

The GATHERER

An Illustrated record of Invention Discovery & Science

Correspondents are requested, when applying to the Editor for the names and addresses of the persons from whom further particulars respecting the articles in THE GATHERER may be obtained, to forward a stamped and addressed envelope for reply, and in the case of inventors submitting specimens for notice, to prepay the carriage. The Editor cannot in any case guarantee absolute certainty of information, nor can he pledge himself to notice every article or work submitted.

Photographing the Skeleton.

VIENNA journals announce that Professor Röntgen, of Wurzburg, has made a discovery which is likely to be of much practical importance in the medical arts. In a former "GATHERER" we drew attention to the fact—discovered by Lenard in 1894—that photographs could be taken by the "dark rays" proceeding from the cathode or negative pole of an electrical induction coil. As such invisible electric rays can penetrate wood, thin metal sheets, etc. (which are, so to speak, transparent to them), but cannot penetrate thick metal



THE LIVING HAND, PHOTOGRAPHED THROUGH BLACK VULCANISED FIBRE, WITH AN EXPOSURE OF FOUR MINUTES.

(From a photograph by Mr. Campbell Swinton.)

sheets (which are opaque to them), it follows that a photograph of a metal object, say a coin or jewel, can be taken not only in the dark but in the dark interior of a box or cabinet. Quite recently Professor Röntgen has made a further advance in this direction by finding that some of the luminous rays from the electric discharge of an induction coil in the vacuum tubes of Professor Crookes are capable of penetrating flesh, paper, wood, and other bodies as though they were transparent, but are stopped by lead, iron, and bone, which are opaque to them. Hence, if the living hand be interposed between the luminous tube and a photographic camera, a photograph of the fleshless bones within the hand is obtained. In the same way one could take a photograph of his own skeleton. The discovery has already enabled physicians and surgeons to examine fractures and malformations of the bone, or stony matter and metal bullets in the living body quite painlessly, and without the use of the probe. Our photographs of the bones inside a living hand and the metallic contents of a pocket have been very kindly taken for us by Mr. A. A. Campbell Swinton the well-known electrical engineer. Mr. Swinton's photographs are obtained by exciting an induction coil with an alternating current from the street mains and charging a battery of twelve Leyden jars with it, then discharging the jars through a "high frequency" coil of Tesla insulated in oil.

Aluminium Dishes.

M. Moissan, the famous French chemist, has discovered that a slight percentage of sodium in aluminium causes it to decay when in contact with water. It follows that pure aluminium should alone be employed in making dishes and flasks, or canisters for holding beverages or provisions, otherwise the metal will corrode and contaminate the viands. M. Moissan has also found that aluminium should never be joined or attached to other metals, or else the joint will decay in presence of moisture. In all these cases the foreign metal sets up a voltaic couple with the



METAL OBJECTS IN CALICO POCKET, PHOTOGRAPHED THROUGH A SHEET OF ALUMINIUM, WITH AN EXPOSURE OF FOUR MINUTES.

(From a photograph by Mr. Campbell Swinton.)

aluminium and water, which causes corrosion of the aluminium, just as iron railings are apt to be eaten away at the junction of them with the lead which fixes them into the stone socket. Manufacturers of aluminium utensils will profit by this chemist's researches, as they have already suffered from the corrosion of the metal in this manner.

Experiments in Memory.

