive to find a likelihood of confusion. *See Safety-Kleen Corp. v. Dresser Indus., Inc.*, 518 F.2d 1399, 1404, 186 USPQ 476, 480 (C.C.P.A. 1975); TMEP §1207.01(a)(i). Rather, it is sufficient to show that because of the conditions surrounding their marketing, or because they are otherwise related in some manner, the goods and/or services would be encountered by the same consumers under circumstances such that offering the goods and/or services under confusingly similar marks would lead to the mistaken belief that they come from, or are in some way associated with, the same source. *In re Iolo Techs., LLC*, 95 USPQ2d 1498, 1499 (TTAB 2010); *see In re Martin's Famous Pastry Shoppe, Inc.* , 748 F.2d 1565, 1566-68, 223 USPQ 1289, 1290 (Fed. Cir. 1984); TMEP §1207.01(a)(i). Here, the evidence of record

shows that the parties' goods are related in function and are sold through the same channels of trade.

Any Sophisticated Purchasing Decision is Outweighed by the Similarity of the Marks and the Relatedness of the Parties' Goods

Finally, applicant argues that the purchasers of the parties' goods are highly sophisticated. Even if true, however, this fact is not determinative. The fact that purchasers are sophisticated or knowledgeable in a particular field does not necessarily mean that they are sophisticated or knowledgeable in the field of trademarks or immune from source confusion. TMEP §1207.01(d)(vii); *see In re Cynosure, Inc.*, 90 USPQ2d 1644 (TTAB 2009); *In re Decombe*, 9 USPQ2d 1812 (TTAB 1988); *In re Pellerin Milnor Corp.*, 221 USPQ 558 (TTAB 1983).

More importantly, because of the similarity in the marks, consumers, even if they exercise some care in their purchasing decisions, are not likely to distinguish between the sources of these related goods. Therefore, the similarity of the marks and relatedness of the goods outweigh the level of care or sophistication of potential purchasers. *See HRL Associates, Inc. v. Weiss Associates, Inc.*, 12 USPQ2d 1819 (TTAB 1989), *aff'd, Weiss Assocs. v. HRL Assocs.*, 902 F.2d 1546, 14 USPQ2d 1840 (Fed. Cir. 1990) (similarities of goods and marks outweigh sophisticated purchasers, careful purchasing decision, and expensive goods); *see also In re Research Trading Corp.*, 793 F.2d 1276, 230 USPQ 49, 50 (Fed. Cir. 1986), citing *Carlisle Chemical Works, Inc. v. Hardman & Holden Ltd.*, 434 F.2d 1403, 58 C.C.P.A. 751, 168 USPQ 110, 112 (CCPA 1970) ("Human memories even of discriminating purchasers . . . are not infallible.").

The overriding concern is not only to prevent buyer confusion as to the source of the goods and/or services, but to protect the registrant from adverse commercial impact due to use of a similar mark by a newcomer. *See In re Shell Oil Co.*, 992 F.2d 1204, 1208, 26 USPQ2d 1687, 1690 (Fed. Cir. 1993).

Conclusion

While the marks differ slightly in appearance, the overall similarity in meaning, connotation and commercial impression is sufficient to support a likelihood of confusion as used in connection with related goods. Any doubt regarding a likelihood of confusion determination is resolved in favor of the registrant. TMEP §1207.01(d)(i); *see Hewlett-Packard Co. v. Packard Press, Inc.*, 281 F.3d 1261, 1265, 62 USPQ2d 1001, 1003 (Fed. Cir. 2002); *In re Hyper Shoppes (Ohio), Inc.*, 837 F.2d 463, 464-65, 6 USPQ2d 1025, 1025 (Fed. Cir. 1988).

Accordingly, applicant's request for reconsideration is *denied.*

The filing of a request for reconsideration does not extend the time for filing a proper response to a final Office action or an appeal with the Trademark Trial and Appeal Board (Board), which runs from the date the final Office action was issued/mailed. *See* 37 C.F.R. §2.64(b); TMEP §§715.03, 715.03(a), (c).

If time remains in the six-month response period to the final Office action, applicant has the remainder of the response period to comply with and/or overcome any outstanding final requirement(s) and/or refusal(s) and/or to file an appeal with the Board. TMEP §715.03(a), (c). However, if applicant has already filed a timely notice of appeal with the Board, the Board will be notified to resume the appeal when the time for responding to the final Office action has expired. *See* TMEP §715.04(a).

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[1] Applicant's assertion that the "CAN" portion of the registrant's mark is emphasized and thus alters the commercial impression of the mark is also unavailing. There is no correct pronunciation of a mark because it is impossible to predict how the public will pronounce a particular mark. *See Centraz Indus. Inc. v. Spartan Chem. Co.*, 77 USPQ2d 1698, 1701 (TTAB 2006); *In re Lamson Oil Co.*, 6 USPQ2d 1041, 1042 n.3 (TTAB 1987); TMEP §1207.01(b)(iv). The marks in question could clearly be pronounced the same; such similarity in sound alone may be sufficient to support a finding that the marks are confusingly similar. *In re White Swan Ltd.*, 8 USPQ2d 1534, 1535 (TTAB 1988); *see In re 1st USA Realty Prof'ls, Inc.* , 84 USPQ2d 1581, 1586 (TTAB 2007); TMEP §1207.01(b)(iv).

Producing PDC products for the world's toughest drilling applications Oil & Gas Journal March 23, 2009

March 23, 2009

SECTION: MANUFACTURING HIGH PERFORMANCE PDC CUTTERS; MegaDiamond; Pg. 42

LENGTH: 1076 words

HEADLINE: Producing PDC products for the world's toughest drilling applications

BODY:

Smith's Ultra-hard Materials division designs and manufactures high performance PDC cutters, maintaining state-of-the-art, ISO 9001 quality certified manufacturing facilities in Provo, Utah (MegaDiamond), and Scurelle, Italy (SupraDiamant). The ultra hard materials are used in Smith's fixed cutter PDC bits, roller cone bits and reaming tools as well as for cutting tools and in the construction and mining industries.

