would so seriously cripple one of its most valuable institutions, and so discourage an activity which produces results not only of the greatest value to science, but to the practical interests of the colony. The affiliated societies themselves contribute, we believe, 1,275*l.* annually to support the work of the Institute, the whole of which is spent in keeping up valuable museums and laboratories, and an interest in science in nine centres of population in New Zealand. Without the annual volume, we fear it is impossible to get members to keep up their subscriptions, and thus the organisation of the Institute, which has stood the test of twelve years, given universal satisfaction at home and abroad, and reflected the greatest credit on the colony, is in danger of breaking up and possibly expiring altogether. This would be little less than a calamity to the colony. Not a penny of the 500*l.* is spent in salaries; the editing, drawing of illustrations, and all else is a mere labour of love. The names of von Haast, Hector, Hutton, and others, are known to men of science all over the world. Dr. Hector especially has acquired a high reputation for his activity, zeal, and the results he has obtained. It is greatly owing to him that New Zealand has done for science far more than any colony of its age. The Institute itself is a model of organisation. The grant of the annual 500*l.* was a wise step worthy of general imitation, and its sudden extinction is a cruel blow to science. We can scarcely believe that New Zealand is capable of persisting in carrying out so shabby and short-sighted a policy, a policy of which any country should be ashamed. We trust that later news will show that there has been some misunderstanding, or that the Government has thought better of it, and continued a grant that could not possibly be better spent.

ALBERT J. MYER

THE young science of meteorology has sustained another heavy loss in the death of General Myer, of the Signal Service of the United States, at Buffalo, New York, on August 24, in the fifty-second year of his age. In 1854 he entered the United States army as an assistant surgeon, was assigned to special duty in the Signal Service in 1858, and in 1860 was made chief signal officer of the army, a position he held till his death.

The distinguished services rendered by General Myer to meteorology may be considered as having been made chiefly during the last ten years. Americans claim for the late Prof. Henry, of the Smithsonian Institution, the honour of having originated, upwards of thirty years ago, the idea of using the telegraph for conveying information regarding coming changes of weather. But it was reserved to General Myer, as respects the United States, to translate the idea into the action of every-day life, in devising, developing, and extending a system of telegrams and reports for the benefit of commerce and agriculture, which as regards the completeness of its organisation, the thoroughness with which it is worked, and its effective success, stands out as a model system of weather telegraphy. Three large weather maps are prepared and issued daily, along with three daily forecasts of the weather, which the telegraph at once sends through all the towns, villages, and hamlets of the States; and no time is lost, on the expiry of each month, in preparing and widely circulating a Weather Review, accompanied with maps showing the storm tracks, the geographical distribution of the atmospheric pressure, temperature and rainfall for the month; together with occasional weather-maps of the highest importance in their bearing on the meteorology of America, Europe, and the rest of the northern hemisphere.

The other great service rendered by General Myer to practical science is the system of international meteorology established by him, one of the important outcomes of which is the series of United States weather-maps now appearing in NATURE, showing the meteorology of the globe for each month. When the scheme was first proposed to the Meteorological Congress at Vienna, in 1873, it was difficult to regard it in any other light than as an impracticable, if not wholly visionary, proposal; but the feeling quickly changed as General Myer unfolded the details of its practical working, and explained that what he required from his brother meteorologists, in addition to their approval of the scheme, was one daily observation at a selected few of their stations, he being authorised by the American Government to say that they would undertake the expense of collecting and discussing the observations.

As our readers are aware, the scheme in General Myer's hands has been a pre-eminent success; and a body of facts is being thereby amassed, destined to furnish the key to the larger problems of meteorology, a science which, from the complex intricacies it presents, requires more than any other science a whole hemisphere at least as its basis of observation. Perhaps the most important of the practical questions which will thus fall to be dealt with are those abnormal distributions of the mass of the earth's atmosphere, short continued or more permanent, from which arise great storms or devastating tornadoes, excessive heat or cold, fine seasons or their opposites, and long-continued rains or droughts, so terrible for the famines which attend them. The explanation of these anomalies will doubtless be the immediate precursor of an intelligent and practically successful forecasting of the character of coming seasons.

