

Stane, with its inscription said to be in memory of Vetta, the son of Hengist? Was it the Newton Stone, with its inscription as yet altogether unread? Was it Maeshowe, with its runic records? or the Ring of Brogar? or the Stones of Stennis, with all their romantic associations? In Ireland, was it the Giant's Ring, near Belfast? Was it the curious fortification known as Staigue Fort? Was it the remarkable tumulus of Newgrange, with its curious decorations? Was it the ruins of Teltain, or the remains of the hill of Tara associated so intimately with the earliest of Irish records? He hoped that the bill would be rejected neither by Englishmen nor Scotchmen; and Irishmen surely would not grudge a slight and almost infinitesimal expense for the preservation of these fragments of early Irish history. Indeed, the expense entailed by the measure would be very trifling; the amount, moreover, would be settled by the Treasury and controlled by the House of Commons. Those monuments had passed through great dangers. They had been spared by Roman soldiers, by Britons, Saxons, Danes, and Normans; they were respected in days of comparative poverty and barbarism; in these days of enlightenment and civilisation, of wealth almost beyond the dreams of avarice, they were in danger of being broken up for a profit of a few pounds or removed because they cumbered the ground. If the House allowed them to be destroyed, they could never be replaced. It was said that the bill would interfere with the rights of property. What rights? The right of destroying interesting national monuments. That was the only right that would be interfered with. It was not incidental to the bill, it was no drawback in the bill, it was the very object of the measure. It was really, however, the rights of destruction, not the rights of possession, which it touched. It was now for the House to determine whether it would exercise on behalf of the nation the right to preserve those monuments; whether it would maintain the right of individuals to destroy, or the right of the nation to preserve. He hoped the House would agree to the second reading of the bill, for it would surely be a shame and a disgrace to allow those ancient monuments to perish."

We are sure Parliament, if it passes the bill in its entirety, will have not only the approval of the nation, but the admiration of educated men all the world over.

### PRACTICAL PHYSICS

*Introduction to Experimental Physics.* By A. F. Weinhold, Professor in the Royal Technical School at Chemnitz. Translated and edited by B. Loewy, F.R.A.S. With a Preface by Prof. G. C. Foster, F.R.S. (London: Longmans, 1875.)

IN English schools of the present day the teaching of Experimental Physics is, with few exceptions, either neglected or abused. Yet there can be little doubt that this subject ought to be an integral part of the secondary education of every boy and girl. Its usefulness merely as knowledge that touches us at every point in daily life, and that finds its development intimately associated with many modern trades and professions, is a tangible argument in its favour. But it is as a means of *education*, rather than as a vehicle of *instruction*, that physics should be taught in schools. And this because of its high power—when properly taught—of educating individual judgment, by training the senses to habits of accurate observation and the mind to clear and precise modes of thought. Added to all this, practical physics confers the benefit, by no means to be lightly regarded, of giving to the hands the power of useful skill.

Prof. Foster well remarks, in his excellent preface to the work before us: "In the study of physics we are obliged not only to learn a large number of new facts, but also to adopt new habits of learning; while we have at the same time to accustom ourselves to attach accurately defined meanings to the terms employed in discussing physical phenomena, and to reason about them with mathematical strictness, and often by the help of technical mathematical methods. These characteristics of the study of physics give to it a value, as a means of training in habits of exact thinking, which probably no other study possesses in the same degree; but at the same time they make this study more than usually difficult, especially to beginners."

It is this felt difficulty, no doubt, that largely contributes to the exclusion of physics from the general curriculum of our schools and colleges. And where physics is introduced, it is, we fear, too often badly taught, for its method of teaching is misunderstood. It generally proceeds upon the old lines of the black board and textbook. Nor is this to be wondered at. For if a schoolmaster be really anxious to teach experimental physics thoroughly, he is staggered at the multiplicity and cost of the apparatus involved, and out of this difficulty our text-books have hitherto shown him no way of escape.

Where experimental science is honestly attempted, chemistry is found to be less formidable; it also abounds in useful practical class-books, and so this subject is far more widely taught than physics. To many parents and schoolmasters chemistry has become the embodiment of all their thoughts of science. Fumes, explosions, and mess, are, to a large section of the public, inevitably associated with their idea of natural knowledge in general, and experimental knowledge in particular. The replacement of physics by chemistry in schools is much to be regretted on educational grounds; for, so far as the present writer's experience goes, it is decidedly adverse to making chemistry the first or chief part of the scientific training of youth. Nor is there much likelihood of seeing experimental physics generally taught in schools until there are good text-books on practical physics that will enable the student to construct his own apparatus as he proceeds.