Since its inception 43 years ago, MegaDiamond has become an industry leader by combining its experience and expertise to produce a wide array of advanced ultra-hard materials and products, including polycrystalline diamond (PCD) and polycrystalline carbon boron nitride (PCBN) products. The company manufactures the products using a complex high pressure, high temperature (HP/HT) process, of which MegaDiamond is the world's only company to have mastered the three major HP/HT manufacturing technologies.

SMITH continues to develop new materials and technologies for ultra-hard products with increasing performance and reliability. Advanced materials labs provide the tools necessary for controlling raw materials, analyzing compositions and evaluating material properties. Sophisticated computer modeling and finite element analysis (FEA) systems assist the highly qualified technical staff in designing products for optimal performance.

Developing and improving ultra-hard technologies

MegaDiamond was founded in 1966 by Dr. H. Tracy Hall, the renowned scientist who was the first person to successfully synthesize diamond in 1954 while working for General Electric Research Labs.

In 1955, Dr. Hall left G.E. and joined Brigham Young University (BYU) as a chemistry professor and director of research, during which time he continued to improve and develop synthetic diamond technology and associated manufacturing equipment. In 1957, he invented the tetrahedral press and later a belt press design that would be scaled up to become the first commercial production equipment.

In 1966, Dr. Hall was joined by two other BYU professors, Dr. Bill Pope and Dr. Duane Horton, who formed MegaDiamond to manufacture synthetic diamonds and HP/ HT equipment. PCD was developed by fusing diamond powder particles together under high pressure, high temperature synthesis conditions, forming a sintered diamond mass that is simultaneously bonded to a tungsten carbide substrate. This results in the advantage of extreme hardness (close to natural diamond) and the toughness characteristics of tungsten carbide.

Ten years later, in 1976, the first modern PDC fixed cutter bit developed specifically for an oilfield application was successfully run in the Rangely field in Colorado, opening the door for diamond bit expansion into traditional roller cone bit applications and increasing demand for MegaDiamond's products.

SMITH acquired MegaDiamond in 1985 and still uses many of Dr. Hall's pioneering technologies and procedures developed over his storied career. In 1994, SMITH acquired SupraDiamant, a French company, and the Scurelle plant in Italy in 1996.

PDC development and manufacture

SMITH has become an industry leader by studying material characteristics and applying new and upgraded processing techniques to provide

SMITH has become an industry leader by studying material characteristics and applying new and upgraded processing techniques to provide the highest quality and best performing polycrystalline ultra-hard products available. The company produces an extensive line of engineered PDC products including diamond enhanced inserts for roller cone and percussion bits and PDC shear elements for fixed cutter bits and reamers. Grades are designed for specific material and wear demands encountered in specific customer applications.

MegaDiamond is the world's only company to master the three major HP/HT manufacturing processes, the cubic press, belt press and piston cylinder press. Each system is capable of generating ultra-high pressures (800,000 psi/55 kbar) and temperatures (2,700°F/1,500°C) required to sinter PCD and PCBN products. Each press design employs its own particular advantages relating to sintering characteristics and properties imparted to the product. MegaDiamond's mastery of each of these technologies provides the company with a unique advantage of optimizing sintering conditions for each product to obtain the highest quality and performance for a given application.

MegaDiamond's domed insert products are available with 813 diamond grade for applications needing more abrasion resistant products and 820 diamond grade for more impact resistant products. Smith's proprietary insert designs incorporate transition layers between the diamond layer and tungsten carbide substrate to improve impact strength and thermal integrity.

The company's shear cutter products are available in diameters ranging from 11 mm to 19 mm and in lengths from 8 mm to 16 mm. The cutters are produced with a diamond grade that is effective in critical applications requiring high impact and high abrasion resistance. The cutters incorporate a unique non-planar interface design for enhanced performance.

Continued ultra-hard product development

With its team of scientists, researchers and engineers, SMITH continues to develop new materials and technologies to provide ultra-hard products with ever-increasing performance and reliability. Advanced computer systems and FEA combine to yield improved product designs.

Performance testing is an integral part of Smith's product development process. MegaDiamond possesses well-equipped test labs where its engineers evaluate materials performance in a variety of functional tests that simulate real-world application conditions. Test data is fed back into the design process to improve existing products and to culminate in new and innovative ultra-hard products.

Smith's aggressive and proactive business strategy for expansion at both of its ultra hard manufacturing facilities includes major investments at the MegaDiamond facility in Utah and additional press capacity at the Scurelle plant to enable manufacturing of shear cutters for oilfield diamond bits for Eastern Hemisphere markets.

High performance PDC cutters and diamond enhanced tungsten carbide inserts are essential for supplying bits that can drill both faster and farther and drive down the cost of drilling. The ability to engineer and supply proprietary cutter designs, provided by MegaDiamond and SupraDiamant, is certainly a key factor in helping to keep Smith Bits the undisputed leader in worldwide drilling records for PDC, roller cone, and percussion bits.

GRAPHIC: PICTURE 1, Cubic Press
PICTURE 2, Piston-Cylinder Press
PICTURE 3, Belt Press
PICTURES 4 and 5, MegaDiamond has mastered the techniques for using a variety of advanced, state-of-the-art presses to create polycrystalline diamond used in an array of cutting configurations.
PICTURE 6, Smith's MegaDiamond headquarters in Provo, Utah.
PICTURES 7 and 8, Polycrystalline **diamond cutters** for **drill bit** are produced in a wide range of sizes and geometries.
PICTURE 9, SMITH operates a polycrystalline diamond manufacturing plant in Scurelle, Italy.

LOAD-DATE: April 17, 2009

PDC DRILL BITS

- Navigator Bits
- Tough-Drill Bits
- Diamond Edge Bits
- VB Series Bits
- Hole Opener Bicenter Bits
- Specialty Bits

VAREL NEWS

May 12, 2010
Varel International President and CEO Jim Nixon Named Ernst & Young Entrepreneur Of The Year® 2010 Award Finalist in Southwest Area - North

April 29, 2010
Varel International Announces Patent Pending PDC Cutter Testing Technologies

August 13, 2009
Varel International Energy Services Named to 2009 Inc. 5000 List

July 1, 2009
Varel International Expands Manufacturing Center in Matamoros

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Specialty Bits: Natural Diamond, TSP and Core Bits

Varel offers a variety of bits and core bits manufactured with natural diamond, Thermally Stable Polycrystalline (TSP), and Polycrystaline Diamond Compact materials, available for specific drilling applications. For additional information, please contact your Varel representative.

