Pacific which takes the longer journey (as the European eel does) from these warm waters to the eastern side of the ocean. A very similar patch, or tongue, of warm water runs far to the eastward from the Queensland coast, to the northward of New Zealand, and here possibly, and even probably, is the chief breeding place of the southern eels. At the same time the comparatively limited distribution of some of the Pacific eels goes to show that these are poor travellers, and are somehow or other hedged in by unknown barriers. We begin to see what a wonderful field of investigation Dr. Johannes Schmidt has made his own. For a score of different eels the breeding place of each has to be determined and the routes followed by old and young have to be mapped out; agreement with the known habits of our own eels has perchance to be verified, or perchance to be disproved. Every locality and route must be studied in regard to its hydrographical features, and what they have in common must be made clear. In the end general truths and common features may emerge, giving an insight into the history of the eel-tribe and the sources from which their strange habits or instincts came.

There is a curious little point, to which Dr. Johannes Schmidt has directed attention, in the name which the eel receives among many remote races of men. It is called 'Tuna' by the Maori, and its name in Samoa, the Philippine Islands, and even in Madagascar is but a slight variant of the same word. This looks like a page from that early history of the migrations of seafaring men of which Prof. Elliot Smith and others have told us. When we find in the Semitic languages and in Greek what looks very like the same word in θύννος or *tunny*, though it be used of another fish, I should not scout as impossible a connexion between all of these; for we begin to see that a few animal names are so old as to care little for linguistic boundaries, and are perhaps the oldest of all old words surviving in the speech of men.

D. W. T.

Oil and the Oil Engine.

SINCE the foundation of the mineral oil industry many a prediction of an oil shortage to occur within the lifetime of the prophet has been made; but in spite of the astounding increase in the use of oil as a fuel within the last two decades, a consumption which is certainly still far from having reached its peak value, there is not the remotest reason to anticipate an oil shortage within the next hundred years. Indeed, in view of the known reserves of oil in hitherto untapped fields, and of the vast quantities still remaining underground in partially exploited districts, future generations should be secure against an oil shortage for at least a thousand years. To-day, the world's output of oil is far below the capacity of wells actually in production, and were it not for output-limiting agreements between oil-producing interests the market would be flooded.

The crude mineral oils do not reach the consumer as such, for being complex mixtures of hydrocarbons of widely varying volatility, they must first be subjected to distillation and other processes whereby the crude product is divided into four main groups, the boiling-point ranges of which serve for their chief market classification. Petrol is the first of these fractions, distilling over at temperatures up to 150° C., and constitutes the main supply of the world's motor spirit. Kerosene or paraffin oil, distilling between 150° and 300° C., is chiefly in demand as an illuminant. The heavy fuel oils, boiling between 300° and 350° C., are burnt directly for steam raising or in engines of the Diesel type. The fourth and final fraction supplies mainly lubricants, waxes, and pitch.

The relative proportions of these four fractions vary with the nature of the crude oil; petrol is most in demand and therefore commands the highest price. So much is this the case to-day that the petrol fraction, although in the best of oils never amounting to more than 20 per cent of the total distillation products, pays for practically half the total oil production and refining costs. Thus there is every incentive to increase the yield of petrol by the thermal decomposition or 'cracking' of the heavier fractions. So successfully have such methods been applied that, to-day, the price of petrol shows the least increase since 1913 of any of the commodities in everyday use, and this in spite of greatly increased costs of production and refining.

The remarkable development within the last fourteen years of cracking processes is clearly brought out in the following table:

Petrol Production in the U.S.A. in Millions of Gallons.

Year.	By direct Distillation.	By Condensation from Natural Gas.	By Cracking.	Petrol Production in per cent of Crude Oil.
1914	1112	..	..	18·2
1919	2601	95	320	25·9
1923	4461	175	1120	30·4
1927	6213	1029	3239	36·7

But for this development in cracking and other processes it is clear that, in order to meet the demand for petrol as a motor spirit, production would have had to be practically doubled, with the result that the petrol fraction would have had to bear some 80 to 90 per cent of the total crude oil production and refining costs, and the market price of petrol would have been doubled or even trebled. Thus the increased efficiency in refining, which is chiefly a result of the introduction of cracking processes, has not only kept down the price of petrol to the consumer, but has also prevented a wasteful flooding of the market for heavy oil, so that the price obtained for this fraction is more proportionate to production and refining costs than would otherwise have been the case.

