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, *a a*, has corks fitted at each end into which pass the tubes *c c d*. Steam issues from the small aperture in *b*, and expanding passes out into the air through *c*. The air within *a a* 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 inthe 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 Palæarctic 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

beetle trap. That it eats caterpillars is also certain: but it feeds more especially on the larger insects, such as may-bugs, dung-beetles, large night-flying moths, especially the Sphinx Moth, and various species of nocturnal insects. It is a very greedy feeder, and in the autumn is often very fat. The indigestible portions of the insects it devours (which it swallows entire) it throws up in long pellets, which may frequently be found in the places where it reposes during the day. As it feeds more especially on those insects which are to be met with amongst the dung in places where cattle have been feeding, or where they are stalled, the Night-jar is often to be met with in these pastures or in the immediate vicinity of outlying folds; and hence the popular delusion that it sucks the goats hanging on to their udders; and from this belief has arisen the common appellation of Goat-sucker.

"This species has the claw of the middle toe furnished on the side with pectinations forming a sort of close-toothed comb; and the use made of this peculiar appendage has puzzled naturalists not a little. Some observers contend that it is used to clean the bristles at the base of the bill from the fragments of wings of insects which may adhere to them; but this cannot well be the case, as these vibrissæ or bristles are large, strong, and placed at some distance apart, whereas the teeth of the claw are thin and very close. Others think that as the bird invariably perches along a branch in a direction parellel with it, and never across the bough like almost all other birds, this pectinated claw may assist it in keeping its perch more firmly than it otherwise would do. Other naturalists, again, contend that it is used to hold large insects with greater security; but it appears that the Night-jar almost invariably takes its prey with the mouth and not with the foot; and consequently this supposition falls to the ground. An anonymous writer suggests that the comb-like structure of the claw may be used for disengaging the hooked feet of beetles from the bill, to enable the bird to swallow them; and this may possibly be the case, as the serrations are well calculated to catch the polished limbs of beetles. Anyone who has attempted to confine *Dytisci* or *Scarabæi* in a collecting-box, must be aware of the difficulty in getting their feet free from the edge, to which they hold with the greatest pertinacity, one foot being no sooner pushed in than another is protruded."

This last explanation seems the most probable one, and it agrees with the observation of Gilbert White (of Selborne), who states that he has distinctly seen the Night-jar raise its foot to its mouth while hawking for insects on the wing.

The passage above quoted is a portion of seven quarto pages devoted to an account of the habits and distribution of the Night-jar. A work like the present, so beautifully and artistically illustrated, and of which only a limited number of copies is printed, is sure to become scarce and to rise considerably in value. Lovers of nature and of art may therefore be reminded, that in becoming subscribers they are not only obtaining a valuable and most interesting book, but are at the same time making a profitable investment. A. R. W.

OUR BOOK SHELF

The Monthly Journal of Education and Scholastic Advertiser. A medium of intercommunication for Masters, Mistresses, and others interested in Education. Nos. 1 to 16. (W. P. Nimmo, 1874, 1875.)

THE original *Quarterly* form of this journal had been for some years "slowly but steadily increasing in circulation." The journal is now issued as a *monthly* publication "by a number of teachers who are anxious to be of service to their fellow-workers, and to all persons interested in education." The editor and principal contributors to the two forms of the journal being the same, as might be expected there is no great difference in the earlier and later volumes, but yet there is, we believe, an improvement on the side of the present series. The advantage of such a frequent issue is pretty obvious, but the meeting the subscription for twelve numbers instead of four, is to some a serious consideration. The number of subscribers, we find, is fairly satisfactory, but to make it more than a barely paying matter a much larger number of subscribers, the editor states, is required.

Glancing rapidly over the articles in the numbers before us, we just indicate a few which strike us as most generally interesting. The first we light upon is a letter from Mr. Wilson, of Rugby, to Dr. Temple, on Successive *v.* Simultaneous Instruction: it was written in January 1869, and in considering the problem of education advocates the "stratification of studies." The question is naturally discussed with an eye to Rugby, but the paper is, as might be supposed, deserving of careful study by outsiders. Another Rugby master, Mr. Kitchener, gives his views on teaching botany to junior classes; and Mr. J. Clifton Ward on natural science teaching in schools. A paper on trifle blindness advocates Dr. Liebrich's views. Besides, we note a reprint of a paper by Dr. Hodgson, on exaggerated estimates of reading and writing; one on French accent; and one, by Dr. Jones, on Mr. Todhunter's essay on Elementary Geometry. These two should be read by all who may wish to see what can be said for and against Euclid as a school text-book of geometry. A portion of each number is devoted to correspondence, and a new feature in this new issue of the journal is a Mathematical Column. What the journal wants is the support and contributions of more of our foremost educationalists, and then it would take a higher position than it does at present.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

On the Dynamical Evidence of Molecular Constitution

I BEG to offer the following remarks upon the extremely valuable and instructive lecture by Prof. Clerk-Maxwell which appeared in NATURE, vol. xi. pp. 357, 374, in the hope that they may tend to the further elucidation of this interesting subject.

If two bodies are attracted towards each other by a force which varies inversely as the square of the distance, and R, r, be the force and distance at any instant, Rr will represent the sum of that portion of the energy of the two bodies which is due to their mutual attraction (the mean being $\frac{1}{2}Rr$); that is, the amount which would be converted from potential to actual energy while they approached each other to this point from an infinite distance.

The sum of the virials $\Sigma\Sigma(\frac{1}{2}Rr)$, or $\Sigma(Rr)$, will therefore represent, for a gas whose molecules are so attracted, the total amount of the energy due to attraction.

According, therefore, to the formula of Clausius, the elasticity of such a gas would be the same as if those forces and a portion of the kinetic energy of translation of every particle equal to the energy which is due to them had no existence.

And as the distances between the particles vary inversely as the cube root of the density, if the attractive forces vary inversely as the square of the distances, $\Sigma\Sigma(\frac{1}{3}Rr)$ will vary directly as the cube root of the density. The deduction from the element of pV represented by $\frac{2}{3}T$ will therefore vary as the cube root of the density, and the value of pV will diminish as the density increases.

If the attractive forces vary in a higher inverse ratio, this effect will be further increased.

And if this ratio be the nth power, the sum of the virials wi