4" TO 17 1/2" (101.6 mm TO 444.5 mm) - In Matrix

PDC Core Bit

6" x 2 5/8" CK571

12 3/4" x 5 3/4" CK58

TSP Core Bit

6" x 5/8" C320

Natural Diamond Core Bit

6" x 2 5/8" C400

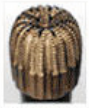
Natural Diamond

8 3/8" VN300

6" VN300

8 1/2" VN300

TSP Bit



8 3/8" VP300

8 1/2" VP500

5 1/2" x 6" VHP300

Sales Contacts

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PDC DRILL BITS

Maximum ROP and durability through effective engineering and premium PDC cutter technology.

Product Line | Cutting Structures | Gage Features | Hydraulics Options | Cutter Selection | Other Features

Product Line

Navigator for Directional Drilling
Navigator bits have the steerability and directional behavior characteristics you need.

Tough-Drill™ Bits for Hard Rock
High ROP. Enhanced durability. Tough-Drill bits eat rock for breakfast.

Diamond Edge Bits
Unique cutting structure provides enhanced stability.

VB Series Bits
Our premium line of matrix bits provide better ROP and longer life.

Hole Openers/ Bicenter Bits
Designed to enlarge the well bore in all types of PDC drillable formations.

Specialty Bits
A variety of natural diamond, TSP and PDC bits for specific applications.

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PDC DRILL BIT NOMENCLATURE VIEW

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ROLLER CONE DRILL BITS

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- High Roller Series Bits
- A-Force Series Bits
- Compass Series Bits
- DuraTech Series Bits
- Tungsten Carbide Insert (TCI) Bits
- Steel Tooth Bits

TECHNICAL SERVICES

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- SPOT™
- PRO-E CAD
- Computational Fluid Dynamics (CFD)
- PRO-E CAM
- Bit Run and Post Run Analysis

Varel International is the world's largest independent manufacturer and supplier of high-quality roller cone and fixed cutter drill bits. Our proprietary design capabilities, efficient manufacturing, and global sales force uniquely positions us to provide drill bits that deliver outstanding performance and value to our customers.

VAREL NEWS

June 23, 2010
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May 12, 2010
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April 29, 2010
Varel International Announces Patent Pending PDC Cutter Testing Technologies

October 27, 2009
Varel International Announces Launch of Compass™ Series Roller Cone Bits

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Steer to success with Navigator

Designed for directional wells, Navigator bits are

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Downhole Products, a Varel International Energy Services company, specializes in the design and manufacture of engineered tubular enhancement products for the global upstream oil and gas industries. Since 1994, Downhole Products has been developing and providing downhole solutions aimed at reducing torque and drag and improving casing running and cementing integrity. Visit http://www.downhole.org to learn more.

DHP News

Press Releases

Downhole Products, Ltd. Announces GRIPPY Product Line Surpasses 250,000 Units Sold

Downhole Products, Ltd. Enhances Reamer Shoe Line with Patent Pending Advancement

Articles

September 2009
Best Practices Emerging for ERD Wells
Hart's E & P, article by Dick Ghiselin

June 2009
Managing director post for Ian Kirk at expansive-minded Downhole Products
Courtesy of Energy International Magazine

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ROLLER CONE BITS

- Ridgeback D-Force Blasthole Bits
- Ridgeback Marathon Blasthole Bits
- Reverse Circulation Bits
- Minerals Exploration Bits
- Pilot Hole Bits
- Industrial Bits

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Reverse Circulation Bits

Varel engineered its reverse circulation bits to deliver exceptional drilling performance in the soft to medium formations typically found in mineral exploration, and to provide the lowest cost per foot of drilled hole. All Varel RX and RC bits are precision machined to work with most existing R/C systems and are available with both sealed and open bearings.

Sealed bearing products feature:

- Fully pressure compensated, non-serviceable lubrication to journal bearing
- Hardmetal inlays on all contact surfaces with silver plated cone bearings
- Specially formulated seal compounds
- High temperature lubricant
- Seals developed for long life

Open bearing products feature:

- Precision roller bearings with special thrust elements to prevent axial wear
- Cones retained by ball bearings
- Pilot pin with hardmetal inlays against a tool steel bushing

All reverse circulation bits feature:

- Cutting structures designed to provide fast penetration rates and durability
- A center hole with the maximum diameter possible for superior hole cleaning and cuttings retrieval

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ROLLER CONE BITS

- Ridgeback D-Force Blasthole Bits
- Ridgeback Marathon Blasthole Bits
- Reverse Circulation Bits
- Minerals Exploration Bits
- Pilot Hole Bits
- Industrial Bits

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Minerals Exploration Bits

Varel's minerals exploration bits are designed for high rates of penetration and durability in soft to medium formation drilling. Available in a variety of diameters, the bits help you achieve your sampling target at a lower total cost.

Minerals exploration bits offer:

- Standard circulation drilling to core point
- Reverse circulation for cuttings retrieval
- Available with both open roller bearings and fully sealed journal bearings

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ROLLER CONE BITS

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- Ridgeback Marathon Blasthole Bits
- Reverse Circulation Bits
- Minerals Exploration Bits
- Pilot Hole Bits
- Industrial Bits

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Pilot Hole Bits

Varel's pilot hole bits have been designed for the most demanding raise bore pilot holes and blind bore pilot holes. All pilot hole bits incorporate a premium sealed bearing system with pressure compensator for added durability.

Pilot hole bits feature:

- Advanced metallurgy with silver plated frictional elements to reduce heat generation and provide resistance to galling under high loads
- O-ring seals made from a proprietary HSN elastomer for long seal life
- Blunt, dome-shaped inserts that provide a durable cutting structure for maximum crushing and chipping action and minimal wear
- Conical and/or chisel-shaped inserts for increased penetration rates in softer formations
- Extra hardmetal and carbide inserts in shirttail surface provide superior seal protection

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bit

Mechanical Devices

1.
A drilling or boring tool for use in a brace or drill press.

2.
The cutting iron of a plane.

3.
A removable boring head used on certain kinds of drills, such as a rock drill.

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bit drag

Mechanical Devices

A bit with serrated teeth, used in rotary drilling. Also, **drag bit**.

