

Now we have waited long enough, and the grinning lad who has taken out cards (I know not why, but all the lads in Edison's employ seem in a state of perennial good humour and happiness) returns with an answer. Perhaps the 'Old Man' is engaged on some intricate problem of invention, or the improvement of some detail of an invention, in a remote nook of the building. In such a case it is as much as anyone's life is worth to disturb him. Or, suppose, more happily, as more rarely, he has an hour or two to spare, and will himself start us on our tour of investigation, laughing and joking the while, but with an air of allowable pride in the completeness of the establishment, which is charming in its frank ingenuousness.

Stepping out of the library, we find ourselves in the room, already described, through which we entered. A closer examination shows that it is divided into narrow aisles running the width of the building, by a series of high shelves partitioned off somewhat after the fashion of book-cases, so as to form large pigeon holes, while the lower portions are occupied with nests of neatly labelled drawers. There are thousands of pigeon-holes and hundreds of drawers, and in them it is to be found as heterogeneous an assortment of articles as can well be imagined. This is the 'stock-room,' but the stock therein contained would supply more than half the shops in Christendom with a sample at least of each of their particular goods. The drawers, some of which are marked with half a dozen names as guides to the varied contents, are filled with such strange things as seal, squirrel, bear, sable, fox, marten, ermine, and beaver skins; tight rolls of the furs or hairy coverings of even rarer animals; feathers of every bird that flies or swims; snake skins, fish skins; hides, raw and tanned; bones, teeth, and tusks of all sorts of creatures, including hippopotami, narwhals, whales, rhinoceros, and sharks; minerals, ores, crystals, and precious stones (cut and in the rough); barks and sections of the trunk of every species of tree; bundles of dried grasses; dried fruits, nuts and beans, salts, sugars; grains such as wheat and maize, both whole and crushed to flour; gums and spices, some of the former so rare that the grains are kept in little folded papers such as diamond merchants use. In short, the whole of nature seems to have been laid under contribution to stock these long, deep drawers. In the pigeon holes above are manufactured articles, the hundreds and hundreds of drugs, chemical solutions, and essences being contained in small glass vials, each plainly ticketed with the name of the contents. There are rolls of woven stuffs, sheet metals, and all sorts of papers, gums, and linings. Then there are bits of machinery, bolts, screws, nuts, angle-irons, tools such as hammers, vises, drills; while blocking up the passage ways are such out-of-place looking objects as ice cream freezers, wheelbarrows, pumps and so on. Everything one can think of, from a packet of needles or a toothpick, to a sledge-hammer or a sewing-machine, can here be found. You turn in amazement to Mr Edison, and his eyes twinkle as he replies to your unspoken query. 'I have tried,' says he, 'to gather together here samples of every material to be found in the habitable world, and I think I have succeeded'; and then, perhaps, having just whetted your curiosity, he hurriedly excuses himself, turns his visitors over to one of his assistants, and plunging up stairs again is presumably soon immersed in his beloved occupations. Whichever of his assistants may have been deputed as guide, you will surely find him cultivated, courteous, an acknowledged expert in one or more branches of scientific research, and proudly interested in the establishment of which he forms a part.

'It is one of Mr Edison's peculiarities,' he will tell you, 'to push on with an experiment or investigation when he has once begun, without pause or break, hardly stopping to bolt a morsel of food or snatch a few hours sleep. Now, in the course of these investigations, he often finds that he needs some material which in the ordinary way he would find it nearly impossible to procure, and in his early days he was from this cause subjected to much inconvenience and delay. Now all this is obviated, and in five minutes he can have anything in reason that he wants.'

'But how can he ever want such weird things as sharks' teeth or rhinoceros-horn? you ask. 'They are reminiscent of the witches' cauldron in "Macbeth."

'That shows that you don't know what queer things electricians use,' replies our modern Virgil. 'During the progress of the experiments with the incandescent electric light, for instance, nearly everything one can think of was tried as a primary material from which to form the delicate carbon filament whose incandescence is the source of light. Finally, as perhaps you know, shreds of one particular variety of bamboo were found to give the most gratifying results; and there, by the way, you can see a few bales of the very reeds from which those strips are cut. Again, the delicate needle, which, affixed to the under side of the vibrating diaphragm of the phonograph, indents the smooth, revolving surface of the waxen cylinder, had to be formed of some material possessing peculiar properties of elasticity and rigidity. Scores of the most unlikely substances, both organic and inorganic, natural and artificial, were tried before the right one was hit upon. And so it goes with all the little details of electric appliances.'

But there is too much to see to linger long in this old and new curiosity shop, and we pass through it to the farther end of the building, and are standing in the lower machine shop amid a bewildering roar of whirling wheels and swiftly speeding leather bands. Griny workmen are hammering and chipping grotesque looking castings of iron and steel at benches placed in front of the wide windows, while all around others are directing the movements of enormous machines, which seem almost like sentient beings themselves, as they perform their allotted tasks, planing, boring, cutting, and shaping the hardest metal, as a carpenter plays

with a block of soft pine. This shop, we are told, is devoted to the manufacture of the heavier parts of such machinery as may be necessary in forming new models of electric motors and so forth. There are machines here, and workmen who can handle them, capable of turning out a monster locomotive or an eighty-ton gun.

