英语综合技能培养与提高

科普(短文翻译)分册

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《英语综合技能培养与提高》丛书编委会

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序

《英语综合技能培养与提高》是一套构思独特、编排新颖的丛书。它包括词汇、语法、阅读、科普（短文翻译）和标准化模拟试题五个分册。各分册既可单独使用，合在一起又构成一个有机的整体。词汇、语法和阅读三个分册着重单项基本技能的训练，这三本书有以下特点：

1. 讲解简明扼要，深入浅出，对疑难点分析透彻，不但能使读者知其然，而且能使他们知其所以然，从而达到举一反三的效果。

2. 在传授知识的同时，注意技能的培养和学习方法的指导。

3. 练习的形式丰富多样，并与讲解的内容紧密结合，能帮助读者进一步巩固所学的知识及提高语言技能。

科普（短文翻译）分册题材广泛，语言精练，译文准确，能使读者较快地提高阅读速度、理解能力和翻译水平。标准化模拟试题分册题型丰富，实战性强，中高级难度层次分明，对提高读者的应试能力大有裨益。

中国石油天然气总公司北京外语培训中心等几所院校的英语教师，从学生的实际需要出发，以语言学和测试理论为指导，结合自己丰富的教学经验，精心编写了这套具有较强的系统性、科学性和实用性的丛书。这套丛书既适合广大英语自学者使用，也可供大专院校师生参考，尤其适合参加各类晋职考试和四、六级英语考试的读者使用。我相信，《英语综合技能培养与提高》丛书的出版，一定会受到广大读者的热烈欢迎。

王式仁

1995年1月27日
于北京大学畅春园

前　言

随着对外合作交流的发展，英语作为一种重要的交际手段，已成为人们不可缺少的工具。如何在短时间内迅速提高英语水平已成为大家日益关注的问题。既想学得快，又想学得牢、以不变应万变，顺利通过各类考试，只有通过训练，才能真正掌握语言学习的基本技能。为此，我们根据多年来从事英语培训教学工作的经验，编写了《英语综合技能培养与提高》这一丛书，以帮助朋友们攻克难关，走入英语语言的自由王国。

本丛书包括词汇、语法、阅读、科普（短文翻译）和标准化模拟试题五个分册。词汇、语法和阅读三个分册着重技能培养，介绍并分析了各类题型及解题技巧，帮助读者熟悉各类考试形式和要求、掌握应试技巧、提高应试能力，此外，还配有练习题及题解，以帮助读者及时巩固所学知识。词汇分册分三、四级和五、六级词汇练习，习题配有注释、译文和词义辨析，解决了词义相近和用法相近的词 给读者带来的困扰。语法分册分析了当今考试中常见的疑难点，并配以各种习题和试题，使读者通过练习，轻松地掌握令人生畏的语法现象。阅读分册分单句理解和篇章理解两个部分，因为单句理解是篇章理解的基石，只有在准确地理解单个句子含义的基础上，才能做到准确地理解整个篇章的含义，该分册还选了许多优秀范文作为阅读练习材料，并配以详解。科普（短文翻译）分册采用英汉对照的体例，选材面广，趣味性强，语言精美，译文准确，可使读者通过大量阅读实践，迅速提高阅读速度及理解能力，提高英汉互译速度及水平。标准化模拟试题分册包括20套模拟题，分A（5～6级）、B（3～4级）两种试卷，旨在帮助读者进行全面复习及自我英语水平测试，通过强化模拟训练，从容应试，取得最佳效果。

本丛书由中国石油天然气总公司北京外语培训中心、石油大学（北京）基础系、石油大学（华东）、石油大学（广州）、北方工业大学、哈尔滨工业大学等院校编写。科普（短文翻译）分册由紫缨、孙旭东、罗万象担任主编，郭蕴崇、呼玉国担任副主编，徐方赋、阎文江、赵秀凤、唐中夫参加了编写工作。这套丛书适用于报考各种标准化水平考试的读者，以及大专院校师生和英语自学者，尤其适于参加各类晋职考试及四、六级英语考试的读者参考使用。

丛书在编写过程中，得到了中国石油天然气总公司北京外语培训中心司潮春主任的大力支持，北京大学英语系的王式仁教授对该丛书提出了许多宝贵意见，英国专家 Patricia Clague 及 David King 和美国专家 Justin Auld 对本丛书进行了指导与最终审定，在此一并致以诚挚的谢意。

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I . Petroleum Industry

1. How Oil Was Formed

Oil was formed in ancient swans and seas. People believed that oil was made out of the bodies of sea animals and plants that died and became covered with sediments. As the sediments became thicker and heavier, the pressure and heat may have melted and squeezed out the oil in these animals and plants. Then the oil gradually soaked into the sediments, which later became covered with more sediments.

