石油机械概论

Introduction to Petroleum Machinery

（英汉双语）

周思柱　华　剑　编著

石油工业出版社
Petroleum Industry Press

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内 容 提 要

本书以英汉双语的方式对石油钻机、涡轮钻具、螺杆钻具、钻井泵、采油设备和海洋石油设备的结构组成、特点、工作原理及维修保养等进行了详细介绍。使用本书，既可掌握专业知识，又可学会专业术语的英文表达方式，在学习专业的同时，提高专业英语的阅读能力。

本书适用于石油钻井、采油、机械等专业的技术人员阅读，也可作为高等院校相关专业本科生和研究生的专业教材。

图书在版编目（CIP）数据

石油机械概论（英汉双语）/周思柱等编著.
北京：石油工业出版社，2002.12
ISBN 7-5021-3916-8

Ⅰ. 石…
Ⅱ. 周…
Ⅲ. 石油工程-机械设备-英、汉
Ⅳ. TE9

中国版本图书馆 CIP 数据核字（2002）第 069895 号

石油工业出版社出版
（100011　北京安定门外安华里二区一号楼）
石油工业出版社印刷厂排版印刷
新华书店北京发行所发行
*
787×1092 毫米 16 开本 15 印张 380 千字　印 1—3000
2002 年 12 月北京第 1 版 2002 年 12 月北京第 1 次印刷
ISBN 7-5021-3916-8/TE・2828
定价：30.00 元

前　言

本书的特点是将石油机械概论和石油机械专业英语整合为一体。本书涉及钻井机械、采油机械等石油机械和装备，内容丰富、知识面广、词汇量大。使用本书，既可掌握专业知识，又学会了专业术语的英文表达方式，在学习专业的同时，提高专业英语的阅读能力。

本书内容的选择和章节的编排，反映了编者近 10 年的科研和教学经验，既注意专业内容的归类统一，又重视由浅入深，循序渐进，引入了一些现代石油机械结构和原理的内容，并介绍了国内石油机械生产厂家的部分新产品。

全书共分七章：第一章，旋转钻机及其组成；第二章，起升系统；第三章，涡轮钻具；第四章，螺杆钻具；第五章，泥浆泵与离心泵；第六章，人工举升方法与设备；第七章，海洋设备。文中上标和下划线标出了生词和词组，每章末附有词汇表。

为了便于读者学习和使用，给出了一定数量的思考题，供读者深入理解专业知识，掌握石油机械结构和工作原理。

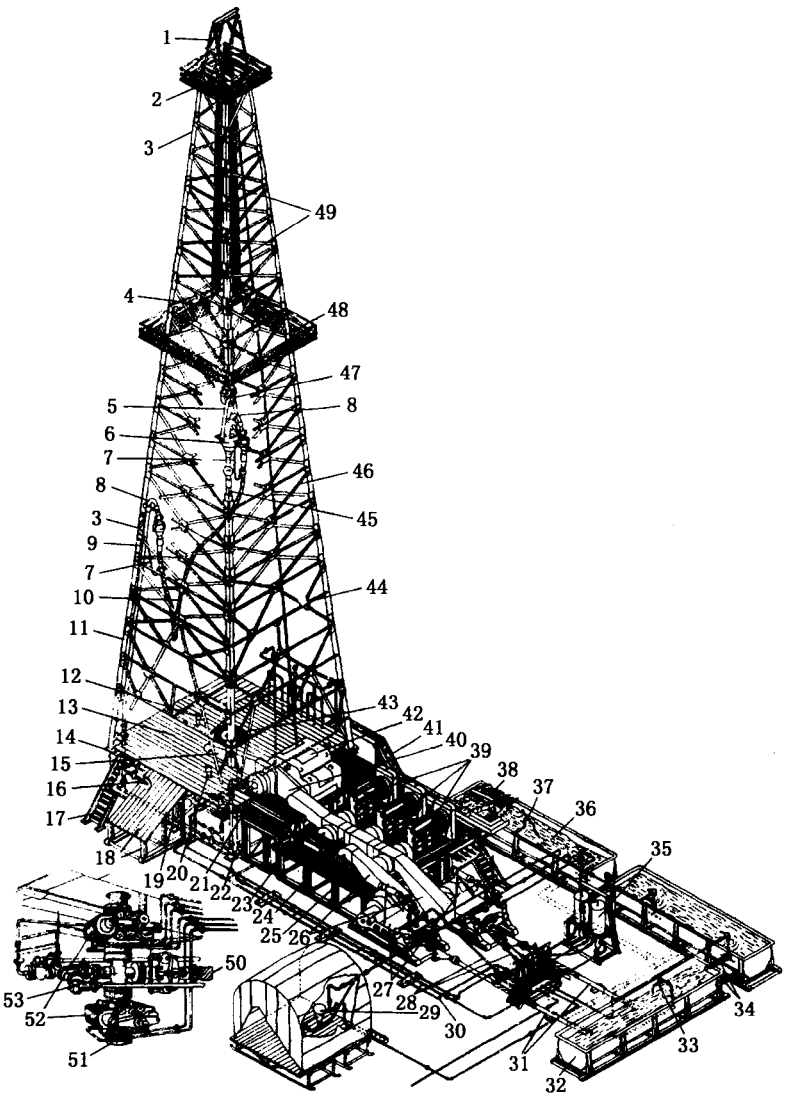
赵国珍教授、陈如恒教授、黄清世教授对本书进行了审阅，并提出了宝贵的意见，在此表示衷心的感谢。