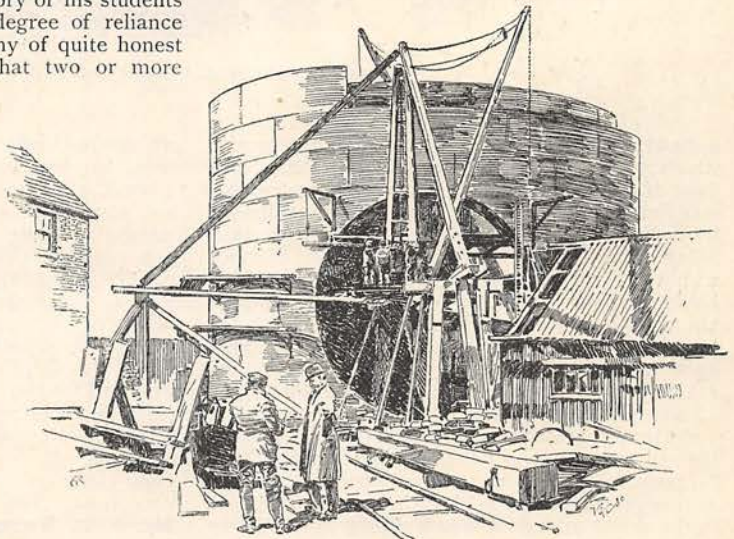
Professor McKeen Cattell, an American psychologist, has been testing the memory of his students with a view to discover what degree of reliance is to be placed on the testimony of quite honest witnesses. It is well known that two or more witnesses of the same event will give different accounts of it, a fact which should "give us pause" in accepting the conclusions of historians, even though these are based on the narratives of eye-witnesses. The subject is of great legal importance, for it may happen that an honest witness is discredited in the eyes of judge and jury by questions which indicate a failure of memory in some particulars. If, therefore, we had some sort of criterion as to the degree of reliance to be placed on the recollection of certain kinds of facts, it would be a gain. Professor Cattell asked his class to write an answer to the question, "What kind of weather was it a week past

to-day?" and to indicate the degree of confidence with which they replied by means of three marks signifying "certainty," "doubt," "guesswork." The answer went far to show that the average person has about as much notion of the weather a week past as he has of that a week to come. Not a single student of the class, numbering about half a hundred, answered correctly. Many other questions were asked with doubtful results, from which, however, it would seem that in general there is a tendency to over-estimate weight and under-estimate distance. The forms of buildings and rooms were given without much approach to accuracy.

Tunnelling by Compressed Air.

A very fine piece of engineering work, and one likely to prove of immense service to many thousands of persons on both sides of the Thames, is rapidly approaching completion at Blackwall. This great public work is none other than the construction of a spacious tunnel only five feet under the bed of the river, and with gradual and easy sloping approaches on either side, reaching from the Greenwich and Woolwich road on the southern bank to the East India Dock Road, near the docks, on the northern. And perhaps the most remarkable thing about this gigantic subway is the fact that the operations under the river were conducted in a huge chamber of compressed air, which, together with a very ingeniously constructed shield, prevented the water of the Thames and the loose wet shingly soil through which the tunnel passed, from pouring in upon the men and drowning them and their work. The excavation of the Blackwall Tunnel is probably the greatest undertaking that has yet been accomplished by the aid of compressed air.

We are so used to the pressure of ordinary air on our bodies that we do not realise that it weighs upon us at the rate of about 147 lbs. to the square inch. But in this huge chamber under the Thames the pressure was increased to 40 lbs. to the square inch. And this great pressure acting within the