It has been found that all animals, no matter where they live or what their size, have oil in their bodies.

Have you seen melted fat running out of a broiling lamb chop or a piece of bacon? Fat is a solid form of oil. You know both seal fat and whale blubber can be melted into oil. And you have certainly heard about fish oils and duck fat. You, too, have a supply of fat under your skin.

Plants also have oil, although you do not usually notice it.

2. The Tomorrow of Petroleum

The creation of synthetic protein from petroleum to help feed men and cattle is high on the list of current oil company research projects in some countries. Manufacturing food from oil will some day become a reality.

Already responsible for many plastics, fibres, and synthetic rubber, petrochemicals will play an important role in tomorrow's demand for new things. As the name implies, petrochemicals are chemicals made from petroleum, from the hydrocarbons found in the latter. By cracking and separating parts, scientists change these hydrocarbons into drip-dry shirts and plastic dishes.

Petroleum is wonderfully compliant about being broken down and allowing its atoms to be arranged in new ways. Petrochemicals today account for one-fourth of all the chemicals made; in ten years this amount is expected to double.

There indeed seems to be no end to the tasks that petroleum will be asked to do. People will not stop finding new uses for it.

3. Ways of Collecting Oil

Oil is usually found in porous rock under a layer of impermeable rock which prevents it from escaping. It can then only be reached by drilling. The initial gushing of oil out of a drill pipe is caused by the pressure of the gas trapped and compressed immediately above the oil deposits. In time, this pressure decreases and the oil has to be pumped to the surface. The crude oil raised directly from wells is not yet for use. It has to be refined.

It has taken about 600 million years for the world's oil reserves to be formed. It will probably take us only a little over a hundred years to exhaust them.

4. LPG And Ethylene Pipelines

In addition to natural gas pipelines, another class of pipeline is employed in the petroleum industry. These are to cater for liquid petroleum gases, which in the main consist of propane, butane and ethylene.

These substances, although in a gaseous state at normal atmospheric temperature and pressure, can be liquefied either by means of pressurization or refrigeration, and consequently transported as liquids , there by avoiding the disadvantage of gaseous transportation. Refrigeration requires specialized plant and is not so easy to maintain over long distances as pressurization, with the result that in practice most LPG lines are made to operate on the latter principle.

This still requires the use of back pressure valves, high pressure storage tanks, and a fairly sophisticated system of controls and operation, compared with conventional lines. These products are usually delivered to the customer in pressurized storage containers. The contents are converted to the gaseous form by means of vaporization.

5. Gasoline and Service Stations

Prices vary by state depending on local taxes. The cheapest variety of gasoline, called "Regular", is perfectly good except for high-powered engines, high altitudes, or cars requiring "unleaded" gas.

The U. S. gallon is slightly smaller than the British "imperial gallon", approximately four liters according to the metric system.

One can order by asking for a specific number of gallons or by price ("$ 8 worth please") or just asking to have the tank "filled up". Most tanks hold 10 to 20 gallons when full.

Routine free services which one can expect (or ask for) at service station include: checking the oil, tires, and water in the battery ; cleaning the windshield; use of their rest rooms (gas stations are the normal places to stop when on a long trip). One does not tip gas station attendants for any of these services. Many stations have "self-service" pumps where motorists put in their own gas at a slightly reduced price —— and forego other services (although anyone can use the Rest Rooms).

If your engine is hot, the attendant should not be asked to check the water in your radiator and may decline to do so. So many attendants have been badly burned by gushing steam that this is no longer a regular service —— as it used to be.

6. Crude Oil Pipelines

In a crude-oil producing field, the gathering lines from the wellhead to the gathering centre in themselves often constitute pipelines of substantial diameter and length.

The main oil pipeline, however, transports total production from the gathering centre to the nearest refinery or ocean terminal.