由于编者水平有限，书中肯定存在某些不妥和需要修改之处，诚恳地希望读者批评指正。

编　者

2002 年 7 月

钻机立体布置图
Isometric plan of a rig



1—人字架；2—天车；3—井架；4—游车；5—水龙头提环；6—水龙头；7—保险链；8—鹅颈管；9—立管；10—水龙带；11—井架大腿；12—小鼠洞；13—钻台；14—架脚；15—转盘传动；16—填充钻井液管；17—梯子；18—坡板；19—底座；20—大鼠洞；21—水刹车；22—缓冲室；23—绞车底座；24—井车箱；25—发动机平台；26—泵传动；27—钻井泵；28—钻井液管线；29—钻井液配制系统；30—供水管；31—吸入管；32—钻井液池；33—固定钻液枪；34—连接软管；35—空气包；36—沉砂池；37—钻液枪；38—振动筛；39—动力机组；40—绞车传动装置；41—钻井液槽；42—钻井绞车；43—转盘；44—井架横梁；45—方钻杆；46—斜撑；47—大钩；48—二层平台；49—游绳；50—钻井液喷出口；51—井口装置；52—防喷器；53—换向闸门

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1 Rotary Rig and Its Components

1.1 Introduction

A rotate drilling rig[1] may be thought of as a factory, or a manufacturing plant. It is designed to produce only one product-namely, hole. A rig differs from other manufacturing facilities, however, in that it is transitory-that is, it must be moved frequently. Thus, a rig could be designed to manufacture more hole if the essential feature of portability[2] did not have to be built in.

This requirement of portability places a limitation on rig design, both as to weight and as to the size of each component. The total weight of the rig is a factor when planning overland[3] moves, but the weight of each part of the rig is even more important. No single component—such as the drawworks, which is a relatively large piece of machinery used to hoist pipe in and out of the hole —can weigh over a certain amount based on truck and highway limitations of gross weight. The rig, therefore, must be rigged down, or disassembled, for a move in such a way that weigh limits are not exceeded by any single component or subassembly[4] of equipment.

The customary unit of measure of rig production-or manufacture of hole-is the foot. In many parts of the world the meter is used in place of the foot; a meter equals about 3.3 feet. The foot is a convenient unit by which to measure the product of a drilling operation and pay the contractor who made the hole. It is a fact of life in the drilling industry, however, that the cost per foot of making hole varies directly in relation to the depth at which the foot is drilling. The deeper the hole, the more costly is each additional foot drilled.