On these grounds chiefly we are glad to welcome the present translation of Prof. Weinhold's "*Vorschule der Experimental Physik*." By following the full and excellent directions given by Prof. Weinhold, any intelligent lad can be his own instrument maker; and besides the pleasure of construction, he will acquire a sound and extensive acquaintance with the elements of physics by the time he has carefully gone through the book.

Knowledge thus obtained will be ineffaceably written on the memory, and its worth will be far greater than a corresponding expenditure of time spent in merely reading several of the ordinary class-books. Nor can there be any doubt, as Prof. Foster says, that "whenever this or some similar work comes to be commonly adopted in schools, physics will be in a fair way of becoming one of the most popular as well as most useful parts of school-work, instead of being, as it too often now is, less liked and worse taught than almost any other subject."

One great merit of Prof. Weinhold's hand-book is its great detail. Nothing is more provoking than the vague

generalities and assumptions found in the general run of physical treatises, so that the student is left in the lurch just at the critical moment when he most needs help. It is quite refreshing to notice the minute care with which Prof. Weinhold describes the construction of each piece of apparatus. As illustrations of this take the instructions for cutting glass on p. 14, for soldering on pp. 27 and 28, for cutting screws on pp. 93 and 94; and especially valuable are the directions for making various simple forms of binding screws given on pp. 656-660. Every woodcut

is drawn to scale, every bit of apparatus employed has its dimensions given, every difficulty is pointed out, and failure thus made almost impossible.

Nor is this work only useful for science students. We venture to say any intelligent boy of twelve to fourteen years old might begin this book by himself, and, steadily working at it out of school hours and during the vacation, would in twelve months' time have not only mastered its contents, but have made for himself a very respectable and thoroughly useful collection of physical apparatus, the

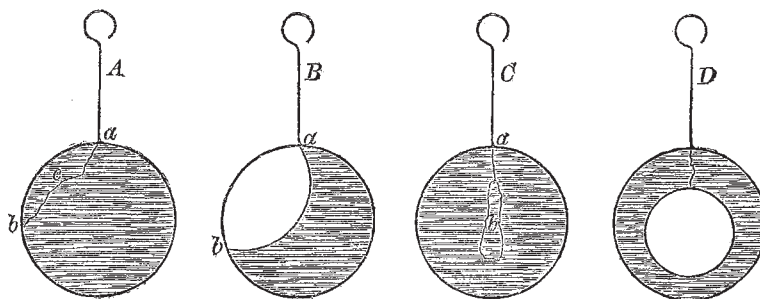


FIG. 1.—Experiments in liquid films.

history and meaning of every fragment of which will be known and loved as part of his nature.

But we shall be doing Prof. Weinhold more justice if we give our readers a few extracts from his hand-book. Here, for example, is a simple and elegant method of demonstrating the tension of liquid films. A ring is dipped in soap solution contained in a flat saucer, and then withdrawn; a film is thus formed after the manner of Plateau's experiments:—"If a very fine silk thread,

the film will always stretch it so as to form an arc of a circle. If a small loop is made at the end of the thread, (Fig. 1, C, D), the latter fixed at *a*, and the film broken at *b*, the thread of the loop will form a complete circle within the ring."

In speaking of hydrostatic pressure, the following simple arrangement is described:—"A pig's bladder, or, better still, that of an ox, is cut down near its mouth so far that the end of a glass tube of about the thickness of a finger, and ten centimetres in length, may be passed through the aperture and firmly tied (if necessary with the help of a cork). A longer glass tube is connected with the shorter by a piece of tight-fitting indiarubber tube, and held in a vertical position by the fork of the retort stand. The bladder is moistened, placed upon the table, flattened out as much as possible, and a piece of board, such as the lid of a box or a drawing-board, laid upon it, so that the bladder is not in the middle, but close to the edge of the board. At each end of the bladder small blocks of wood about two or three centimetres high are placed, in order to protect the glass tube, which reaches under the board, from being broken by the pressure of the board and the weights to be afterwards placed upon it. By pouring water from a bottle or through a funnel into the tube, the bladder is filled until the board begins to rise above the blocks and is in contact with the table only along one edge."