We clamber up a steep staircase and find ourselves in another room as large as the one we have just left, and, like that, filled with the busy hum of revolving wheels overhead and clanking machinery below, only in this case everything is of a daintier, lighter make and appearance. This is the shop where instruments of precision and all the more delicate portions of the mechanical work are turned out. More wonderful in many ways are these mechanical aids to human power, for these iron and brass levers and cog-wheels seem capable of doing all that man can do, and more. In this shop can be made the most delicate instruments possible,—machines so tiny that they would not outbalance a nickel placed in the opposing scale; and while below, so our Virgil tells us, motors weighing many tons can be just as easily manufactured. Here are workmen, evidently of highly nervous organisation, filing and polishing the almost imperceptible needles, which, when inserted in their proper place in the phonograph, will 'keep track' even of a woman's tongue; and others are putting together the nicely proportioned and delicate brass work which goes to make the rest of the 'talk recorder.' Others again, are finishing off to an exquisite smoothness the surfaces of the wax cylinders on which the record is made, and later on we shall find more than one workman busy casting these same cylinders by pouring the queerly odoriferous molten wax from a ladle into brass moulds. The moulds look not unlike a row of greasy rockets, but are of highly ingenious construction, specially adapted for their peculiar task.

Virgil, however, warns us that we must not linger, and we are soon poking our heads into large, light, and airy rooms, where spectated men in their shirt-sleeves are draughting, from the rough sketches of Mr Edison, carefully plotted plans and elevations of inventions of greater or less importance, while others are pursuing scientific investiga-

down stairs; for here is the old 'barrel-organ' phonograph of ten years ago side by side with the perfect little instrument of to-day, while the electric light lamp is shown in its infancy as well as in its maturity.

'Up still higher we mount, and come to a large, airy, well-lit room directly over the library. One end of this is occupied by a rostrum, in front of which benches are disposed. This is the lecture room, and here at least once a week the staff of assistants and their friends listen to a lecture on some topic of practical interest to them, delivered either by one of the heads of departments or by some acknowledged expert from the outer scientific world. These lectures which are given at Mr Edison's sole expense, are viewed by him simply as an indirect means of increasing the efficiency and the enthusiasm of his corps of helpers.

At Virgil's suggestion we waste no time here, but follow him down the winding staircases and past the hive of busy workers, until we have reached the ground floor, and are in the outer air once more, though our travels are not yet over. There are still the outbuildings to be investigated, and before we begin we have to visit the engine-house, and admire the powerful giant with his tireless arms turning for ever, like Ixion, the huge wheel which represents the motive power of all those whirling machines in the great throbbing building. We deliver up our watches to a swartly handit, who grins cheerfully as he relieves us of them, and this act of spoliation accomplished we visit the electric motors, which furnish electricity not only to the countless lamps in the laboratory itself, but also to a large portion of the town of Orange and to the larger suburban residences hereabouts. When we have wondered at these, and have been pleased like children at the sight of the constant stream of many-coloured sparks which fly off at various places with Memphisian energy, we prevail on the dusky handit to render up to us once more our time-pieces, and emerge once more to take a peep at the ten-feet-long astronomical telescope, which has its little observatory all to itself, set up in a convenient part of the grounds.

Then we visit the four one-story buildings, which I have already described as running out at right angles to the main edifice. In one of these is housed the large ore separator, which has been above referred to. It is a ponderous affair, with the cruel-looking crusher attached which grinds up the big masses of hematite and quartz as though they were loaf sugar, and then passes the pulverized result by means of an endless chain of little buckets to the hopper, down which the metallic stream falls, to separate into two minor currents ere it reaches the ground,—the sheep, or pure ore, on one side; the goats, or refuse rock, on the other.

The next building is devoted to storage purposes, and contains naught of special interest. Of the two remaining, one, which is full of noisome fumes, is devoted to the chemist of the establishment and all his works. Here, far from his fellows, he is allowed to make all the horrible compounds, with their still more horrible smells, he pleases, and so presumably enjoys the closest approach to happiness a chemist can know, and varies the monotony of existence by an occasional explosion.