An individual or a group of individuals known as a drilling contractor owns most rigs. However, companies engaged in finding, producing, or refining petroleum own most holes, or wells. These companies are often called operators or operating companies; the

1 旋转钻机及其组成

1.1 引言

一台旋转钻机可以看作是一家工厂或一个制造厂，设计它是用来生产唯一的产品——所谓的“井眼”。然而，由于钻机作业是暂时性的，因此它不同于其它的制造设备，也就是说，钻机必须经常搬家。如果在设计时不必考虑轻便性这个基本特点的话，它可以钻更多的井眼。

轻便性要求在设计钻机时对部件的重量和尺寸都有所限制。当计划陆地运输时，钻机的总重是要考虑的因素，但更重要的是各个部件的重量。诸如绞车之类用于起升和下放钻柱的相对大型的机械，其单件重量不能超过车辆的载重和路况的限重，因而在运输时钻机必须拆卸或分解。采用了这种方法，任何单件或组件就不会超重。

衡量钻机的产品——井眼深度的常用单位是英尺，而在世界很多地方米取代了英尺，1m 大约等于 3.3ft。当计算钻井的工作量以及支付钻井承包商的酬金时，英尺是一个方便的单位。然而，每英尺钻井的成本与井的钻深成正比，这是钻井作业中的常识。井眼越深，每英尺的钻井成本越大。

绝大多数钻机由个人或团体所拥有，他们被称作钻井承包商。但是，绝大多数油井的拥有者是从事勘探、生产和炼油的公司。这些公司常被称为经营者或营业公司。这些经营者雇用钻井承包商或跟他们签约，由钻井承包商来钻井。经营者认为，更合适衡量钻井工作量的单位是井的数量而不是英尺。一口井可以看作为合约规定的目的层的深度的英尺总数。对经营者来

operator hires, or contracts, the drilling contractor to drill the well. From the operator's point of view, a more appropriate unit of measurement for drilling is the well, not the foot. A well may be thought of as that number of feet required to reach the objective for which the contract was issued. An unfinished well, however deep it may be, has no more value to the operator until the last foot is made than a new automobile has before the last part is put in place. Therefore the oil operator usually contracts to pay a certain sum per foot of hole when, and only when the well is completed to a specified depth. Sometimes, in special cases, drilling contracts are drawn on a daywork basis, which means that payment is made for each day the rig is used, plus certain extras.

The contractor must provide equipment and machinery of sufficient strength and power to drill to the specified depth, be it 2,000 or 20,000 feet. Both the operator and the contractor are interested in such details as the time required for completing the job; the safety of the equipment, property, and personnel throughout the operation; and the ability of both the men and equipment to do acceptable work.

1.2 Interrelationships of Rig Components

Fig.1-1 shows the relationships of major components that make up a rotary drilling rig. These components work together to accomplish the three main functions of all rotary rigs-that is, the functions of the hoisting, circulating, and rotating systems.

1.2.1 Hoisting system

The mast or derrick supports the hook[5] and elevators[6] by means of the travelling block, wire line, crown block, and drawworks[7]. The drawworks are powered by prime movers-which are usually two, three, or even four engines—to raise or lower drill stem so that the bit[8] can drill.

1.2.2 Circulating system

When drilling is in progress, the components of the hoisting system along with the mud pump and prime movers[9] are used to circulate drilling fluid from the mud pit through the standpipe[10], rotary hose, swivel[11],

说，一口未钻完的井，无论它有多深就如同最后一个零件尚未装配的汽车，无论它有多深，都没有多大价值。因此，石油经营者通常这样签约，即只有当油井达到特定的深度时才按英尺数支付报酬。有时，在特殊的情况下，钻井合同是以计时工作为基础而签订的，那就意味着报酬按钻机工作日来支付，再加上一定的额外费用。

不论井深是 2000 还是 20000ft，钻井承包商必须提供强度和功率足够的装备和机械来钻到既定深度。经营者和钻井承包商都感兴趣的是这样的细节，诸如完成工作所用的时间，工作过程中设备财产及所有人员的安全，以及人员和设备的工作能力等等。