Until about 1957, crude thus shipped, in particular to Europe, arrived at coastal refineries and any further movement was in the form of refined products. From 1957 onwards, however, inland refineries were developed in Europe, resulting in the construction of large, inter-oil -company-owned crude-oil systems.

The rapid development of offshore production since the late 1960s has greatly increased the number of submarine crude-oil pipelines installed.

Generally speaking, crude-oil pipelines are the most fundamental pipeline systems used in the oil industry —— although there are complexities used introduced where, for example, many differing segregated crudes are shipped through the jointly owned systems, or in the case of high pour point crudes which set apparently solid at temperature above the ambient.

7. The History of Pipelines

The transport of fluid by pipeline was known to early civilisation . The ancient water aqueducts, which may still be seen today, are one of several examples of this.

Pipelines have been used for transporting oil since the first years of commercial crude-oil production. A six-mile long, two-inch diameter line was built in Pennsylvania in 1865. In the late nineteenth century, the Russians built pipelines from their Caucasian oilfield to the Caspian Sea, one of them over 400 miles long. In 1911, BP, then the Anglo-Persian Oil Company, commissioned its first crude-oil pipeline 130 miles long from Masjidi-Sulaiman to Abadan.

In the oil-producing countries of the Middle East, there was no practical alternative to the pipeline for the movement of large volumes of crude oil to the coast and so here development of pipelines continued. In Europe, however, with widely distributed areas of consumption fed by traditional means of transport from coastal refineries, development was slow. It was the USA with its own crude-producing wells and rapidly expanding centres of production that the modern pipeline industry developed. Since 1957, however, Europe has seen a rapid growth of pipeline networks for crude oil, refined products and gas. Similar developments have taken place in all other industrialized ares of the world.

8. Control Systems

At one time, in addition to staff on the "origin" or "base" pump station and the receiving terminal, all booster pump station along the pipeline had to be manned "round the clock" by shift workers. In recent years, remote automatic control of pipelines had been developed to the point where complex systems extending over hundreds of miles and serving terminals, are controlled from one central control room.

Remote pumping stations and receiving terminals are designed for fully automatic operation on a "fail safe" basis. Operation of the principal equipment of the station or terminal may be initiated from the system control room and essential data are transmitted to it. Communication is normally by microwave radio or direct cable, but public utility circuits are sometimes used.

Many pipeline systems make use of computers to assist in batching schedules, that is the predetermined cycle of products or crudes. Some of the newer systems are progressing to the point when, ultimately, the control of whole systems will be "direct on line" to the computer.

9. Petrol

There is not enough petrol in the world for everyone now, and each year there is less, so what are we going to do when it finishes? Perhaps we will go back to horses and carriage and bicycles.

In the Second World War, some people did not use petrol in their cars. They made gas from wood and plants instead, and then they put it in big bags on top of their cars. The cars did not go fast, but it was better than nothing. But we can not cut down all our trees to make gas ; we need them for other things too.

Besides gas, we can also use electricity for our cars, but first we must make the electricity! Some countries have coal, and they make electricity with that, but we will not always have coal. Other countries have big, strong river, and these turn turbines and make electricity more easily and cheaply.

We are also able to get power from the tides. We put turbines in the mouth of a river. Then, when the tide comes up, it turnes the turbines , and when it runs back towards the seas, it turns them again. And we know that the waves of the sea can also turn turbines when they go up and down.

10. Oil Refining

An important industry, oil refining, grew after the Civil War. Crude oil, or petroleum

—— a dark, thick ooze from the earth —— had been known for hundreds of years. But little use had ever been made of it. In the 1850's, Samuel M. Kier, a manufacturer in western Pennsylvania, began collecting the oil from local seepages and refining it into kerosene. Refining, like smelting, is a process of removing impurities from a raw material.

Kerosene was used to light lamps. It was cheap substitute for whale oil, which was becoming harder to get. Soon there was a large demand for kerosene. People began to search for new supplies of petroleum.

The first oil well was drilled by E. L. Drake, a retired railroad conductor. In 1859, he began drilling in Titusville, Pennsylvania. The whole ventures seemed so impractical and foolish that onlookers called it "Drake's Folly". But when he had drilled down about 70 feet (21 meters), Drake struck oil. His well began to yield 20 barrels of crude oil a day.