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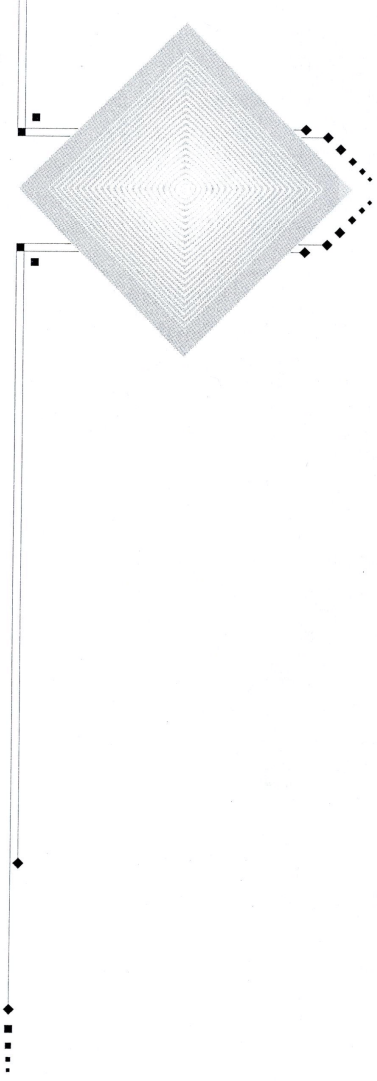
A Dictionary for the Petroleum Industry



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in cubic feet, with the most common standard cubic foot being measured at 60°F and 14.65 pounds per square inch absolute, although base conditions vary from state to state.

cubic metre (m^3) *n*: a unit of volume measurement in the metric system, replacing the previous standard unit known as the barrel, which was equivalent to 35 imperial gallons or 42 U.S. gallons. The cubic metre equals approximately 6.2898 barrels.

cumulonimbus *n*: a cloud formed from a cumulus cloud that has reached great vertical development. This type of cloud has a top composed of ice crystals and a bottom composed of water droplets. Also called a thunderhead.

cumulus *n*: a white, puffy cloud with a dark base. Its shape is constantly changing. Prominent in the summer months, cumulus clouds generally cover only 25% of the sky.

cup case thermometer *n*: a holder for a mercury-in-glass thermometer that incorporates a small metal container into which the bulb of the thermometer is inserted and that serves to hold a small sample of liquid the temperature of which is being measured. The liquid in the cup keeps the bulb submerged in liquid until the temperature is recorded.

cup packer *n*: a device made up in the drill stem and lowered into the well to allow the casing and blowout preventers to be pressure-tested. The sealing device is cup-shaped and is therefore called a cup.

cup test *n*: see *packer test*.

cup-type elements *n pl*: rubber seals that are energized by pressure and not by mechanical force.

curb angle *n*: on offshore installations that have grated decks and floors, a member fixed to concrete or supporting steelwork at the perimeter of a flooring area.

cure *v*: to age cement under specified conditions of temperature and pressure.

cure a title *v*: to remedy defects and omissions that, in the opinion of the examining attorney, could make the present owner's claim to property questionable. To cure a title, a title examiner may require additional facts not evident in the material examined. The curative material is usually obtained in recordable form.

current *n*: 1. the flow of electric charge or the rate of such flow, measured in amperes. 2. the predominantly horizontal movement of ocean waters.

current meter *n*: an instrument that records an ocean current's speed and direction (along with temperature, salinity, pressure, and other variables). The current meter is moored in position by an anchor or weight on the ocean bottom that is connected to a float at the surface.

curtailment *n*: reduction in service or purchases below contracted-for levels. Curtailment of gas sales service is a method of balancing a utility's natural gas requirements with its natural gas supply. There is usually a hierarchy of customers for the curtailment plan based on priority of usage according to established regulatory standards of priority. A customer may be required to cut back partially or totally to eliminate this take of gas, depending on the severity of the shortfall between gas supply and demand and the customer's position in the hierarchy. From the customer's standpoint, curtailment may also mean a reduction by the customer of its takes of gas from its supplier. Curtailment of a transportation service occurs when demands for service exceed the capacity of the pipeline. Capacity curtailment is based on contract rather than end-use priority. All interruptible service must be entirely curtailed before any firm service is curtailed. Currently, interruptible transportation service is curtailed based on position in the first-come, first-served queue. Firm transportation service is usually curtailed on a pro rata basis.

cushion *n*: a quantity of water, drilling fluid, or compressed gas placed inside drill pipe or tubing to control both annular and formation pressures. Usually mud in the pipe or tubing supports pressure and prevents the pipe or tubing from collapsing; mud also holds back formation pressure pushing up the pipe or tubing. But sometimes, such as in drill stem testing, it is necessary to have empty pipe or tubing downhole. The cushion protects the pipe or tubing until it is in place. It also allows control of the rising formation pressure as the cushion is removed, as in drill stem testing, to prevent formation damage.

cushion gas *n*: see *blanket gas*.

custodian *n*: also called a lease operator or pumper. See *pumper*.

custody transfer *n*: the changing of the ownership of or the responsibility for quantities of gas, petroleum, or petroleum products. See also *lease automatic custody transfer*.

cut *n*: 1. portion or fraction of hydrocarbons that have been separated according to boiling point or gravity. 2. the line of demarcation on the measuring scale made by the material being measured.

cut and fill *v*: to cut down high ground or fill in low ground to achieve a uniform grade for a pipeline.

cut-and-fill boundary *n*: the limits to which a crew may cut and fill when laying a pipeline.

cut drilling fluid *n*: a drilling mud whose density has been decreased by the entrainment of formation fluids or air.

