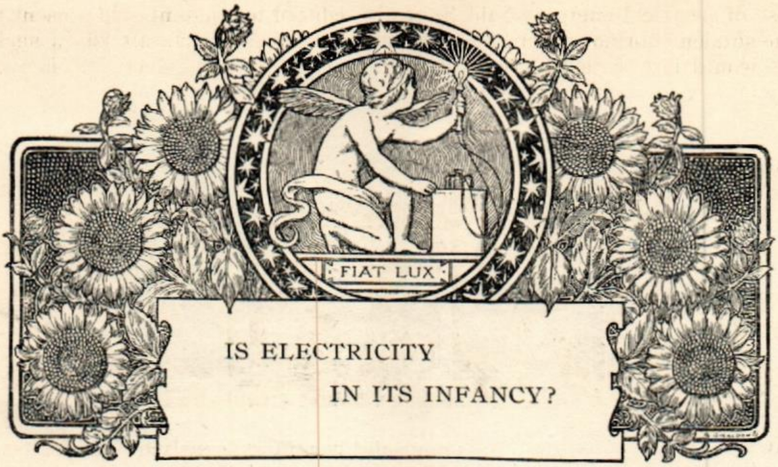


IS ELECTRICITY IN ITS INFANCY?

AS the remark is yet frequently made that electricity is in its infancy, it may be well to point out how old most of the electrical principles are which are in such common commercial use to-day. The arc-light was discovered in 1809, by Sir Humphrey Davy, and was employed in a lighthouse in 1858. The electric motor was invented by Davenport, of Vermont, about 1835. It was used by Jacobi, in 1839, to propel a launch on the river Neva, and Page ran an electric locomotive between Washington City and Bladensburg, Md., in 1850, attaining a speed of nineteen miles an hour. In 1859, Farmer lighted his parlor in Salem, with an electric incandescent lamp, and the electric telegraph is now just fifty years old. Galvanic batteries supplied the electricity for these purposes which made it too costly. The perfecting of the dynamo is what made it possible to do all these things, by reducing their cost to within reasonable limits ; that is the reason why electrical industries have developed so fast within the past fifteen years.

The dynamo is a machine for transforming mechanical energy, like that of water-power, or the steam-engine, into electrical energy, and it is one of the most perfect machines that has been or is likely to be devised by man. A steam-engine may have an efficiency of ten per cent., that is, it may yield ten horse-power for a hundred horse-power spent to produce it. A turbine water-wheel will give back ninety per cent., but a good dynamo will yield as much as ninety-six per cent., and the same is true of motors and transformers, which means that it will ever be impossible for any one to make such apparatus five per cent. more efficient than what we now have. In this direction the coming man has no field for improving upon our work.

But electricity is looked upon as being a very mysterious something with unlimited possibilities, whereas the other so-called forces are limited. In reality, one is as mysterious as any other, but they are all quantitatively related, and the laws of electrical energy are just as definitely determined as those of any of the others. The working power of water, of steam, and of electricity, are each determined by their quantity and pressure. The pressure of water is determined by the height of the fall, the pressure of steam by its temperature, and that of electricity by its voltage. No one imagines it to be possible to get more than a hundred horse-power out of a hundred horse-power waterfall, neither is there any more reason for expecting more from a hundred horse-power of electrical energy. This means that, mechanically considered, we have reached the possible limits of efficiency, and so far, electricity is not in its infancy, but is already mature, and will not have another cubit added to its stature. This does not mean there will be no further improvements and new adaptations, for there certainly will be. The incandescent lamp now wastes ninety-five per cent. of the energy supplied to it. When heat energy can be transformed directly into

THE PROGRESS OF SCIENCE.