There is a neat illustration of the work done by falling bodies on p. 74, but the author is evidently unacquainted with Prof. Ball's admirable manual on experimental mechanics, wherein the student will find mechanical problems more rigidly and amply put to the test of experiment.

The section on Sound, we observe, omits all reference to the beautiful demonstrations which can be given of the reflection and refraction of sound, nor is there a single reference to the subject of sensitive flames, the value of which as phonoscopes should, in our opinion, hardly have been overlooked. The following simple method of making Kœnig's gas-flame manometer is given on p. 395. For

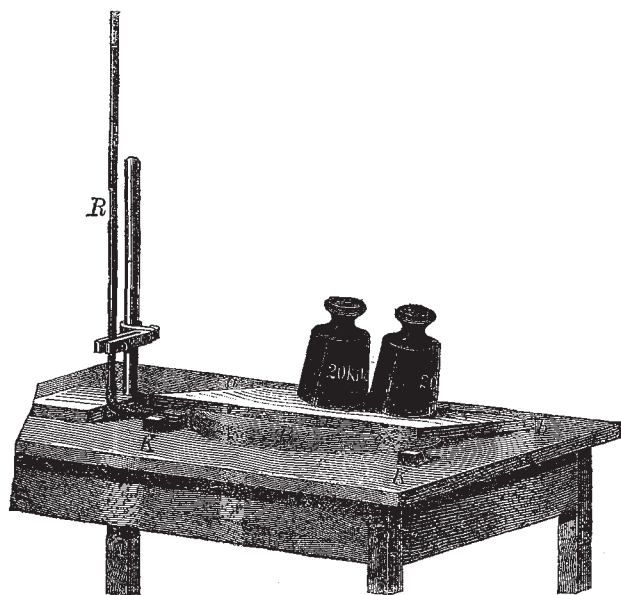


FIG. 2.—Weights raised by liquid pressure.

wound from a cocoon, is tied to two points of the ring *a* and *b* (Fig. 1, A, B), and the film which is formed be broken within the portion *c*, by the finger or a rolled piece of blotting-paper, the unbroken portion of the film will contract and stretch the thread into a beautiful curve. If the thread be fixed only at *a* and held by the finger at *b*, its length may be altered at will, but the contraction of

the ordinary wooden capsule a large cork is substituted. "It is cut across the middle, the necessary holes are bored in it for the tubes, and a conical cavity is cut into each half with a sharp penknife, as shown in Fig. 3. Large corks are never quite air-tight; the whole of the outside should therefore be covered with a layer of sealing-wax one or two millimetres thick; this is done after the two halves have been glued together and the whole is perfectly dry." Before being glued together, a piece of goldbeater's skin is stretched between the two halves at *h*. The tubes *abc* are of glass, the aperture of

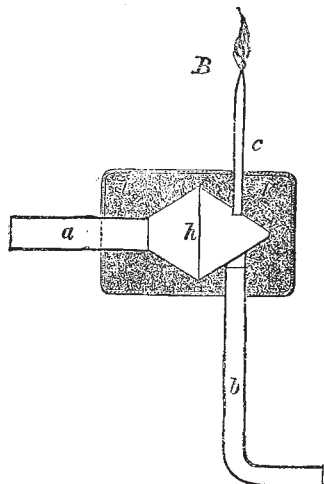


FIG. 3.—The Flame Manometer.

*c* being about 0.4 mm. Here we may observe that, instead of goldbeater's skin or collodion film, which students in general will find difficult to procure, a portion of one of those children's toy balloons made of thin india-rubber may be substituted with great advantage. It should be attached as follows: the edge of the capsule is first glued, and the inflated balloon then pressed on it; when the glue is dry, the portion that remains attached to the capsule is cut round with a knife; by this means a tense thin film is strained across the instrument.