Exercise

1. Why the number of drilled well is selected as a better measurement for drilling than the feet ?

2. What limitations are produced by the portability of a rig?

1.2 钻机组件的相互关系

图 1-1 表示了一台旋转钻机的主要组件的相互关系。这些组件协同工作以完成所有旋转钻机三个主要功能，即提升、循环和旋转。

1.2.1 提升系统

井架通过游车、钢丝绳、天车，绞车来支撑大钩和吊卡。绞车通过原动机组驱动，原动机组通常是 2 台、3 台甚至是 4 台动力机，用来提升、下放钻杆以便钻头钻进。

1.2.2 循环系统

在钻井过程中，提升系统各部件与泥浆泵和原动机组共同工作，用于使钻井液从泥浆池通过立管、水龙带、水龙头、方钻杆、钻杆、钻铤到钻头循环流动。钻井

kelly[12], drill pipe[13] and drill collars[14] to the bit. The drilling fluid is a special liquid or sometimes air or gas. Cuttings are flushed from the bottom of the hole up the hole to the surface, thus providing a clean place for the bit to work.

1.2.3 Rotating system

The rotary table[15] powered by the prime movers, is turned to rotate the kelly, which it is lowered through the kelly drive bushing[16]. The rotation of the kelly causes the bit to turn and make hole. The kelly, of course, is supported by the hoisting system, and circulation is maintained by the circulating system.

The interaction between the bit and the formation in which is making hole guides the driller in using the rest of the rig to make hole more effectively. To evaluate the performance of the rig, the driller must observe the following:

1) the rate of rotation by the rotary table;

2) the weight applied on the bit by the drill stem;

3) the rate of circulation and the pressure applied on the circulating fluid by the mud pump;

4) the timing of the withdrawal of the dull bit and the replacement of it with a new one. (Normally the bit is replaced only when it ceases to make hole effectively-that is, when the bit wears out and is in a dull condition.)

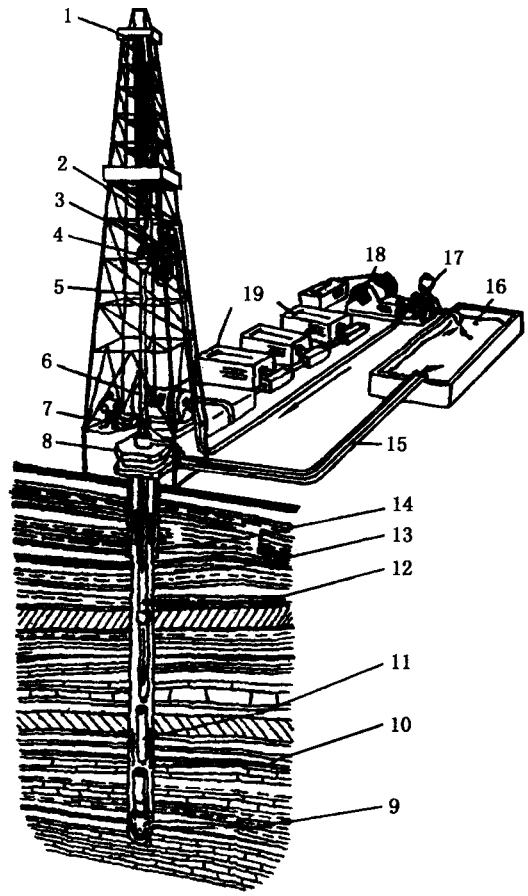

Fig.1-1 Systems and components for a rotary drilling rig

1—Crown; 2—Traving block; 3—Hook; 4—Swivel; 5—Kelly; 6—Drawworks; 7—Rotary table; 8—Blowout preventer; 9—Bit; 10—Mud; 11—Drill collar; 12—Drill string; 13—Borehore; 14—Surface casing; 15—Mud ditch; 16—Mud pit; 17—pulsation dampener; 18—Mud pump; 19—Engine

图 1-1 旋转钻井法示意图

1—天车；2—游动滑车；3—大钩；4—水龙头；5—方钻杆；6—绞车；7—转盘；8—防喷器；9—钻头；10—泥浆；11—钻铤；12—钻柱；13—井眼；14—表层套管；15—泥浆槽；16—泥浆池；17—空气包；18—泥浆泵；19—动力机