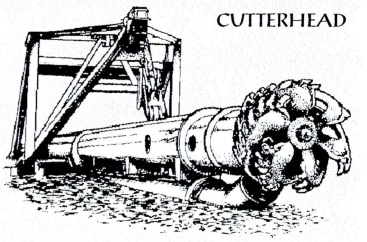
cut fluorescence test *n*: a test involving the observation of a formation sample immersed in a solvent and under ultraviolet light. If any hydrocarbons, which fluoresce under ultraviolet light, are in the sample, they will dissolve and appear as streamers or streaks of color different from the solvent.

cutoff valve *n*: a special valve on an engine that, when activated, blocks the flow of fuel to the engine to make it stop running.

cut oil *n*: an oil that contains water, usually in the form of an emulsion. Also called wet oil.

cutout *n*: an area of deck grating on an offshore installation removed to clear an obstruction or to permit pipes, ducts, columns, and the like to pass through the grating.

cutterhead *n*: in pipeline construction, the lead component in a directional drilling assembly. A circular steel band ringed with conical cutting teeth, the cutterhead does the actual boring of the hole for the pipeline under the waterway being crossed. Also called fly cutter.


CUTTERHEAD

cutters *n pl*: 1. on a bit used on a rotary rig, the elements on the end (and sometimes the sides) of the bit that scrapes, gouges, or otherwise removes the formation to make hole. 2. the parts of a reamer that actually contact the wall of the hole and open it to full gauge. A three-point reamer has three cutters; a six-point reamer has six cutters. Cutters are available for different formations.

polyacrylamide *n*: a polymer whose basic repeating unit, or monomer, is a combination of carbon, hydrogen, oxygen, and nitrogen. Polyacrylamides are used to adjust the viscosity of water slugs during chemical flooding operations. They can also adhere to the walls of rock pores, decreasing the effective permeability of established channels, forcing the injection fluid into new channels, and thus improving sweep efficiency.

polyanionic cellulose (PAC) *n*: a chemical compound used to reduce water loss in muds that are affected by salt contamination.

polychlorinated biphenyl (PCB) *n*: a family of highly toxic chemical compounds consisting of two benzene rings in which chlorine takes the place of two or more hydrogen atoms; known to cause skin diseases and suspected of causing birth defects and cancer.

polycrystalline diamond compact (PDC) *n*: a synthetic diamond used in the manufacture of the cutters on PDC bits.

polyester *n*: a thermosetting or thermoplastic material formed by esterification of polybasic organic acids with polyhydric acids.

polymer *n*: a substance that consists of large molecules formed from smaller molecules in repeating structural units (monomers). In oilfield operations, various types of polymers are used to thicken drilling mud, fracturing fluid, acid, water, and other liquids. See *micellar-polymer flooding, polymer mud.* In petroleum refining, heat and pressure are used to polymerize light hydrocarbons into larger molecules, such as those that make up high-octane gasoline. In petrochemical production, polymer hydrocarbons are used as a feedstock for plastics.

polymer flooding *n*: a type of miscible drive in which a polymer is injected into an injection well to allow oil and water to mix and flow to a producing well. See *miscible drive.* Compare *alkaline (caustic) flooding, swaterflooding.*

polymerization *n*: the bonding of two or more simple molecules to form larger molecular units.

polymer mud *n*: a drilling mud to which a polymer has been added to increase the viscosity of the mud.

polymer units *n pl*: units in a refinery that polymerize propylene and ethylene in the presence of a catalyst and in a liquid solvent. Polypropylene and polyethylene are produced. Following polymerization, the product is removed from the reactor and processed through a purification facility for removal of catalyst residue and separation of the solvent. The powdered product is then conveyed in a pneumatic conveyor to the finishing area, where additives are blended with powder and the mixture is processed through an extruder to form pellets.

polyphase *n*: several alternating emfs of the same frequency and sine wave form. A polyphase generator has two or more circuits in the field windings.

polysaccharide *n*: a carbohydrate composed of many monosaccharides. Polysaccharides are used to adjust the viscosity of water slugs in chemical flooding operations.

pontoon *n*: an attachment, added to a stinger, that is flooded to lower pipeline toward the seafloor at an angle that will not overstress it.

pony rod *n*: 1. a sucker rod, shorter than usual, used to make up a sucker rod string of desired length. Pony rods are usually placed just below the polished rod. 2. the rod joined to the connecting rod and piston rod in a mud pump.

POOH *abbr*: pull-out-of-hole.

pool *n*: a reservoir or group of reservoirs. The term is a misnomer in that hydrocarbons seldom exist in pools, but, rather, in the pores of rock. *v*: to combine small or irregular tracts into a unit large enough to meet state spacing regulations for drilling.

pooling *n*: the combining of small or irregular tracts into a unit large enough to meet state spacing regulations for drilling. Compare *unitization.*

pooling and unitization clause *n*: in an oil and gas lease, the clause that permits the lessee to pool or unitize the leased tract.

poor boy *v*: to make do; to do something on a shoe-string. *adj*: homemade.

poor boy degasser *n*: usually, a mud-gas separator that is fabricated by the personnel on a drilling rig's location, or by welders employed by the drilling contractor in the contractor's storage yard. It is a steel, air-tight cylinder into which drilling mud is piped to provide a space for gas in the mud to escape.

poor boy gravel pack *n*: a bradenhead pack; a method of gravel packing in which no packer is used.

poor boy junk basket *n*: see *finger-type junk basket.*

POP *abbr*: putting on the pump; used in drilling reports.

POP contract *n*: see *percentage of proceeds contract.*

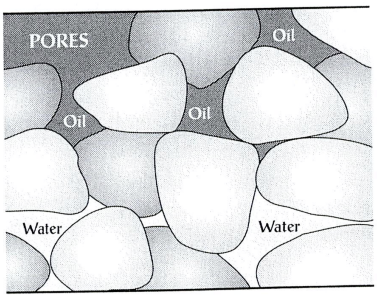
popcorn *adj*: (slang) having the quality of being substandard, unsafe, or cheap.

poppet valve *n*: a device that controls the rate of flow of fluid in a line or opens or shuts off the flow of fluid completely. When open, the sealing surface of the valve is moved away from a seat; when closed, the sealing surface contacts the seat to shut off flow. The direction of movement of the valve is usually perpendicular to the seat. Poppet valves are used extensively as pneumatic (air) controls on drilling rigs and as intake and exhaust valves in most internal-combustion engines.

