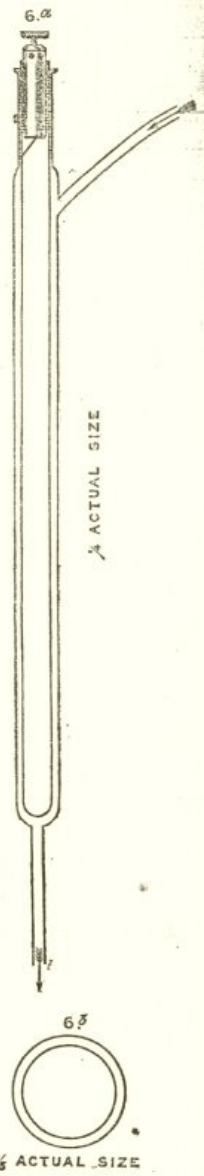
THE INDUCTION TUBE OF W. SIEMENS

A TRANSLATION from a French periodical, *La Nature*, of an article on "Tubes for silent electrical discharges," appears in NATURE of Jan. 29 (vol. ix. p. 244). After referring to the action of the electric spark upon oxygen gas, the author of the article continues: "For the purpose of more easily obtaining ozone, M. Houzeau has recently constructed an apparatus worked by a Ruhmkorff coil, in which there are no longer sparks, but only dark discharges—*effluvia*—far more efficacious in the production of modified oxygen." Again, it is said, that M. Houzeau "has recently devised an apparatus for the preparation of ozone, which is spreading rapidly among the laboratories, and which has already yielded very remarkable results." A description of the apparatus is then given; further on, it is said, that "M. Houzeau is not the only one who has made use of the tubes whose structure he has made known, but that M. Boillot, a writer, it appears," well known to the readers of the *Moniteur*, "has made some further propositions about them; and lastly, that M. A. Thénard" (whose investigations constitute the main subject of the article) "has brought to bear on the construction of the tubes a further modification which makes them still more efficacious." A description and drawing of the apparatus of M. A. Thénard is given. Those who are unacquainted with the facts of the case will be surprised to learn that the invention thus publicly announced, although, doubtless, in principle deserving of the highest praise, was not made either by M. Houzeau, M. Boillot, or M. A. Thénard, but is simply a somewhat clumsy form of the Induction-tube devised by W. Siemens, which is described in his "Memoir on Electrostatic Induction," contained in *Poggendorff's Annalen*, for 1857 (vol. cii. p. 120).

This Induction-tube is one of the most remarkable, as well as simple instruments, of chemical research which has ever been devised; enabling us, by the action of electricity, to effect changes in the composition of gases which may be compared with the chemical changes effected in liquids by the agency of the voltaic battery. A few words in explanation of the instrument may interest the readers of NATURE.

The simplest form of induction-apparatus consists in two thin glass plates, of which one side is coated with tin-foil, and which are so arranged that the uncovered surfaces are parallel to one another, and separated by a uniform, narrow interval of about one or two millimetres filled, say, with air. If this apparatus be charged with electricity by a sufficiently charged Leyden jar, at the moment of the charge the air between the plates becomes luminous, and the same appearance is presented when the apparatus is discharged. To produce this effect, however, the apparatus must be charged beyond a certain limit, determined, in each case, by the speeial arrangement of the apparatus and the materials employed in its construction. Now, if the two plates of tin-foil be respectively connected with the terminals of a powerful Ruhmkorff's coil, the apparatus is successively charged with electricity and discharged; these operations being alternately repeated in such rapid succession that the air, in the interval between the plates, appears permanently luminous. We have, moreover, evidence of the occurrence in this interval of chemical changes determined by the electric action, in the odour and characteristic properties of ozone which may be recognised in a current of air or oxygen compelled to pass between the plates. The conclusion drawn by Siemens from this experiment is, that the electric polarisation of the particles of a dielectric cannot be carried beyond a certain point; and that if it be attempted to accumulate electricity in the apparatus beyond this point, the excess of this tension or polarisation appears in the form of the dynamical phenomena occurring between the plates, namely, light, heat, and chemical change. (*Poggendorff's Annalen*, *loc. cit.*, p. 119).