News of Drake's success brought oil prospectors to the scene. By the early 1860's, these wildcatters were drilling for "black gold" all over western Pennsylvania. The boom rivaled the California gold rush of 1848 in its excitement and Wild West atmosphere. And it brought far more wealth to the prospectors than any gold rush.

Crude oil could be refined into many products. For some years, kerosene continued to be the principal one. It was sold in grocery store and door-to-door. In the 1880's and 1890's, refiners learned how to make other petroleum products such as waxes and lubricating oils. Petroleum was not then used to make gasoline or heating oil.

11. The Petroleum Industry

Oil by-products have also become more efficient and cheaper to use than other fuels, especially coal. Heat for our home, offices, and school, for example, is more and more provided by oil instead of coal. Oil is now also used to power most forms of transport; it has replaced coal in ships and trains in many countries. Oil is also used to lubricate many different kinds of machines, including automobiles. Without lubrication, the moving parts of our machines would quickly wear out.

Another important factor in the growth of the oil industry has been the development of petrochemicals. Many products have been created by chemists from petroleum. These include most of our modern plastics and fertilizers. Indeed, the increase in agriculture productivity —— sometimes known as the green revolution —— could not have taken place without petroleum-based chemicals, including not only those that enrich the soil like fertilizers but also those that kill weeds, insects, and other pests —— herbicides, insecticides, and pesticides.

The greatest problem for the future of the oil industry is that petroleum is not a renewable natural resource. All the petroleum that exists, no matter whether it is hidden under the earth or the seas, was created millions of years ago. As the use of oil has increased, so have the predictions that oil will soon be exhausted. So far, improved techniques for exploraton, drilling, and recovery of petroleum have kept the supply ahead of the world's consumption.

The oil industry, however , looking ahead to the day when the supply of oil may become exhausted , is engaged in research to find not only substitutes for oil but also other sources of energy.

12. Tankage

The total volume of tankage installed at any terminal will vary with a number of factors. These are principally the size and frequency of vessel arrival (taking into account possible weather delays) ; the consistency of the shore side crude arrival to, or discharge from, the terminal; and the number of grades of crude or product to be handled at any one time. Finally, governmental requirements as to minimum strategic storage often have a substantial effect. Arising from these variables ,the amount of tankage might lie between five and ten days of the normal rated throughput of the terminal.

As is the case for the tankers, crude oil shore tankage has over the past ten to fifteen years increased rapidly in size and, in consequence , the cost per unit volume of storage has been substantially reduced. At one time, 20 000 to 25 000-ton tanks were considered a normal maximum. In recent years, however, by the use of high-strength steels and new design methods, it has been possible to build tanks up to 150 000 tons capacity. Although the increase in tank size combined with the high loading and discharge rates has increased the need for large diameter link-up pipework,there is relatively less of this and so its effect on the cost is small,except where there is a long distance between the jetty and the tankage. The ability to receive the contents of one large crude carrier in at the most two tanks,is obviously an advantage from the point of view of segregation of different crudes.

The size of tankage in product terminals,although showing an upward trend,has not increased to the same extent. This is due to the need to maintain at most terminals a wide range of products in limited batch sizes.

13. Numerical Control

The major disadvantage of machine tool automation thus far described lies in the economics of the process. It is expensive to tool a machine for automatic production. Therefore, unless the part is to be made in very large numbers, the cost becomes prohibitive. Great need exists for a method that permits rapid automatic production, economical in joblot amounts. The answer has been found in the numerical control of machine tools.

In numerical control, the blueprint for a part is converted into a punched paper-tape instruction, which is adapted via a computer to direct the operation on a specific machine tool. Thus general purpose machine tools are "instructed" to machine a part according to information stored on a roll of tape. The tape can be re-run for more copies of the same part or can be stored for future use. Furthermore, other tapes can be used to "command" the same machine tool to make other parts.

There is a wide area of performance duplication between numerical control and automatics. Numerical control, however, offers more flexibility, lower tooling cost, quicker changes, and less machine down-time.

In machining contours, numerical control can mathematically translate the defined curve into a finished product, saving time and eliminating templates. This can in turn improve accuracy. Another advantage appears to be great saving of machine time, the equivalent of increasing productive capacity with no increase in facilities.