液是特殊的液体，有时是空气或天然气。钻井液将岩屑由井底冲到地面，从而为钻头工作提供一个清洁的工作环境。

1.2.3 旋转系统

原动机驱动转盘使方钻杆旋转，方钻杆穿过方补心下降。方钻杆的旋转使钻头旋转钻进。无疑，方钻杆由提升系统悬持，钻井液的循环是由循环系统来维持。

钻井时钻头和地层之间的相互作用指导司钻更有效地利用钻机其它部分钻井。

Exercise

1. What are the major functions of a rotary rig?

2. Describe the relationship among the three main systems of a rotary rig by observing the Fig 1-1.

1.3 Rotary Drilling Bits

In the final analysis, the bit is the only part of the rotary-rig equipment that actually makes hole. Thus, all other equipment on a drilling operation may be thought of as auxiliary to the bit. This is not to suggest that the bit can make hole alone. Nevertheless; the bit is the mast[17] critical item of a rotary operation. It is by far the most refined of the rotary rig tools—that is, it is available in more style and is more highly specialized for every condition of drilling than any other tool on the rig.

To select a bit, some information must be known about the nature of the rocks to be drilled. This information always includes a factor of depth in the earth because general rock hardness (and sometimes abrasives) increases with hole depth. After selecting the bit sizes required, the best types of bits may be determined according to the rock formation anticipated.

In the vernacular[18], to make hole means that the bit is set on the bottom and turned to the right. But not just any bit will do-it must be a bit designed with a particular type of drilling mind.

Because the bit is the key component of rotary drilling, the question asked more often than not by the drilling contractor about a well on which he is about to bid is "How many bits will be used?" The answer not only gives him one item of direct cost—the cost of the bits-but also is useful in estimating the number of days required to drill the well and total cost to the contractor.

Exercise

1. Tell the reason why the other equipments on a rig can be regarded as the auxiliary devices of the bit.
2. What is the basis of choosing a bit?

1.3 旋转钻井的钻头

归根结底，钻头是旋转钻机上唯一进行钻井的部件。因此，钻井过程中的所有其它设备可以看成是钻头的辅助设备。这并不意味着钻头能单独钻井。然而，钻头是旋转钻井中最重要的部件。迄今它是旋转钻机中最精致的，它的型号比钻机上其它部件多，并且专门化程度更高，用以适应各种钻井条件。

为了选择钻头，必须了解所钻岩层的一些特征。深度因素必须始终加以考虑，因为岩石硬度一般随井深的增加而增加。在选定了所需的钻头尺寸后，就可以根据预期的岩层特性来确定最适用的钻头型号。

通俗地说，钻井就是将钻头置于井底并顺时针旋转。但不是任何一种钻头都能行，它必须是一种根据特定的钻井方案而设计的钻头。

因为钻头是钻机的关键部件，所以对于即将投标的那口井，钻井承包商时时关心的是将要用多少只钻头。这个问题的答案不仅给出了一项直接成本——钻头的费用，而且对于准确估计钻井所需时间以及总费用也是有用的。

为了评价钻机的工况司钻必须注意：1）转盘转速；2）由钻柱加在钻头上的钻压；3）泥浆泵所提供的泥浆流速及压力；4）何时需要取出钝钻头并更换新钻头（一般而言，只有在钻头不能有效钻井时，也就是当钻头磨损变钝时才更换）。

1.4 Drill Stem

The drill stem[19] consists of three main components: drill collars, which are heavy, thick walled, hollow steel tubes; drill pipe, which like the drill collars, is a hollow steel (sometimes aluminum) tube although not as heavy as the collars; and a kelly, which is a hollow, square or hexagonal-sided[20] length of steel tubing. Put another way, the drill collars, drill pipe, drill-pipe tool joints-devices used to connect length of drill pipe together-and kelly comprise the drill stem.

The following are the principal functions of the drill stem.

1) It lowers the bit into the hole and withdraws it. However deep the bit may penetrate in the process of manufacturing hole, it must be placed at that depth by the drill stem.

2) Part of the drill stem (the drill collars) puts weight on the bit so that the bit can penetrate the formations more effectively. (The drill-pipe portion of the drill stem should never be used to put weight on the bit. If drill pipe is used to add weight, rapid failure of the pipe is certain.)