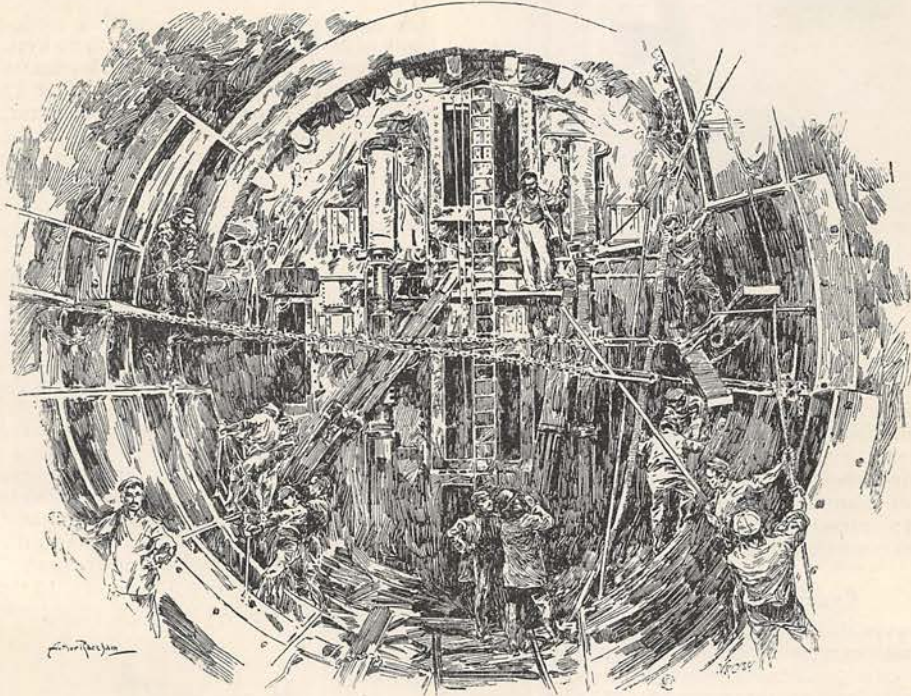
BLACKWALL TUNNEL WORKS.

shield and within the tube of the tunnel—which was built up quickly behind it of immense flanged plates of iron weighing a ton each—was sufficient to prevent the water from rushing through the gravel. The air was first sucked in from the ordinary atmosphere through a valve in an air-compressing cylinder, where it was compressed by engine power, and then forced into a huge iron reservoir, from which, after being cooled by water, it was conducted, rushing along pipes, to the compressed-air chamber below.

At the end of the chamber rose the famous shield. It consisted of an immense iron cylinder

“dump” down clay through the water on the river bed, over the spot where the men were at work.

The shingly soil, as fast as it was dug out, was shovelled into waggons and drawn through an air-lock at the entrance to the compressed-air chamber, and removed to the surface. The air-lock was worked in much the same manner as a lock on a river or canal, and enabled the men to become “acclimatised” to the pressure as it was gradually increased in the lock, when they passed through to their work. In order to afford entrance to the tunnel for foot passengers, without walking to the commencement of the sloping approaches—



BLACKWALL TUNNEL WORKS : THE SHIELD.

somewhat larger than the diameter of the tunnel, which was 27 feet, and weighing 250 tons. The front of this cylinder had a sharp cutting edge, and was forced forward through the loose gravelly soil by hydraulic power, a pressure of about 4,500 tons being used for this purpose. A short distance within the cutting edge were “shutters” of iron, having various openings, or doors, of different sizes. Behind these openings were fitted cells, or “pockets,” in which the men could work: they opened the door of their pocket and dug and raked in the gravel and soil before them, the compressed air whistling through from their side and exerting pressure sufficiently strong to prevent the soil and the river from pouring in upon them. So powerful, indeed, was the compressed air that at times it was likely to blow through the openings in the shield so fiercely that it would have shot up the gravel and mud through the bed of the river. To prevent this catastrophe, the engineers had to

which are chiefly for vehicles—huge caissons have been let down 76 feet below the surface of the ground, close to the river banks on either side, and fitted with stairways. There are other very interesting engineering operations to which attention could be drawn, but the result of the whole will be to provide a handsome and spacious subway under the wide Thames, faced with white bricks or tiles, and illuminated by electricity, for the densely crowded districts on both sides of the river. In addition to foot traffic communication is provided for two lines of vehicles. The tunnel will probably be opened in the spring of 1897, and will then have occupied from four to five years in construction. Its successful accomplishment reflects great credit on both the engineers and contractors concerned. The work is being carried out under Mr. A. R. Binnie, chief engineer of the London County Council, and he is ably assisted by his two resident engineers on the works, Mr. David Hay

and Mr. Maurice Fitzmaurice. Messrs. Pearson and Son, of Westminster, are the contractors, and their engineer and manager on the works is Mr. E. W. Moir, who occupied a similar position under the same firm at the Hudson Tunnel, New York.

Another Cure for Headache.