14. Bitumen

The residue obtained after distillation of crude oil to remove materials boiling up to the end of the gas-oil range (about 350 C), can be further distilled, under vacuum, to give waxy distillates for the preparation of lubricating oils, or for feeding to units such as a catalytic cracker. The "vacuum residue" left behind from this second stage of distillation is known as "bitumen". By controlling the temperature to which the distillation is continued, so the "hardness" and other properties of this residual bitumen can be varied, although such properties will also be very dependent on the crude oil used. Bitumen is a dark viscous material and in fact is normally regarded as a solid at ambient temperatures. Because of its adhesive, plastic nature and water-proofing qualities, it is widely used for road-making purposes, generally in the form of a binder for stone aggregates. For such purposes, resilience to resist deformation by heavy traffic is important, and obviously the bitumen must not become soft and sticky on a hot day. It should be noted that because of the hundreds of compounds it contains, a bitumen does not have a sharply defined melting point, but merely become progressively softer and more fluid as the temperature is raised. The hardness or otherwise, of a bitumen is therefore expressed in terms of a "softening-point" test which measures the temperature at which the bitumen reaches a standard, but quite arbitrary degree of fluidity. Actual hardness, at a given temperature, is determined by another criterion, the penetration test, which measures the depth to which a standard needle will sink into a bitumen, when a specified load is applied to the needle for a fixed time.

For a bitumen obtained by vacuum distillation, from a given crude oil, there will be a certain relationship between softening point and penetration test. It is possible however to modify this relationship by a process known as "blowing". If air is blown through molten bitumen, chemical reactions take place, changing the nature of the molecules and this causes the softening point to increase. The product also has a reduced ductility, this being a measure of the extent to which a thread of bitumen can be stretched. Such "blown bitumen", because of its high softening point, and its more rubbery nature, is particularly suitable for impregnating roofing felts, where the prime requirement is for a product which will neither crack in cold weather, nor flow under hot sunlight.

15. Fossils and Oil

People sometimes ask, "Why waste time studying fossils"?

Studying fossils is far from being a waste of time, because many useful facts can be learned from them. Generally speaking, fossils are epecially important because they are the only clues to the existence and appearance of life on Earth millions of years ago. When arranged in proper geologic order, fossils reveal how life has steadily developed from lowly-organized primeval creatures to the complex animals of today . Such knowledge helps us better to comprehend the origins and evolution of life, and this in turn helps us to understand a little of what we ourselves are.

Since different fossil types are found in different strata, certain distinctive fossils can be used to identify different kinds of sedimentary rocks, including those below ground level or separated by miles of ocean. Even rocks at very great depths, when bored by the drills of engineers, can be identified by their fossil contents. Fossils are therefore valuable aids to mining and petroleum engineers.

Particularly important are the microfossils, which serve as indicators of the presence or absence of subterranean oilfields. In his laboratory the micropalae ontologist washes the rocks brought up in the core of the oil-drill, and separates the tiny fossils from them.

The specimens are then mounted on special slides and examined under a microscope. Information derived from these minute remains frequently provides valuable data as to whether the rocks pierced by the oil-drill are of the kinds usually associated with oilfields.

16. Gas and Condensate Reservoirs

Just as in the case of oil, the gas may be contained in a closed reservoir where there is no water closely associated with the gas or, on the other hand, it may be in a reservoir where it is in direct contact with an aquifer possessing a competent water drive mechanism. In the first case, where the water drive mechanism is poor or non-existent, the gas is driven out of the pores of the reservoir rock by the expansion of the gas itself, the reservoir pressure will decline, and the production of the wells will fall. In the second case, where there is an effective water drive mechanism in operation, the gas will be driven out by the expansion of the aquifer water into the pores vacated by the gas, and there will be no marked decrease in the reservoir pressure or in the production capacities of the wells during their producing life . Where an effective water drive mechanism exists, the same considerations arise as with an well —— the wells should not be located too near the "gas/water contact", nor should production rates be so high as to cause fingering or water coning.

In certain instances gas reservoirs of high pressure and temperature, which are usually found at great depth produce substantial quantities of liquid petroleum along with the gas.

This liquid does not come from a separate oil zone, but exists as a gas in the reservoir and is made up of that part of the reservoir gas which condenses as its pressure is reduced by production. The liquid fraction is known as "condensate" and the type of reservoir is known as a "gas condensate reservoir".