3) It transmits a turning, or rotating, action (torque) to the bit. As a driller might say, "It turns the bit to the right." (Bits are always rotated clockwise when drilling hole.) Thus, the drill stem is a drive shaft[21] driven by a device on the rig called the rotary table.

4) It conducts the drilling fluid under pressure from the surface to the bit. (The drilling fluid can be a special liquid or air or gas.) Thus, the drill stem is also a vertical conduit, or pipeline.

It is very important for all members of the drilling crew to handle and maintain the components of the drill stem properly and safely. Drill collars are heavy; for instance, one collar may weight 1.5 tons. Obviously, handling that much weigh calls for care. Further, when the drill stem is placed in the hole with the bit on bottom to make hole, it is put under tremendous stresses—stresses that come from the turning action and from the tremendous weight of the drill-stem components. If the drill stem is not kept in the best possible condition, not much time passes before the manufacture of hole

1.4 钻柱

钻柱包括三个主要部分：钻铤，它是厚壁沉重的中空钢管；钻杆，它虽然没有钻铤重，但象钻铤一样，也是中空的钢管，有时是铝管；方钻杆，它是方形或六边形的中空钢管。换句话说，钻铤、钻杆以及用于连接单根钻杆的钻杆接头和方钻杆构成了钻柱。

钻柱有如下主要功能：

1）下放和提升钻头。无论要钻多深的井，钻头必须由钻柱下放到所需的深度。

2）钻柱的一部分（钻铤）对钻头施压以使钻头更有效地穿透地层（钻柱的钻杆部分不能用于对钻头施压，否则将导致钻杆很快失效）。

3）将旋转扭矩传递给钻头。司钻可能会说，它使钻头向右旋转（钻井时，钻头总是顺时针旋转）。因此，钻柱是一根由钻机上称作转盘的装置所驱动的传动轴。

4）它把高压钻井液从地面引导到钻头（钻井液可能是特殊的液体或气体），因此钻柱也是一根直立的导管或管线。

对于全体钻井队员来说，正确操作、维护钻柱是非常重要的。例如，钻铤是很重的，一根钻铤重达 1.5t。显然，操作如此重量的部件需要非常小心。而且当底端有钻头的钻柱下放到井内钻井时，它承受着巨大的应力，这种应力来源于扭转和钻柱部件的巨大重量。如果钻柱没有在最好的工况下工作，不久就会由于钻柱的失效而造成钻井中断或令人讨厌的停钻。

然而，钻 20000ft 或更深的井是很常见的，30000ft 的深度也已经钻达。显然，钻这些井的钻井队员，正确地操作、维护钻柱，这才使利用现代科技钻如此深度的井成为可能。规范地操作、维护钻柱对于现代钻井来说是非常重要的。

comes to an abrupt and unwelcome halt because of drill-stem failure.

Nevertheless, wells of 20,000 feet or more are drilled routinely every day, and depths of 30,000 feet have been achieved. Obviously the crews who drill these wells run and handle their drill-stem equipment properly to take advantage of the modern technology that makes such depths possible. Good handling and running practices are very important to modern drilling.

Exercise

1. How many parts does the drill stem consist of?

2. What is the function of the drill stem?

1.5 Kelly and Swivel

The upper end of the drill pipe terminates where the topmost length, or joint, of the pipe screws[22] onto a device called a kelly sub, or a saver sub. The sub is a short, connecting fitting that screws onto the bottom of the kelly. The bottom threads on the sub mate temporarily with the threads on the top of each length of drill pipe that is added to the stem. The sub saves wear on the threads of the kelly. When the threads on the sub become worn, it is replaced or rethreaded.

The drill stem was referred to earlier as both a drive shaft and a pipeline. The kelly is the upper terminus of this drive shaft and pipeline. The kelly is about 40 feet long. It is either square or hexagonal on the outside and is hollow throughout its entire length to provide a passage for the drilling fluid. Its outer surface engages corresponding square or hexagonal surfaces in the drive bushing. The rotary activates the drive bushing, which in turn rotates the kelly, The kelly moves freely up or down through the drive bushing even when the bushing is rotating.