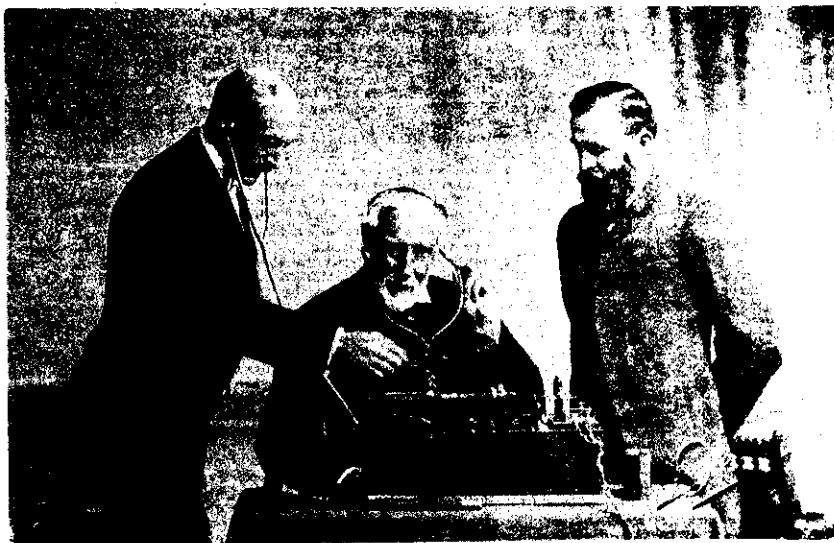
This last building is in some respects the most interesting of all. It contains some of the most marvellous instruments of precision to be found in the world, for here are to be found those ingenious arrangements for accurately measuring electricity and light, which are known as galvanometers and photometers. With these

the strength of a current or the brilliancy of a light can be absolutely measured to the minutest fraction, and so delicate are the galvanometers that even a bunch of keys carried in one pocket as one stands near them will disarrange their exquisite sensibilities and render them useless. In this room too are various examples of magnetic coils, one of which, an innocent looking affair about a foot in length, but containing many miles of the finest silk-covered wire, can throw a spark twelve inches long, and kill a man or half a dozen men in a fraction of an instant. Other curious contrivances there are also, including a mechanical calculator, which will add up bewildering rows of figures, subtract and divide with the precision of a normal schoolmaster, by the mere turning of a crank.

So we have 'made the rounds,' and, entering once more the laboratory proper, may chance to meet Edison himself, his labours over, starting homewards. He is as full of animal spirits as a lad released from his Latin lesson, and we stroll with him up the hill, and spend a few minutes with him in the library of the magnificent home, standing in the centre of its trimly kept lawns, and shaded by its leafy trees, which he has built for himself away from the bustle of New York, the noise of which city he declares drives him almost insane, when for business reasons he has to visit it. Then, as time and trains wait not even for us, we take our way to the station, through the dusky evening shadows of the country roads, and wag our heads wisely as we think, first, of the little newsboy crying his wares but a comparatively few years ago, and then of that marvellous building we have just left, the weekly running expenses of which are far up in the thousands, and which was built and is maintained simply as the private workshop of one man—surely the grandest workshop in the whole world.

SIR GEORGE GREY AND THE PHONOGRAPH.

Recently, when Professor Archibald had concluded his exhibition of the phonograph in Auckland and was on the point of departing, it was suggested by Mr Mitchell to Mr Upton, the Mayor, that the opportunity should be taken of preserving for future generations a record of the utterances of Sir George Grey. Mr Upton thereupon addressed a letter to Sir George Grey, expressing to him the idea. Of this the latter thought fit to approve, and a day was accordingly appointed on which Sir George Grey Professor Archibald, and Mr Upton met together at the studio of Mr Hanna, in Queen-street, and enacted a cere-



Hanna, Photo. MR ARCHIBALD. SIR G. GREY. MAYOR OF AUCKLAND. SIR GEORGE GREY AND THE PHONOGRAPH.

tions with all the careful laboriousness and patience of enthusiasts. Here, surrounded by cabinets of minerals, saucers of acids, scales able to detect the variation in weight of a single hair, and clever magnetic contrivances, are a couple of investigators prying into the affinities of various ores, having in view the perfection of the novel ore separator which will be Edison's next gift to the commercial world. In yet another room interesting experiments in electro-metallurgy are being conducted, and in great jars of evil-smelling liquid, phonograph cylinders, covered with the microscopic dots and dashes which are the visible memorial of sound, are receiving deposits of various metals. The outcome of all this tentative work will be the still further perfecting of the already patented scheme for limitless reduplication of phonographic records.

Then we are shown a larger apartment, wherein are arranged in frames thousands of the glass globes in which, when exhausted of all air, incandescent filaments will become a source of grateful light. They are undergoing the exhausting process under the careful gaze of sundry other assistants; and, numerous as they are, they will be chiefly used for experimental purposes, those for the use of the public being prepared elsewhere. A long, low room is devoted to testing the average 'lives' of these experimental lamps, and presents a curious appearance, with its hundreds of brilliant lights covering the ceiling in closely parallel lines,—a firmament of tangible stars. We are told here, that the ideal lamp, for the realization of which all these investigators are constantly striving, will burn for an indefinite period, and, save when it meets with an accident, will not require renewal for years and years. Not the least interesting of these little scientific headquarters is the photographic studio, under the superintendence of a good-looking young artist, who, like every one else about the place, is refreshingly enthusiastic about his own speciality. He has an establishment which a leading professional 'knight of the camera' might envy, for he has one lens which enables him to use plates about the size of an ordinary newspaper, and so prevents the necessity of enlarging. Some of his exterior views betray the skilled artist in their picture-queeness and the cleverness with which the one point of view which is the right one has been taken advantage of. Hanging on their walls are pictures of inventions and machines in their various stages of development, and this little gallery forms a fitting complement to the scrap-books we looked over