17. Drilling (1)

After the geologists and their assistants have decided where there is likely to be oil, the actual drilling can begin. An exact place is picked to spud in the well; that is, to begin drilling.

This begins one of the biggest, most exciting, and most expensive gambling games in the world today. Have the geologists been right? Will the drilling produce oil? Will all the money invested in the well, often involving millions of dollars, return the investment, or will it be a total loss? A large proportion of all the wells drilled are dry holes, wells that have not struck oil. This is particularly true in new oil fields. The first producing well in Alberta, Canada, came in only after thirty years of exploration and 133 dry holes. Obviously, in that case the indication of oil were strong enough to make it worthwhile to continue the search.

When the spot to spud in the well has been selected a portable derrick is erected to hold all the equipment and machines that will be used while the drilling is going on. The derrick is an open-work tower , ordinarily made of steel. It is a symbol —— for both the oil industry and the search for petroleum. Today, most derricks can be erected in a few hours.

18. Drilling (2)

Drilling techniques are used to drill an oil well. One of them , cable-tool drilling, is the same system that was used for digging the first real oil well back in 1859, a system originally used for digging wells for water. Basically, it involves punching a hole deeper and deeper into the ground. A cutting tool, called a bit, on the end of a drilling stem is raised and then allowed to fall; the bit cuts and crushes the dirt or rock at the bottom of the well. When the stem and bit are pulled up, the debris at the bottom of the well is removed. Then the bit is dropped again to crush more rock, and the process is repeated over and over again. Casing, steel pipes that line the well for a variety of reasons, is used in all wells except those abandoned at very shallow depths.

Cable-tool drilling is only used when the well is shallow and when there is hard rock to cut through. Most modern wells are drilled by the rotary drilling method. This is similar to the way in which a carpenter drills a hole in a piece of wood. A cutting bit drills with a circular or rotary motion, at the same time pushing up the waste from the drilling process.

Cable-tool drilling was derived from the method for drilling wells for water. Thanks to the rotary method, both water and oil have been discovered at great depths beneath the surface of the ground. Great reservoirs of water have been found by oil drillers below the surface of Libya and Saudi Arabia, two arid countries which are large producers of oil.

19. Man and Oil

Many years ago, when most people got their water direct from wells, they were sometimes annoyed by a dark liquid which came out of the ground and polluted the water. It smelt bad and was extremely dirty . Some people discovered that it was good for caulking boats —— it prevented water getting in through cracks in the wood. Others found it was a good medicine for the stomach. But most people thought it was a nuisance. Today we have a rather different opinion about this substance known as crude oil.

In 1855, a young teacher at Yale University, Benjamin Silliman, became interested in crude oil. He soon found that it could be used as a fuel for heating and lighting. So he asked his friend Edwin Drake, a railwayman, to try to produce this oil on his land in Philadelphia. Drake tried to collect the oil, which was seeping to the surface, by digging a large hole. This was not successful and he decided to try drilling. Suddenly, as he was drilling the hole, oil began to flow out in a great stream. The first oil well had started production and the age of oil was just approaching. Today, J. P. Getty and Howard Hughes, who are said to be the world's two richest men, both have fortunes based on oil —— the first on the Standard Oil Co. and the second on a highly fortunes efficient oil drilling tool.

20. Construction of Pipelines

Almost all cross-country pipelines are buried, usually to a depth of cover of about one metre. In some remote areas, pipelines are laid above ground, but this does not always result in cost savings, as provision must frequently be made for expansion in the form of costly pipe supports and guides.

The technique of economic construction involves highly specialized equipment and experienced contractors. A pipeline "spread" will comprise several teams working in unison, starting with right-of-way clearing and grading, followed by pipe stringing, then the welders (perhaps the most vital craft of all), followed by ditching machines , coating machines, and then by sideboom tractors which will lower the completed continuous pipe into the ditch and backfill. Last of all come the clean-up crew to restore the land to its former condition. In good pipeline country, completed construction rates of 1 to 3 miles per day are normal and the distance from front to back of a "spread" will not exceed 2 to 3 miles. Special crews deal with road and river crossings along the route and the installation of valves, etc.