A swivel is shown in Fig.1-2. This is a remarkable mechanical device. The swivel does not rotate, but it supports the Kelly, which does. Furthermore, the entire load of the drill stem is carried by the swivel whenever drilling is in progress. In addition, drilling fluid is introduced into the drill stem through the swivel. This fluid may be under pressure exceeding 3,000 pounds per square inch (psi). The fluid comes in through the gooseneck[23], a curved pipe that connects the swivel to a hose carrying the drilling fluid from the mud pump. The fluid then passes

1.5 方钻杆与水龙头

在钻杆的上端，处于顶端的钻杆接头用螺纹连接在被称为方钻杆接头或保护接头的设备上。方钻杆接头是一个短的连接接头，它用螺纹连接在方钻杆的底部。接头底部的螺纹与接进钻柱的每一个单根的顶部螺纹暂时相配合。这种接头可以减少方钻杆丝扣的磨损。当接头丝扣磨损后就更换它或重新攻丝。

上文把钻柱看作是驱动轴和管线。方钻杆是这根驱动轴和管线的上终端。方钻杆大约 40ft 长，外表为方形或六边形，整个方钻杆是中空的，从而为钻井液提供一个通道。它们外表面与方补心的方形或六边形内表面相吻合。转盘驱动方补心，从而带动方钻杆旋转。即使在方补心旋转时，方钻杆也可以在方补心内自由升降。

图 1-2 所示的是水龙头，这是一个重要的机械装置。水龙头不旋转，但它悬持方钻杆，而方转杆是旋转的。而且钻井过程中，水龙头始终承受着钻柱的全部重量。此外，钻井液也经水龙头流入钻柱。有时钻井液压力超过 3000psi。钻井液是通过鹅颈管进入的，鹅颈管是一根用来输送来自泥浆泵的钻井液的曲管，它连接了水龙头和水龙带。冲管是水龙头中心的一个垂直管道，钻井液通过它进入方钻杆和钻柱。总的来说，水龙头的功能是：1）承受钻柱重量；2）允许钻具组合旋转；3）为高压钻井液进入钻柱提供一个通道。

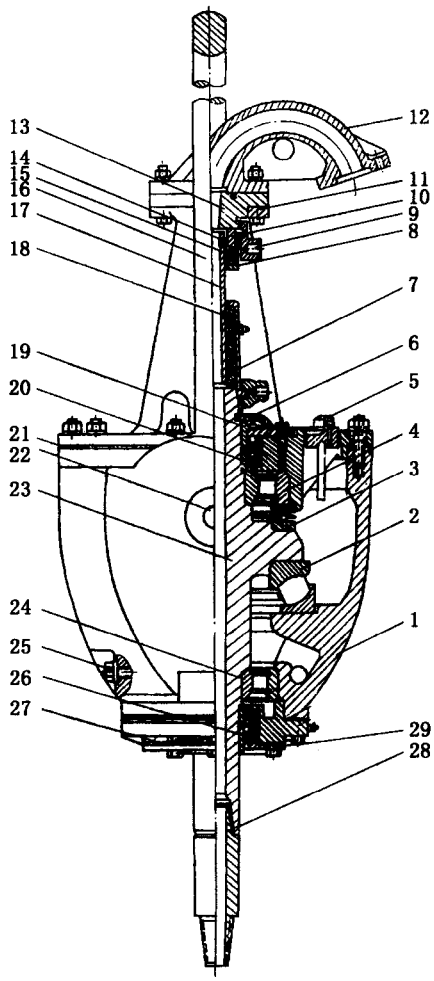

Fig.1-2 Swivel Structure

1—Shell; 2—Main bearing; 3—thrust bearing; 4—Upper alignment bearing; 5—Bolt; 6—Rubber diaphragm; 7—Packing box of wash-down pipe; 8—Packing box of upper wash-down pipe; 9—Gland ring of upper packing box; 10—Seal element; 11—Top cap; 12—Swan neck; 13—nipple joint; 14—Detent ring; 15—Packing box of upper wash-down pipe; 16—Bail; 17—Washing pipe; 18—Packing of wash-down pipe; 19—Upper oil-scaling gland; 20—Upper oil packing; 21—Ring gasket; 22—Pin; 23—Central pipe; 24—Lower alignment bearing; 25—Cock; 26—Lower oil packing; 27—Asbestos sheet; 28—Attaching connector; 29—Gland