pop valve *n*: a spring-loaded safety valve that opens automatically when pressure exceeds the limits for which the valve is set. It is used as a safety device on pressurized vessels and other equipment to prevent damage from excessive pressure. Also called a relief valve, safety relief valve, or safety valve.

por *abbr*: porosity or pores; used in drilling reports.

pore *n*: an opening or space within a rock or mass of rocks, usually small and often filled with some fluid (water, oil, gas, or all three). Compare *vug.*



pore pressure *n*: see *formation pressure.*

pore throats *n pl*: connections between pores.

pore volume (PV) *n*: the total volume of pore space in a reservoir formation.

porosimeter *n*: a device used to determine porosity of a formation by measuring a known volume of gas at a known pressure compressed into a core sample. The gas is measured at atmospheric pressure and at an elevated pressure. These measurements are used to calculate gain volume and pore volume.

porosity *n*: 1. the condition of being porous (such as a rock formation). 2. the ratio of the volume of empty space to the volume of solid rock in a formation, indicating how much fluid a rock can hold. See *absolute porosity, effective porosity, pore.*

passivation *n*: the process of rendering a metal surface chemically inactive, either by electrochemical polarization or by contact with passivating agents.

passive margin *n*: an area that develops when a growing ocean basin causes continents to drift apart.

patch *n*: a material used to cover, fill up, or mend a hole or weak spot. A metal piece extending half-way around a pipe and welded to it is a half-sole patch. Two half-sole patches make a full-sole patch.

patch tool *n*: see *casing-patch tool.*

patent *n*: in the case of land, an instrument by means of which a government transfers a fee simple estate to another party.

pawl *n*: notches or slots machined into the table part of a rotary table assembly into which a bar on the rotary table assembly's locking device fits to keep the table from turning. See *rotary locking device, rotary table assembly.*

pay *n*: see *pay sand.*

pay formation *n*: see *pay sand.*

paying quantity *n*: see *commercial quantity.*

payout *n*: the point at which the operator of a well has recovered the costs of drilling, completing, and operating the well and can begin to show a profit.

pay sand *n*: the producing formation, often one that is not even sandstone. Also called pay, pay zone, and producing zone.

pay string *n*: see *production casing.*

pay thickness *n*: an expression of the vertical height of the formation yielding hydrocarbons in commercial amounts.

pay zone *n*: see *pay sand.*

PB *abbr*: plugged back; used in drilling reports.

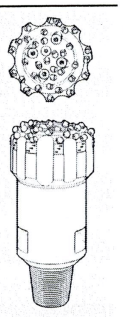
PBR *abbr*: polished bore receptacle.

PCB *abbr*: polychlorinated biphenyl.

pcf *abbr*: pounds per cubic foot.

PDC *abbr*: polycrystalline diamond compact.

PDC bit *n*: a special type of diamond drilling bit that does not use roller cones. Instead, polycrystalline diamond inserts are embedded into a matrix on the bit. PDC bits are often used to drill very hard, abrasive formations, but also find use in drilling medium and soft formations.



PDC BIT

PDC log *abbr*: perforating depth control log.

P-Δ-P *n*: the difference in pressure, commonly referred to as between casing annulus and tubing.

PDI *abbr*: paraffin-deposition interval.

PD meter *n*: positive-displacement meter. It measures the single-phase volume of gas or fluid by filling and emptying chambers of a specific volume.

PDVSA *abbr*: Petróleos de Venezuela S.A.

peak polished rod load *n*: the highest load imposed on the polished rod throughout a complete sucker rod pump cycle.

Pearson holiday detector *n*: a holiday detector that checks for coating defects as well as for any metal debris near a buried pipeline. See *holiday.*

peat *n*: an organic material that forms by the partial decomposition and disintegration of vegetation in tropical swamps and other wet, humid areas. It is believed to be the precursor of coal.

pebble puppy *n*: (slang) a field geologist's (or rock hound's) assistant.

pedestal crane *n*: relatively large stationary crane mounted on an offshore unit.

peen *n*: a wedge or spherical-shaped end of a hammer head, which is usually opposite a flat face on the head. *v*: to enlarge, straighten, or smooth with a peen.

peening *n*: permanent distortion in the outer wires of a wire rope, often caused by the wire rope's pounding against a sheave or a machine member, or by heavy operating pressure between the wire rope and a sheave, the wire rope and a drum, or the wire rope and an adjacent wrap of rope.

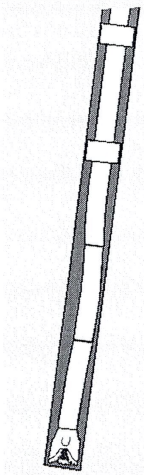
peg model *n*: an analog model of three dimensions used to study the structure and stratigraphy of a subsurface area. It is made by placing pegs of varying heights into a flat platform to represent the structural contours of strata.

PEL *abbr:* permissible exposure limit.

pelican hook *n*: (nautical) a wire rope attached to an anchor and sometimes to the anchor chain and used to pull and lower the anchor. The ends of the pendant not on the anchor are attached to buoys on the surface of the water.

pendant *n*: see *guy rope.*

pendulum assembly *n*: a bottomhole assembly composed of a bit and several large-diameter drill collars and stabilizers placed to allow the bottom drill collar to bend toward the vertical. The assembly works on the principle of the pendulum effect and is used to decrease drift angle. See *pendulum effect.*



PENDULUM ASSEMBLY

pendulum effect *n*: the tendency of the drill stem—bit, drill collars, drill pipe, and kelly—to hang in a vertical position due to the force of gravity.

penetration rate *n*: see *rate of penetration.*

Pennsylvanian period *n*: a geologic time period in the Paleozoic era, from 320 to 280 million years ago. Also, the latter part of the Carboniferous period. It was named for the outcrops of coal in Pennsylvania.

pentane *n*: a liquid hydrocarbon of the paraffin series, C_5H_{12}.

pentane-plus *n*: a hydrocarbon mixture consisting mostly of normal pentane (C_5H_{12}) and heavier components that are extracted from natural gas.

peptization *n*: increased dispersion of solids in a liquid caused by the addition of electrolytes or other chemical substances. See *deflocculation, dispersion.*

peptized clay *n*: a clay to which an agent has been added to increase its initial yield.

per *abbr*: permeability; used in drilling reports.

percentage chart *n*: a chart for reading differential and static pressures. Its readings reflect a percentage of full scale from 0 to 100 for both static and differential pressure. Readings must be converted, but can be used on any flow recorder, regardless of range.

percentage of proceeds (POP) contract *n*: a gas sales contract under which the buyer processes the gas for recovery of liquid products (ethane and heavier hydrocarbons) and sells the residue under a buyer's contract with the pipelines.

percentage timer *n*: a switch that turns a motor on for a set percentage of the revolution of a cam and off for the remainder of the revolution.

percolation *n*: the tendency for gas to rise in the drilling mud in the annulus, even when the well is shut in and circulation is stopped. It occurs because gas is light in density.

bidirectional meter *n*: a meter that can measure flow from either direction.