21. Berth Design

For maximum utilization, there is no doubt that a conventional jetty built from the shore is most desirable. It provides the safest berthing conditions and enables all services to be readily provided. If it is necessary to build offshore, then a "sea island" is to be preferred, that is to say a structure founded on the sea bed. This will, in a favourable location, give the same berthing security as a jetty but, clearly, it does give problems in providing services. The construction of a "sea island" is, however, relatively more expensive than a buoy mooring. The use of a single buoy mooring (SBM) has developed in recent years, such as installed at Das Island. These allow a vessel to approach in any direction and to secure to the buoy from the bows. Loading hoses are connected from the buoy to the vessel, through which it is either loaded or discharged. Despite its apparent simplicity, this system does have considerable disadvantages in that the long floating hoses are vulnerable to damage and also prohibit high loading or discharge rates due to pressure and/or flow limitations. Additionally it is extremely difficult to provide any other services to a tanker so moored, unless they can be conveniently carried out by lighter.

The increasing size of the crude carriers demands stronger and more carefully designed jetties and fendering. Additional cost is also occasioned by the increased size of pipework necessary to meet the high flow rates required by such vessels. Nevertheless, there are considerable economies in the long run, in that the capacity of the jetties increases markedly. A jetty handling vessels of only 32 000 dwt is capable of an annual throughput of approximately 6 million tons per annum. A similar jetty handling all 200 000 dwt. vessels would be capable of a throughput of 40 million tons per annum. In practice, of course, this latter figure is never realized, as any jetty has to handle a fairly wide range of the vessels still in service. Nevertheless, in specific cases, throughputs of 15 to 20 million tons per annum over one jetty have been achieved.

22. Fleet Programming

The programming of the group's fleet, i. e. the planning as to what ship shall load what cargo at which port and deliver to which other port, is agreed as a result of the close liaison between the Operations Group and Supply Department. The complexity of achieving, in the most economic manner, the desired delivery programme of a wide range of crude oil and products on a world-wide basis by the use of a large and varied fleet of ships is obvious. No less so is the need for the closest liaison between the supply organization dealing with this aspect of seaborne transport and BP Tanker Company. The need for flexibility in the shipping programme is of paramount importance as the imponderables of weather, political events, port and canal congestion , maritime accidents and so on, often upset the most carefully drawn up programme.

The orders given to a ship for a certain voyage are therefore susceptible to last-minute changes, and the carrying out of that voyage in the safest and most efficient and economic manner becomes the responsibility of the ship's master under the orders given from his head office, i.e. Operations Group.

23. Fleet Administration

To administer and manage this enormous fleet requires a high degree of skill and versatility in the Headquarters staff. The technical staff concerned with shipbuilding must have the necessary theoretical knowledge as well as practical know-how and must keep abreast of developments in ship design, etc., in order that the heavy capital investment in building new ships shall produce the most efficient vessel for the company's particular requirement. The programmers and ship managers must be able to take into account all the many factors which influence the choice of ship for a particular voyage. Engineering and maintenance staff must have a high degree of technical knowledge as well as wide practical experience to be able to diagnose and prevent the kind of faults that can occur in the complex machinery used on board. Planning and research staff must be able to look ahead and not be restricted by precedent and past experience. Navigational and marine considerations at ports and in areas throughout the world must be considered by marine experts in the Headquarters office.

The complex arrangements for establishing the conditions of service, salaries, wages, leave and so on, for the thousands of seafarers who man the ships, are dealt with by Fleet Personnel Division who have a specialized knowledge of the circumstances relating to a seafarer's employment, including the need to act as a link between him and his family.

24. The Separation of Oils

When we boil some water in a pot over the fire, it changes into a vapour (steam). If we hold a piece of cold glass in the vapour, drops of water form on it. The vapour changes back into a liquid. Now suppose we carefully heat a mixture of petrol and kerosene (Do not try this; it might catch alight and cause damage!). Suppose we make the mixture a little hotter than boiling water. The petrol, which boils easily, turns into a vapour; but the kerosene, which does not boil so easily, remains as a liquid.

We can collect the petrol vapour and cool it in another container so that it runs back into a liquid. In this way we have separated the two oils. There is another similar way of separating two oils. We can heat the mixture so that both oils turn into vapours, and then slowly cool the vapours. The kerosene vapour turns into a liquid first and can be collected; the petrol does not turn into a liquid until it has been cooled much more.

Petroleum is a mixture of many oils, but they can be separated in the ways we have de-