图 1-2 水龙头结构

1—壳体；2—主轴承；3—防跳轴承；4—上扶正轴承；5—螺栓；6—橡胶伞；7—下冲管盘根盒；8—上冲管盘根盒；9—上冲管盘根盒压帽；10—密封压套；11—上盖；12—鹅颈管；13—短节；14—挡圈；15—上冲管盘根；16—提环；17—冲管；18—下冲管盘根；19—上油封盖；20—上机油盘根；21—垫圈；22—轴销；23—中心管；24—下扶正轴承；25—螺栓；26—下机油盘根；27—石棉板；28—配合接头；29—压盖

through the wash pipe, a vertical tube in the center of the swivel body, and into the kelly and drill stem. To summarize its purposes, the swivel 1) supports the load of the drill stem, 2) allows rotation of the drilling assembly, and

Exercise

1. Why is the kelly made as a hollow pipe?

2. The swivel keeps rotating in drilling, true or false?

3) provides a passageway for fluid under high pressure to enter the drill stem.

1.6 Rotary

The rotary is the piece of equipment on a rotary rig that gives the rig its name. Prior to the introduction of this type of drilling equipment, percussion drilling—the cable-tool system—was in universal use. To make hole, the cable-tool rig literally[24] hammered[25] the bit into formations. No rotating was involved. The rotary rig gives the drilling tools their rotary motion; the unit of the rig that gives this movement is the rotary.

The rotary is an extremely rugged and elementary machine that is distinguished primarily for its ability to withstand punishment and give long service. Operating through drive bushings, the rotary rotates the kelly and, through it, the drill stem and the bit. The kelly drive bushing may be driven by a square opening in the rotary table or by four pins that fit into openings in the table.

The rotary serves two main functions: 1) to rotate the drill stem and 2) to hold devices called slips that support the weigh of the drill stem when the latter is not supported by hook and elevators.

The rotary drive generally consists of a rotary-drive sprocket[26] and chain, the rotary drive sprocket being a part of the drawworks. However, an independent engine, or an electric motor with a direct drive to the rotary is also used on many rigs. In such case, the rotary is driven by a drive shaft rather than by chains and sprockets.

1.7 Blocks and Wire Line

The travelling block[27], crown block[28], and wire line are the three components whose function is to connect the supporting derrick or mast with the load of pipe to be lowered into or withdrawn from the hole. During drilling operations, this load usually consists of the drill pipe and drill collars, with the bit attached to the bottom of the drill collars. However, a string of special pipe called casing[29], which is often a heavier load than the

1.6 转盘

转盘是旋转钻机上的一种设备，旋转钻机因此而得名。在使用这种钻井设备以前，一般用的是顿钻，这是一种绳式钻具。为了钻井，顿钻钻机把钻头打进岩层，而没有旋转运动。旋转钻机使得钻具旋转，提供旋转运动的钻机部件就是转盘。

转盘是非常耐用，它是最基本的设备。它在恶劣工况下的工作能力以及坚固耐用使得它有着出色的性能。转盘通过方补心使方钻杆旋转，再通过方钻杆使钻柱和钻头旋转。方补心由转盘上的大方瓦或装在转盘开口内的四个销来带动。

转盘有两个主要功能：1）旋转钻柱；2）当钻柱不用大钩和吊卡悬持时，在转盘上安放卡瓦来支撑钻柱重量。

旋转驱动装置一般由旋转链轮和链条组成。链轮是绞车的一部分。然而许多钻机上也经常使用一台直接驱动转盘的单独的动力机或电动机。此时，转盘由传动轴而不是由链条和链轮来驱动。

Exercise

1. What is the role of the rotary?
2. What is the driver of the rotary table?

1.7 游车与钢丝绳

游车、天车和钢丝绳是三个用来连接支撑井架并承载下放或提升钻柱的主要部件。钻井过程中，负荷通常包括钻杆和钻挺的重量，钻头安装在钻铤底部。然而，一长串比钻杆和钻铤更重的特殊管子必须下放到井中并用水泥固结，这种管子称为套管。钢丝绳绕过井架顶部的天车滑轮。