DURING October, we shall pass our neighbor, Mars, nearly at the least possible distance, and with the planet so well elevated in the northern sky, as to offer a very favorable opportunity for the study of his surface. The "opposition,"—i. e., the moment when the planet is just opposite to the sun and rises at sunset—occurs on the 20th; and if the orbits of the earth and Mars were just on the same level, and were perfect circles around the sun, this would be also the moment of nearest approach. In fact, however, Mars will be nearest on the 13th, when its distance will be almost exactly forty millions of miles, or about one hundred and seventy times the distance of the moon. Between October 1st and 23d, the distance will hardly vary a single million of miles, but by the end of the month it will have become forty-three millions, and will swiftly increase. With the largest telescopes it is sometimes (not very often) possible to use with advantage a magnifying power of one thousand in scrutinizing the planet's surface, enabling us to see it about as we do the moon when we look at her with a powerful opera-glass. Of course, no very minute details can be noted, —nothing much less than forty or fifty miles across,—but the white-capped disc is a very beautiful object with its delicate variegation of many-colored markings, gradually shifting in place and form, as the planet turns itself under the observer's eye, and its swift little moons dodge in and out from one side to the other.

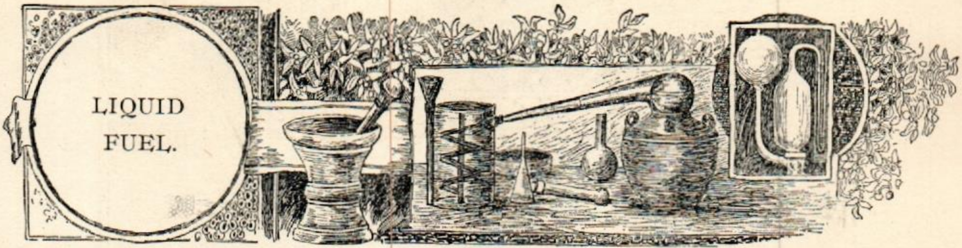
The special points of interest this year relate mainly to the still unsettled questions first raised some years ago by the observations of the Italian observer, Schiaparelli, upon certain curious markings called "canals" by him, and their unaccountable behavior in doubling and again undoubling from time to time. The phenomena are by no means easy to see, and his observations have been hitherto only partially confirmed ; sufficiently, however, to make it certain that while his descriptions and explanations probably need correction, yet they involve real facts, unparalleled upon the earth, and present a very perplexing problem. There are other questions also, respecting the constitution and topography of the planet,—its land and water system, its lakes and mountains, the changes that accompany the progress of its seasons, and the still more important alterations of some of the larger features of the planet's surface, which, according to some observers, have gradually taken place during the past twenty or thirty years. It is clear that in our present areography, fact and imagination are almost inextricably combined, and it will be a slow and difficult task to separate the real from the fanciful, and what is permanent and belongs to the ball of the planet itself, from that which is temporary and merely atmospheric.

It may be worth while to add, that there is not the slightest reason to expect this year any very startling discoveries, and that the current talk about the possibility of soon demonstrating the presence of intelligent inhabitants upon the planet, and perhaps actually establishing communication with them, is mere sensational nonsense.

C. A. YOUNG.

electrical energy without needing an intermediate steam-engine, it is probable that the cost of electrical energy would be easily reduced to one-tenth its present figures, and the sudden enormous increase in its use which would certainly follow such a discovery, would indeed justify the prevalent expression that "electricity is now in its infancy."

A. E. DOLBEAR.



AMONG the many important, though not generally known applications of native petroleum is its use as a liquid fuel. The use of this liquid as a fuel, to a limited degree, is not of very recent date, but it has steadily grown in importance and extent, until it may now be said to have passed entirely through the experimental stage, and the advantages of the fuel in many cases is a question of cost only. Crude petroleum combines a greater number of the requirements for a good fuel than any other liquid. These requirements are, capacity for heat production during combustion, absence of smoke and offensive gases consequent to combustion, and lastly, cheapness.

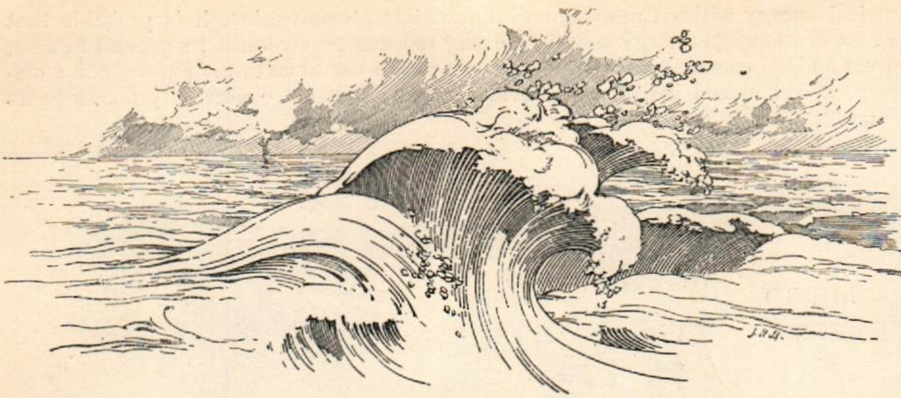
Natural petroleum consists of many hydrocarbon oils and gases, differing widely in boiling point, density, and inflammability. By heating to a certain temperature, the more volatile constituents are driven off and used for various purposes, while the remainder constitutes the liquid fuel.