Big Inch *n*: the first cross-country pipeline with a 24-inch (61-centimetre) diameter. The 1,340-mile (2,157-kilometre) Big Inch was begun in 1942 with government financing as a part of an emergency construction program (War Emergency Pipelines) to meet the demand for petroleum products during World War II.

big-inch pipe *n*: thin-walled pipe of high tensile strength with a diameter of 20 inches (51 centimetres) or more.

bilge radius *n*: the radius of the rounded portion of a vessel's shell that connects the bottom to the sides.

billet *n*: a solid steel cylinder used to produce seamless casing. The billet is pierced lengthwise to form a hollow tube that is shaped and sized to produce the casing.

bill of lading *n*: a document by which the master of a ship acknowledges having received in good order and condition (or the reverse) certain specified goods consigned by a particular shipper, and binds himself or herself to deliver them in similar condition, unless the perils of the sea, fire, or enemies prevent it, to the consignees of the shippers at the point of destination on their paying the stipulated freight.

binding bar *n*: a steel bar or section fixed to the edges of a panel of deck grating on an offshore installation that is flush with top of the grating supports.

biochemical *adj*: involving chemical reactions in living organisms.

biodegradation *n*: a process similar to composting.

biofacies *n*: a part of a stratigraphic unit that differs in its fossil fauna and flora from the rest of the unit.

biogenic *adj*: produced by living organisms.

bioherm *n*: a reef or mound built by small organisms and their remains, such as coral, plankton, and oysters. Originally a wave-resistant coral structure served as an anchor for calcareous debris that formed limestone. It was tectonically submerged, or the sea level rose faster than the corals could build it, and it was eventually buried beneath marine shales. A bioherm is often porous enough to hold large accumulations of hydrocarbons, especially if it has been dolomitized. A bioherm is a stratigraphic trap.

biomass *n*: the total mass of living organisms per unit volume per unit of time.

bioremediation *n*: 1. the process of breaking down organic wastes with microbes. Bacteria that are naturally present in the environment use microbial enzymes to break down the materials into a soluble form that passes through the cell walls of the bacteria. The bacteria metabolize the material and convert it into components that are more readily assimilated in the environment, such as water or carbon dioxide (i.e., a gardener's compost pile). 2. the creation of engineered and managed conditions to boost natural bioremediation processes. Nutrients are added to stimulate the bacteria naturally present in the waste. Oxygen and pH levels are adjusted for maximum effectiveness, and, if conditions are right, the bacteria grow in large numbers and break down the hydrocarbons much more rapidly than with natural bioremediation. In cases in which the necessary bacteria are not already present in the waste, suppliers can provide them along with the appropriate nutrients.

biosphere *n*: the thin zone of air, water, and soil where all terrestrial life exists.

biota *n pl*: the animals, plants, fungi, etc., of a region or period.

biotic *adj*: relating to life, biologic; relating to the actions of living organisms.

biotite *n*: a type of mica that is high in magnesium and dark in color.

birdcage *n*: a wire rope that has been flattened and the strands of which have been spread. *v*: to flatten and spread the strands of a wire rope.

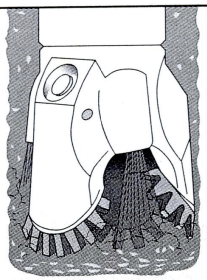
birdcaged *adj*: see *wickered*.

birdcaged wire *n*: wire rope used for hoisting that has had its wires distorted into the shape of a birdcage by a sudden release of load.

bird-dog *v*: to supervise another too closely or continuously.

bit *n*: the cutting or boring element used in drilling oil and gas wells. The bit consists of a cutting element and a circulating element. The cutting element is steel teeth, tungsten carbide buttons, industrial diamonds, or polycrystalline diamonds (PDCs).

BIT



These teeth, buttons, or diamonds penetrate and gouge or scrape the formation to remove it. The circulating element permits the passage of drilling fluid and utilizes the hydraulic force of the fluid stream to improve drilling rates. In rotary drilling, several drill collars are joined to the bottom end of the drill pipe column, and the bit is attached to the end of the drill collars. Drill collars provide weight on the bit to keep it in firm contact with the bottom of the hole. Most bits used in rotary drilling are roller cone bits, but diamond bits are also used extensively.

bit breaker *n*: a special device that fits into a bit breaker adapter (a plate that goes into the rotary table) and conforms to the shape of the bit. Rig workers place the bit to be made up or broken out of the drill stem into the bit breaker and lock the rotary table to hold the bit breaker and bit stationary so that they can tighten or loosen the bit.

bit breaker adapter *n*: a heavy plate that fits into the rotary table and holds the bit breaker; a device used to hold the bit while it is being made up or broken out of the drill stem.

bit cone *n*: on a roller cone bit, a cone-shaped steel device from which the manufacturer either mills or forges steel teeth, or into which the manufacturer inserts tungsten carbide buttons. Most roller cone bits have three cones, which roll, or rotate, on bearings as the bit rotates. As the cones roll over the formation, the cutters on the cone scrape or gouge the formation to remove the rock.

bit cutter *n*: the cutting elements of a bit.

bit dresser *n*: 1. a member of a cable-tool drilling crew who repairs bits. 2. a machine used to repair, sharpen, and gauge bits.