The *Medical Record* prescribes walking backwards as a cure for nervous headache. Any kind of walking will do, so long as it is backward, but it is well to walk very slowly, first placing the ball of the foot on the floor and then the heel. A long narrow room with high windows is recommended. Besides curing the headache in ten minutes or more, the exercise tends to bring about a graceful carriage of the person.

Water-Scavengers.

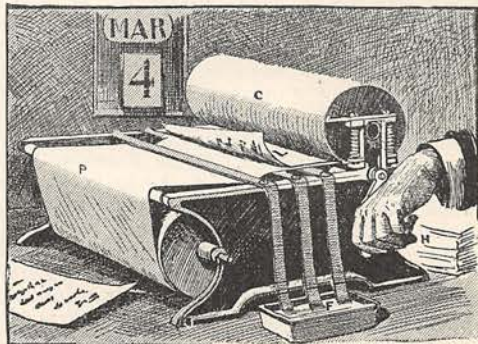
It must have occurred to many people to inquire the reason why stagnant pools, such as one sees by the roadside in the country, do not become utterly corrupt. Microscopic vegetation plays an important part in the purification of these waters; but there are scavengers who are constantly at work—some consuming decaying animal matter and others feeding on the bottom mud, which they purify by abstracting from it all organic matter as it passes through their bodies. Two of this class are figured below, and their various attitudes are drawn from life. The long, slender creatures are the larvæ of a crane-fly, closely allied to, but much smaller than the well-known Daddy-long-legs. They lived for some months in the vessel here shown, and the correspondent who placed the material at the Editor's disposal has been successful in rearing the fly. The stouter larva is that of a bee-like fly, often seen hovering over flowers near water. Both these larvæ breathe through the tail. Some of the crane-fly larvæ are shown with the tail, which is telescopic, thrust above the surface. In the other larva the tail ends in a star-like process of six rays, covered on each side with fine hairs. When the animal floats up to the surface these pierce the film, and conduct a supply of air to the breathing-tubes.



WATER SCAVENGERS.
(Sketched from life.)

An Automatic Letter-Copier.

The little machine for copying letters which we illustrate hails from America. As will be seen, the copying-paper, P, is carried on a roll, from which it is drawn forward underneath a copying cylinder,



AN AUTOMATIC LETTER-COPIER.

C, by turning a handle, H. Before it reaches the cylinder the paper is moistened by passing over wet wicks of felt dipping into a pan of water. The letter, L, to be copied is laid, with the writing undermost, on the moistened paper, and is copied by giving one turn to the handle. It is stated that a hundred letters can thus be copied in five minutes.

"The Queen's London."

This work is one which is of interest not only to citizens and residents in the capital of the Empire, but to all its visitors from the provinces and from over seas. Messrs. Cassell's album of beautiful views, which is issued under the above title, is singularly varied in its contents, and Greater London falls within its scope, to the great profit of lovers of suburban "beauty spots." For gift or memento a more suitable volume has seldom been issued.

In Handy Form.

Messrs. Longmans have added to their "Silver Library" a new edition of Mr. Rider Haggard's stirring Mexican story, "Montezuma's Daughter." — Mr. Lang's interesting chapters on "Cock Lane and Common Sense" are also issued again as an addition to this series, and a volume of "Leisure Readings," edited by the late Richard Proctor, comes to us side by side with Mr. E. A. Butler's "Our Household Insects," and completes a set of four useful volumes in a most acceptable form and dress. — Messrs. Cassell have just published a new edition, in a single, very easily handled volume, of C. A. Fyffe's "History of Modern Europe," a work which goes far to make the present position of international politics intelligible, and which should be by the side of every newspaper reader and in every library. While avoiding excess of bewildering references to authorities, chapter and verse for each important statement are clearly indicated. — Another new and cheaper edition, from the same publishers, is the late G. A. Sala's "Life and Adventures," which is now put before the public at a price and in a form which makes it possible for all his friends and admirers to possess a copy.