The native petroleum of Russia yields from thirty-one to thirty-five per cent. of light oils, and from sixty to sixty-five per cent. of fuel oil. In American petroleum the percentage of fuel oil is only from twenty to twenty-five.

There are now a great many steamers and locomotives in the Euxine and Caspian districts using this fuel. All the locomotives on one of the Argentina railroads, and several steamers on the Platte river use it. Steamers driven by this fuel have crossed the Atlantic, and it has also been used on the Pacific coast. The principal advantages of the fuel are that for equal power it occupies but little over one-third the space of coal. There is, accordingly, a great saving of storage space and labor in storing. There is complete combustion and no smoke, so that the chimneys may be shorter; in ships, the oil can be kept in ballast tanks and can be replaced by water as it is used, thus effecting a still greater saving of storage room. There is also a great saving of labor in the engine department, as the number of stokers can be greatly reduced. The ash-pit is entirely done away with, and it is probable that boilers to use with the fuel, will be constructed without fire-grates.

In combustion, the oil escapes through a small pipe and is blown into spray by a jet of steam taken from the boiler itself. Compressed air has also been used for spraying. The best data available indicates that for steam production the cost is about seven to four in favor of the oil, as compared to coal. The facts given might seem to point to a rapid introduction of the oil as a substitute for coal. The total production of the oil fuel during the present year has been estimated at fifteen million tons, which is equivalent to about twenty-six million tons of coal. The total production of coal in the whole world is probably over five hundred million tons. This great disparity renders any general substitution of oil for coal impracticable at present; that it will replace coal as a steam raiser in many places is very probable.

S. E. TILLMAN, Prof. U.S.M.A.



TIN ORE.

THE only important ore of tin is the oxide, known as tinstone or cassiterite. It is a very widely-distributed mineral, found in half a dozen European countries, in Greenland, at a number of localities in the United States, in the Andes, and in a great belt of territory stretching from the straits of Malacca through Australia to Tasmania. Just as there is but one ore of tin which is of any commercial importance, so there is but one characteristic mode in which veins of tinstone occur. They are substantially always found in granitic rocks or in close association with them, and the rock often contains crystalline particles of the ore. Even the accompanying minerals, such as mispickel, wolfram, and lithia mica, are usually the same, even in antipodal localities.

The Appalachians contain tin deposits throughout their entire length : in Maine, New Hampshire, Massachusetts, Virginia, West Virginia, North Carolina, and Alabama. Two of these, at King's mountain, North Carolina, and on Irish creek, Rockbridge county, Virginia, have recently been reëxamined for the United States geological survey. They seem remarkable, however, only for their close adherence to the standard type of tin deposits.

The truly extraordinary thing about the occurrence of tin is, that while the conditions favorable for its deposition have prevailed in numberless localities, the regions in which it forms deposits of great value are very few. The Romans sought Wales and Cornwall for their tin, and no other district in Europe has produced any great quantities of the metal. The product of the Americas has been trifling, and the one region of the earth which seems to possess an inexhaustible quantity of tinstone is the belt reaching from the straits of Malacca, through the Dutch Islands and Australia, to Tasmania.

Other ore-forming processes have been active in this belt, but not more so than elsewhere. California, besides its gold, has produced great quantities of quicksilver and a mere trifle of tin, California's output of tin being scarcely more valuable than Australia's output of quicksilver. I can see no probable explanation of the distribution of tin, excepting that the original constitution of the earth was such that immense masses of tin compounds found a place relatively near the surface in the great tin-bearing regions of to-day.

GEORGE F. BECKER.