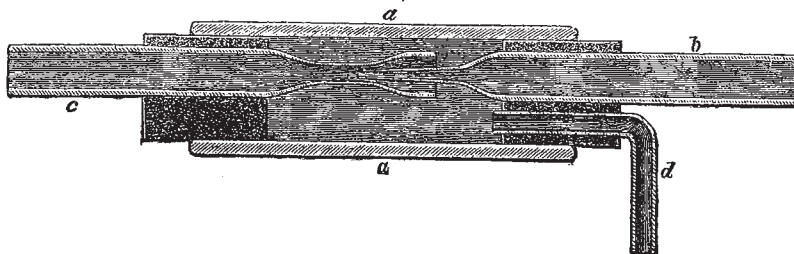


FIG. 6.

edges are then ground with emery powder, a hole bored for filling the prism, and the sides of plate-glass (French plate should have been stated) cemented on by a mixture of glue and treacle.

The accompanying woodcuts indicate two simple arrangements for showing the heating power of the electric discharge. In the one case (Fig. 4) wires, bent as shown in the figure, are insulated by sealing-wax and passed through a cork, in the centre of which is a glass tube allowing a gas jet to issue between the wires, the

These toy balloons will be found of frequent service in acoustics.

The useful little instrument just described will therefore cost little beyond the slight trouble of making it. Nevertheless, the English editor has permitted a firm of instrument makers to advertise it for half a guinea at the end of the volume as "an indispensable piece of apparatus required by the student of this work." In like manner it is "indispensable" to buy a Barker's mill, the price charged being a guinea, when on p. 201 the student is shown how to make one for twopence. We might quote several other instances from this carelessly inserted advertisement. As a translator Mr. Loewy seems to have done his duty

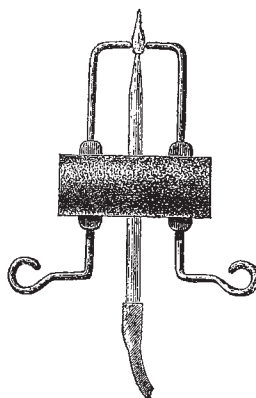


FIG. 4.

Heating effects of the discharge in Leyden jar.

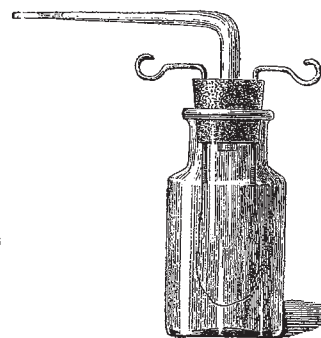


FIG. 5.

well, but we would suggest the necessity of his exercising a little more editorial care if a second edition of this work is called for.

In the section on Light there are some capital instructions for making concave and convex mirrors, and for constructing a simple form of spectroscope, which is entirely built up by the student. The manufacture of a bisulphide of carbon prism (employed in this spectroscope) is always a matter of difficulty. Prof. Weinhold recommends making the body of the prism of a lamp cylinder cut to a wedge shape by an ignited pastille; the

gas being ignited on the discharge from an electrophorus between the points. The other apparatus (Fig. 5) shows that even good conductors are heated by the electric discharge. "A small wide-necked glass bottle is closed by a cork, through which two wires pass and also a glass tube, which is drawn to a point about 1.5 mm. wide, and bent horizontally. The wires are connected by a long, very narrow strip of tinfoil. The glass being very slightly warmed by holding it in the hand for a moment, a drop of water is brought upon the point of the tube.

The heat produced by the passage of the spark through the strip of tinfoil is sufficient to expand the air in the bottle again, and the drop of water is pushed outwards by the expanding air through a space of one or several millimetres."

Fig. 6 is a simple form of the so-called "injector" or steam-jet pipe for feeding the boilers of steam-engines. A glass tube, *aa*, has corks fitted at each end into which pass the tubes *cc* *dd*. Steam issues from the small aperture in *b*, and expanding passes out into the air through *c*. The air within *aa* becomes rarefied, and the water into which the tube *d* dips is thus driven by atmospheric pressure into, and finally ejected from, *c*.

"The construction of the little injector presents no difficulty, but the dimensions of the various parts must be exactly those shown in the figure, if the action is to be depended upon. Each side of the right angle into which the jet tube is to be bent should be about 3 cm. long, and the tube as wide as *c*; the pointed end should be like that of *b*, or very little narrower. An india-rubber suction-tube, 10 or 15 cm. long, may be attached to *d*. The india-rubber tube employed for connecting the apparatus with the vessel in which the steam is generated should fit very tight; it must not be tied with thread, so that in case the pressure of the steam becomes too great, the india-rubber may be forced off the glass tube, instead of its being torn or the glass broken by the pressure."