This magnificent work General Myer could not have accomplished unless he had been backed by the moral and material assistance so generously and readily accorded him by his Government. With a settled conviction that this national work, if undertaken at all, should be carried out in a spirit and manner worthy of the great Republic, the Government of the United States relegated the work to the Signal Service of the War Department, with an annual vote from the Exchequer, which, while not too large for the work to be done, no Government on this side the Atlantic has yet thought of emulating.

While writing this brief notice of General Myer's work, we have been repeatedly reminded of the name of Leverrier—probably because, though widely different in many ways, both rendered services to meteorology to a great extent identical, both possessed the rare genius of organising and the resolute will that easily sets obstacles aside, both secured the support of their respective Governments, both were animated by large views of the capabilities and requirements of the science, and both were successful in an eminent degree in largely extending the sphere of its operations.

PHYSICS WITHOUT APPARATUS[1]

V.

THE Science of Electricity may be regarded in several different aspects. Firstly, there is the study of the simple phenomena such as schoolboys delight to see: the attractions and repulsions of rubbed bodies, the sparks, the shocks, the heating of wires, and rotation of diminutive electric engines. Secondly, there is the exact measurement of electrical quantities, and the verifying of the great laws of the science, involving exact manipulation and standard instruments. Thirdly, there is the technical study of the applications of the science, the details of telegraphic apparatus, the necessities of construction and maintenance, the management of electric lights, and other branches of electrical engineering. Lastly, comes the high mathematical theory cultivated only by the few.

Of the practical portions of this vast mine of scientific wealth, the greater part is only to be reached by the aid

[1] Continued from p. 440.

of special instruments of an expensive character. Only the first and simplest of the elementary *phenomena* of the science can be shown without apparatus. Yet even here the rudest means suffice in the hand of the master to produce the desired ends.

In his lessons on Frictional Electricity, delivered to juvenile audiences at the Royal Institution, Prof. Tyndall has shown in his unrivalled way how with the commonest objects, tumblers, egg-cups, needles, sealing-wax, pewter-pots, eggs, apples, and carrots, may lend themselves to produce the sparks, the shocks, the movements of attraction and repulsion which are more commonly obtained by the use of large and expensive electrical machines. No doubt these lessons—masterly examples of elementary science teaching—are familiar to many of the readers of "Physics without Apparatus." To the science teacher they are an indispensable primer of instructions how to impress common objects into the service of science. The only matter for regret is that they stop so far short of the

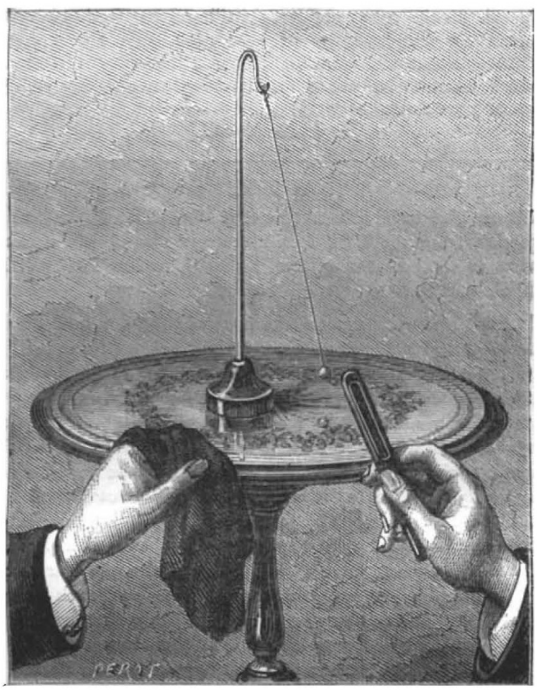

FIG. 16.

entire subject, and do not touch the kindred branches of voltaic electricity or magnetism.