bit drift *n*: the tendency of the bit to move other than vertically, caused by an interaction between the rotation of the bit and the varying resistance of the formation being drilled.

bit gauge *n*: a circular ring used to determine whether a bit is of the correct outside diameter. Bit gauges are often used to determine whether the bit has been worn down to a diameter smaller than specifications allow; such a bit is described as undergauge.

bit hydraulic horsepower *n*: the measure of hydraulic power expended through the bit nozzles for cleaning the bit cutters and the hole bottom.

bit matrix *n*: on a diamond bit, the material (usually powdered and fused tungsten carbide) into which the diamonds are set.

detergent *n*: in lubricating oils and in some engine fuels, a chemical that is added to the oil or to the fuel that suspends dirt, carbon, and other foreign matter in the oil or fuel. As a result of the detergents in motor oil, the oil will very quickly appear dirty because it is suspending the particles.

determinable fee *n*: an interest in property that will end at the happening or nonhappening of a particular event. In some states, an oil and gas lease is considered a determinable fee in real estate.

detonation *n*: 1. an explosion. 2. the knock or ping produced when fuel of too-low octane rating is used in the engine. Compare *preignition*.

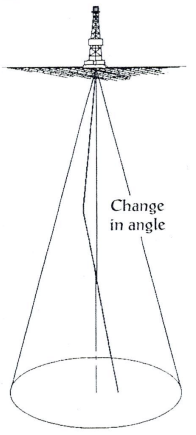
deuterium *n*: the isotope of the element hydrogen that has one neutron and one proton in the nucleus; atomic weight is 2.0144.

development and production plan *n*: a plan required by the MMS before development and production can take place in the OCS. The MMS approves or disapproves the plan based on environmental, technical, and economic considerations.

development drilling *n*: drilling that occurs after the initial discovery of hydrocarbons in a reservoir. Usually, several wells are required to adequately develop a reservoir.

development well *n*: 1. a well drilled in proven territory in a field to complete a pattern of production. 2. an exploitation well.

deviation *n*: departure of the wellbore from the vertical, measured by the horizontal distance from the rotary table to the target. The amount of deviation is a function of the drift angle and hole depth. The term is sometimes used to indicate the angle from which a bit has deviated from the vertical during drilling. See *drift angle*.



DEVIATION

deviation and azimuth indicator *n*: see *double recorder*.

deviation effect *n*: when a gas is confined within a pressure-tight container, the tendency of the gas pressure to be slightly above or below that which is normally expected because of the attraction or repulsion of individual gas molecules.

deviation survey *n*: an operation made to determine the angle from which a bit has deviated from the vertical during drilling. There are two basic deviation-survey, or drift-survey, instruments: one reveals the drift angle; the other indicates both the angle and the direction of deviation.

devise *v*: to make a gift of real property (e.g., land) by means of a will. Compare *bequeath*.

Devonian *adj*: of or relating to the geologic period from about 400 million to 350 million years ago in the Paleozoic era, or to the rocks formed during this period, including those of Devonshire, England, where outcrops of such rock were first identified.

dew point *n*: the temperature and pressure at which a liquid begins to condense out of a gas. For example, if a constant pressure is held on a certain volume of gas but the temperature is reduced, a point is reached at which droplets of liquid condense out of the gas. That point is the dew point of the gas at that pressure. Similarly, if a constant temperature is maintained on a volume of gas but the pressure is increased, the point at which liquid begins to condense out is the dew point at that temperature. Compare *bubble point*.

dew-point recorder *n*: a device used by gas transmission companies to determine and to record continuously the dew point of the gas.

dew-point spread *n*: the difference between the actual air temperature and the dew-point temperature.

dew-point temperature *n*: the temperature at which the rate at which water vapor leaves a gas equals the rate at which water vapor enters the gas at a given pressure.

dew-point tester *n*: a high-pressure stainless steel or nickel-plated brass chamber with a magnifying window, a sample inlet, a pressure gauge, a tripod socket, a gas outlet, and an angle-mounted mirror. It ascertains dew point by observing the temperature and the pressure at which condensation occurs on and disappears from the mirror.

DF *abbr*: derrick floor; used in drilling reports.

diagenesis *n*: the chemical and physical changes that sedimentary deposits undergo (compaction, cementation, recrystallization, and sometimes replacement) during and after lithification.

dial thermometer *n*: a thermometer on which the temperature is indicated by a moving needle or pointer on a circular face or disk rather than with liquid in a glass or a liquid crystal display (LCD).

dial-type assembly *n*: see *dial thermometer*.

diamagnetic *adj*: antimagnetic. Diamagnetic materials resist flux by aligning themselves at right angles to the lines of force in a magnetic field. See *ferromagnetic*, *paramagnetic*.

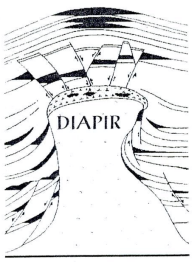
diameter *n*: the distance across a circle, measured through its center. In the measurement of pipe diameters, the inside diameter is that of the interior circle and the outside diameter that of the exterior circle.

diamond bit *n*: a drill bit that has small industrial diamonds embedded in its cutting surface. Cutting is performed by the rotation of the very hard diamonds over the rock surface.

diaphragm *n*: a sensing element consisting of a thin, usually circular, plate that is deformed by pressure applied across the plate.

diaphragm meter tangent *n*: part of a diaphragm meter that regulates the length of the diaphragm stroke; used to adjust the volumetric displacement.

diapir *n*: a dome or anticlinal fold in which a mobile plastic core has ruptured the more brittle overlying rock. Also called piercement dome.



diapirism *n*: the penetration of overlying layers by a rising column of salt or other easily deformed mineral caused by differences in density.

diastrophism *n*: the process or processes of deformation of the earth's crust that produce oceans, continents, mountains, folds, and faults.

diatom *n*: any of the algae of the class Bacillariophyceae, noted for symmetrical and sculptured siliceous cell walls. After death, the cell wall persists and forms diatomite. Diatoms first appeared in the Cretaceous period and still live today.

diatomaceous earth *n*: an earthy deposit made up of the siliceous cell walls of one-celled marine algae called diatoms. It is used as an admixture for cement to produce a low-density slurry.