Before closing the volume, we notice one or two places, besides those previously alluded to, in which a little improvement might be made. For example, in describing the construction of the gold-leaf electroscope, the mode of cutting gold leaf is omitted. The author recommends students "to have the strips cut and fixed to the flat end of a wire by a skilled mechanician." This is unsatisfactory, for students cannot have recourse to a skilled workman when they like. Nor is there any very great difficulty about cutting and fixing the gold leaves when the proper method is patiently tried. Here, as throughout all practical work in physics, perseverance is the essence of success. Again, we observe that useful little instrument the "carrier," or proof-plane, might be more readily made than is stated here. The simplest plan is to procure an ebonite penholder, and fasten a disc of gilt paper at the end intended for the pen. These penholders are most useful adjuncts to a physical laboratory.

Further on, radiant heat receives rather meagre treatment. There is no description of any form of air-thermometer, an instrument which in a modified shape is capable of doing most useful work through the whole subject of heat. Nor is the subject of magnetism so fully treated as we should have expected; and in current electricity some description should have been given of the measurements of resistance and electromotive force: a simple form of Wheatstone's bridge—such, for example, as that suggested by Prof. Foster—can readily be made, and is indispensable for the proper study of this subject.

But the work is intended as an introduction to the study of physics, and, as such, it is altogether the best we have yet met with among English hand-books. The volume unfortunately is of an unwieldy size, and might have been made far more convenient for the constant reference it requires if a better arrangement of type had been adopted.

W. F. B.

DRESSER'S "BIRDS OF EUROPE"

*A History of the Birds of Europe, including all the Species inhabiting the Western Palaearctic Region.* By H. E. Dresser, F.Z.S., &c. (Published by the Author, by special permission, at the Office of the Zoological Society of London.)

THE issue of Parts 35 and 36, completing the third volume, affords us the occasion of again noticing the progress of this beautiful and important work.

The energy with which the author has laboured to ensure punctuality in the issue is beyond all praise; and now that about half the work is completed, and we find that the last twelve parts, with figures of nearly 120 species of birds, have appeared within the year, subscribers have every assurance that they will, in due course, possess a finished work.

And this punctuality of issue is not effected by any haste or carelessness of workmanship either in the plates or the letterpress. In the last double number we find some pictures which are triumphs of artistic skill. Such in particular is the figure of the Night-jar (*Caprimulgus europæus*), in which the downy softness of the plumage, the exquisite mottling of the feathers, the roundness and repose of the whole bird, the half-closed sleepy eye, and the well-contrasted background, are exquisitely rendered. The Wryneck (*Yunx torquilla*) is almost equally good, and the tail of this bird in particular is rendered with a delicacy and skill which cannot be surpassed. Another charming picture is that of the Smew (*Mergus albellus*), surrounded by half a dozen young, whose various attitudes and the grouping of the whole, with the quiet river scene, are in admirable taste. The two Sand-martins (*Cotyle riparia*) perched on bending reeds form another beautiful bit of nature. An important feature of this work is the care taken to figure the birds in all their different states of plumage, and more especially that of the young or nestling birds. In this part we have four species in which the young are figured—the Black-winged Kite, the Pied Flycatcher, the Dottrell, and the Smew—and in every case the plumage of these infants is remarkably different from that of their parents. The introduction of these young birds adds greatly to the variety and interest of the plates as mere pictures; but they also have a high scientific value, since they are with good reason believed to indicate what was probably the plumage of the ancestral form of the group to which they belong. From this point of view, the young are really very old birds indeed, and may, when thoroughly studied, enable future ornithologists not only to reconstruct the forms, but also to reproduce the colouring of the birds of past ages. They thus, to some extent, make up for the deficiency of fossil remains of birds; and this work, when completed and the plates arranged in systematic order, will be invaluable to the philosophic naturalist.

It is difficult to choose an extract which shall give any adequate idea of the valuable scientific matter to be found in the letterpress. The following passage (somewhat condensed), taken from the account of the Night-jar, touches on a difficult question which the observations of some of the readers of NATURE may help to clear up:—

"The Night-jar feeds on moths, beetles, and insects of various kinds, most frequently capturing its prey on the wing, its capacious gape forming an excellent moth or