The experiments we lay to-day before our readers are mere repetitions of ordinary lecture experiments, but require no apparatus of a technical kind for their performance. To show the attractions and repulsions due to electrification requires only the appliances depicted in Fig. 16. A stick of sealing-wax rubbed briskly through a dry warm piece of cloth or flannel suffices as a source of electricity. A small light ball cut out of pith or cork is attached by a drop of sealing-wax to a silk thread and thus suspended to any suitable support. It is first attracted toward the electrified stick of wax; and then repelled when by contact it has received a portion of the charge. The repulsion is not very easy to show if the ball is not exceedingly light. For this purpose a small feather, or bit of down out of a pillow, answers far better. A support from which to hang it may be improvised out of a penholder and a couple of books. The electricity excited on the wax by friction with a woollen fabric is of the *negative* kind. *Positive* electricity is no less easily obtained from a warm glass tumbler by exciting it with a warm and dry silk handkerchief. And, if both these sources are at hand the further experiment may be made

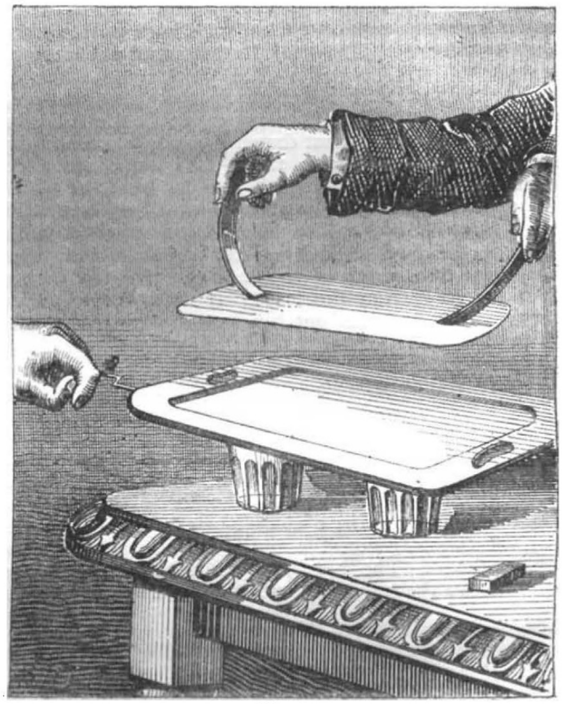

FIG. 17.

of charging the feather with either kind of electricity and then showing that though it is then repelled by electricity

FIG. 18.

of the same kind, the opposite kind of electricity attracts it. The mutual repulsion of two similarly electrified bodies is beautifully shown by means of two silk ribbons, as follows :—The two ribbons, about a foot long, are both side by side on the table, held at one end between the finger and thumb, and then electrified by drawing along them several times a piece of indiarubber. They are then lifted up from the table, when, if care has been taken that all is warm and dry, they are found no longer to hang straight down side by side, but to stand out and repel each other.

To obtain an electric *spark* requires preparations on a larger scale. M. Tissandier recommends the following method :—A piece of stout drawing-paper (warm and dry, of course) is laid upon a table—or upon a warm dry board. It is then rubbed with the dry hand, or with a silk handkerchief, or with a clothes-brush, or, best of all, with a piece of indiarubber. It will stick slightly to the table in consequence of its electrification. Now throw down on to it a bunch of keys, and grasping two corners lift up the sheet from the table. If at the very moment of lifting any one holds out his knuckle to the keys he will receive a small pale spark perhaps three-quarters of an inch long.

A more certain way we have found with what we may call a *Tea-tray Electrophorus* (Fig. 17). A common tea-tray of metal is supported on two dry glass tumblers. A piece of common brown paper cut so as to be a little smaller than the tray, and with rounded corners, is warmed, laid on the table and rubbed briskly with a piece of indiarubber, or with a clothes-brush. It is then laid down for an instant on the tray and the tray is touched with the hand. The brown paper is then lifted a few inches above the tray. If at this juncture some person

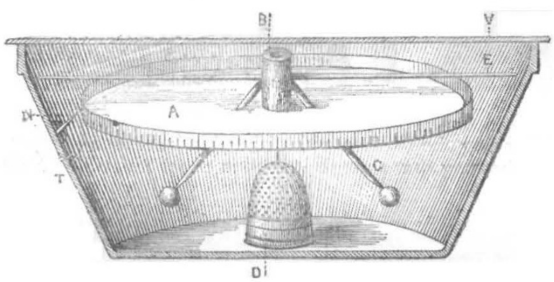

Fig. 19.

presents his knuckle to the tray he will receive a bright spark, which under favourable circumstances may be a couple of inches long. By simply putting the paper down, touching the tray, and again lifting up the paper the tray is again charged : and a large number of sparks may be thus drawn one after the other in rapid succession. The paper may be lifted by the hands, but it will be found better if a couple of ribbons or strips of paper be fixed on with wax to serve as handles, as shown in our figure.