Even so, the relative prices of petrol and heavy oil, when compared on an energy content basis, are approximately 3 or 4 to 1. There is thus every incentive for the development of heavy-oil-burning engines suitable for use under conditions in which the petrol driven motor has hitherto reigned supreme. A move in this direction has already been made by the introduction of the Diesel-type heavy-oil-burning engine for the purposes of motor road transport.

Diesel engines can be conveniently classified into three main types, according to the speed at which they are designed to run. Low and medium speed Diesel engines which develop their full power at speeds below 500 and 1000 r.p.m. respectively are, chiefly owing to considerations of weight per unit of power developed, practically restricted to use in stationary installations or for marine purposes, and to a less extent in railway locomotive practice. High speed Diesel engines running at speeds of more than 1000 r.p.m. have the advantage of higher power-weight ratios than those possessed by the lower running types, and are being successfully employed for heavy road transport. It is probable that the use of such engines will, in time, be extended to the lighter classes of road transport vehicles and even to aircraft.

In addition to the great saving in fuel costs, the use of the Diesel engine offers further important advantages such as greater efficiency, compression ignition, less volume of fuel carried for a given mileage, practically eliminated fire risks, and a reduction in the size and area of the cooling system. The ultimate successful application to road and air transport of the high-speed Diesel engine will, however, depend largely upon the extent to which the designer is successful in reducing its inherent disadvantages, the chief of which are low power-weight ratio, starting difficulties, the offensive nature of the exhaust gases, oil creepage, and heavy transmission stresses. It remains to be seen, if and when the heavy oil engine has been sufficiently developed to compete successfully with the petrol motor, whether the resulting demand for heavy oil will not lead to such a levelling out of prices for the respective fuels that the Diesel engine will be robbed of one of its chief merits.

These recent developments in the heavy oil engine and its uses are a strong incentive to continued improvement in the petrol motor. Until the gas turbine has become a working proposition, the main line of improvement in the reciprocating type of engine lies in the direction of an increase in the compression ratio, an upper limit to which is set by the incidence of the well-known phenomenon of 'knock.' In attacking this problem two lines are being actively pursued. Some classes of motor spirit, such as benzol and other aromatic hydrocarbons, do not give rise to knock, no matter how high the compression ratio may be; but by far the larger bulk of our petrol supplies are rich in paraffins which are notorious offenders in this respect. To reduce the trouble the chemist is engaged in studying the effect of blending these different classes of spirit and has also attacked, with considerable success, the problem of treating bad petrols with substances such as lead tetraethyl, small additions of which suffice to reduce their tendency to knock, so that the 'doped' fuel can be burnt in engines of a considerably higher compression ratio than would otherwise have been possible.

Further, the engineer has not failed to realise that correct cylinder head and piston design is an important factor in suppressing knock. It is now well known that, other conditions such as turbulence, freedom of the explosion chamber from hot spots, etc., being equal, the incidence of knock is largely controlled by the distance of unimpeded travel of flame through the explosive mixture near the beginning of the firing stroke. Thus the same petrol can be burnt without giving rise to knock at a higher compression ratio in a small cylinder than in one of a larger capacity. Likewise a central position of the sparking plug, or, better still, multiple point ignition, materially assists in its suppression.

The expenditure in Great Britain on petrol alone is about £60,000,000 per annum, and is steadily increasing. Practically the whole of these supplies are imported, and there is little or no prospect of home-produced spirit materially affecting this state of affairs. There is, therefore, a great inducement to use solid fuels for road transport purposes. That the coal or coke fired steam-driven lorry continues to hold its own in spite of its exceptionally low thermal efficiency is a clear indication of the vast possibilities open to a motor which would combine the efficiency of the internal combustion engine with the low cost of coal. Intensive experimental work and exhaustive tests on road vehicles fitted with internal combustion engines running on gas generated in suction producers are now being carried out in Great Britain and other countries with much promise of success.

The Ice Age and General Drayson's Theories.

FROM time to time theories claiming to be scientific are put forward, most frequently in the domain of astronomy, which fail to secure the recognition of the orthodox. For the most part they pass quickly into deserved oblivion and are heard of no more. The fate of Gen. Drayson's ideas is quite peculiar. They have been kept alive by a devoted band of disciples, but no qualified astronomer who has considered the theories can profess more than the mildest interest in them. This attitude has led to resentment, and the Draysonians have not been slow to make accusations of obscurantism against the astronomers. As the world owes its release from the tyranny of dogma to nothing so much as the development of astronomy, and as in no science is the co-operation