The sparks obtained by the tea-tray electrophorus may produce a slight pricking sensation, but to give a regular electric *shock* will oblige us to store up a charge in a Leyden jar. This important piece of apparatus we have found possible to improvise in the following fashion. A round-bottomed glass tumbler is procured—if of thin glass it is preferable—and is filled to about three-quarters of its height with leaden shot. If shot is not at hand *dry* coal-dust will answer, but not so well, and great care must be taken to wipe clean the upper part of the tumbler. Everything must be warm and scrupulously dry. Into the shot a silver spoon is stuck to serve the place of a rod and knob. This is held as shown in Fig. 18, by grasping it well in the hollow of the hand, so that the hand may cover the whole of the rounded bottom of the glass. Having thus prepared and grasped our Leyden jar we must charge it with sparks from the tea-tray electrophorus. It should be held with the spoon handle near to, but not quite touching the edge of the tea-tray, while another person performs the operations of lifting the brown paper up and putting it down, then touching the tray, then lifting up again—and so on until a dozen sparks have been sent into the jar. On touching the knob a smart little shock is experienced in the wrists and elbows, and a short bright snapping spark announces the discharge of the jar.

The subject of currents of voltaic electricity is somewhat beyond the province of "Physics without Apparatus," and so is the greater part of the subject of magnetism. We may however conclude this article by presenting our readers with a simple mariners' compass described some time ago in a French magazine (Fig. 19). A short knitting- or darning-needle, E, which has been magnetised by rubbing it on a magnet, is pushed into a small cork, B, and balanced in the following way :—A sewing-needle is fixed, point downwards, in the lower end of the cork, and this is poised on a sewing-thimble. To balance it about the point of the needle a couple of matches pointed at the ends are thrust into the sides of the cork obliquely, and weighted at their lower ends with little balls of sealing-wax. A circle of paper or thin card marked with the "points" of the compass may be attached to the cork; and to prevent draughts of air from blowing the needle round it should be placed in a deep saucer or dish of glass or porcelain.

(*To be continued.*)

NOTES

We are glad to be able to state that Mrs. Clifford is to receive a pension from the Civil List in recognition of the eminent services to mathematics of her husband, the late Prof. W. K. Clifford, F.R.S.

In the absence of precise information as to the cause of the lamentable explosion at Seaham Colliery, we cannot say anything useful on the occurrence. When such terrible "accidents" occur, Science is invariably asked if she cannot do anything to prevent them, anything to render the miner's occupation less dangerous than it is. Those who ask such questions seem to be ignorant of the fact that, while much remains to be done, science has already done not a little to point out the causes of such explosions and provide the miners with remedies. But it is well known that a large proportion of such explosions are due to the wilful neglect on the part of the miners of the means which science has put into their hands to prevent such calamities. We are in a fair way of finding out the real nature of the connection between meteorological conditions and explosions in mines; it is in this direction that investigations should be carried out with thoroughness and zeal.

The Sir Josiah Mason's Science College, Birmingham, is to be opened on October 1 next, with an introductory lecture by Prof. Huxley. The classes for students will commence on Tuesday, the 5th. The course of instruction, as at present arranged, includes mathematics, chemistry, physics, and biology. Further details may be learned from our advertising columns.

Two eminent foreign botanists will, the *Gardener's Chronicle* states, shortly visit this country—Dr. Asa Gray and M. Alphonse de Candolle.

We are glad to learn that the Gilchrist Trustees have given two engineering scholarships to University College, London, to be awarded by competition. There is an entrance scholarship (this year two are offered) of the value of 35*l.*, tenable for two years, to be competed for by those who have not previously been students of the College, and who are not more than eighteen years of age. The examination takes place this year on September 28, and candidates must send in their names to the secretary on or before the 23rd. The subjects of the entrance examinations will be as follows :—Mathematics, mechanics,