Now it is evident that in this arrangement the two sheets of glass may be replaced by two concentric cylinders of glass, the interior of the inner cylinder and the exterior of the outer cylinder being coated with tin-foil, as in the case of the plates. It is precisely this change which is effected in the induction-tube of Siemens, but with the additional advantage that in the induction-tube a regular flow of the gas to be operated upon may be maintained, that the experiment may be made at any required temperature, and the gaseous products of the experiment collected for examination. The construction of this induction-tube will be readily understood from the annexed drawing (taken from *Pogg. Ann.* loc. cit.), where the ring shows the horizontal section of the tube.



If the reader will be at the trouble of comparing the description of the tube of M. Houzeau and the drawing of the tube of M. A. Thénard, with the description and drawing of the induction-tube of Siemens he will be satisfied of the substantial identity, both in principle and construction, of these pretended novelties with that invention. At the same time if the statement of these ridiculous pretensions were limited to those made in the article translated in NATURE, vol. ix. p. 244, they would hardly be worthy of notice, but this is not quite the case. The induction-tube of Siemens under the title of "the tube of M. Houzeau," is being rapidly acclimatised as a French discovery. In the article on ozone contained in a recent number of the "Dictionnaire de Chimie," which bears evidence of being the work of a highly competent writer, where we might expect to find a comprehensive treatment of the subject, a similar lapse occurs. We have there, too, a drawing of the tube of M. Houzeau, which is described as "a happy modification of the tube of M. Babo," but not a word is said about Siemens, the inventor of the tube, whose name is simply dropped. Other similar instances might be brought forward which have afforded an opportunity of rectifying these mistakes, but of which no advantage has been taken. I have therefore ventured to make these remarks, not only I may say in the interest of justice, but also, having myself made many experiments with the induction-tube of Siemens, I have learned, perhaps, more than others to appreciate its value and feel myself under a special debt of gratitude to the inventor.

B. C. BRODIE

RECENT RESEARCHES ON TERMITES AND HONEY-BEES

THE accompanying letter, just received from Fritz Müller, in Southern Brazil, is so interesting that it appears to me well worth publishing in NATURE. His discovery of the two sexually mature forms of Termites,

and of their habits, is now published in Germany; nevertheless few Englishmen will have as yet seen the account.

In the German paper he justly compares, as far as function is concerned, the winged males and females of the one form, and the wingless males and females of the second form, with those plants which produce flowers of two forms, serving different ends, of which so excellent an account has lately appeared in NATURE by his brother, Hermann Müller.

The facts, also, given by Fritz Müller with respect to the stingless bees of Brazil will surprise and interest entomologists. CHARLES DARWIN

Feb. 11

"For some years I have been engaged in studying the natural history of our Termites, of which I have had more than a dozen living species at my disposition. The several species differ much more in their habits and in their anatomy than is generally assumed. In most species there are two sets of neuters, viz., labourers and soldiers; but in some species (*Calotermes* Hg.) the labourers, and in others (*Anoplotermes* F. M.) the soldiers, are wanting. With respect to these neuters I have come to the same conclusion as that arrived at by Mr. Bates, viz. that, differently from what we see in social Hymenoptera, they are not modified imagos (sterile females), but modified larvæ, which undergo no further metamorphosis. This accounts for the fact first observed by Lespès, that both the sexes are represented among the sterile (or so-called neuter) Termites. In some species of *Calotermes* the male soldiers may even externally be distinguished from the female ones. I have been able to confirm, in almost all our species, the fact already observed by Mr. Smeathman a century ago, but doubted by most subsequent writers, that in the company of the queen there lives always a king. The most interesting fact in the natural history of these curious insects is the existence of two forms of sexual individuals, in some (if not in all) of the species. Besides the winged males and females, which are produced in vast numbers, and which, leaving the termitary in large swarms, may intercross with those produced in other communities, there are wingless males and females, which never leave the termitary where they are born, and which replace the winged males or females, whenever a community does not find in due time a true king or queen. Once I found a king (of a species of *Eutermes*) living in company with as many as thirty-one such complemental females, as they may be called, instead of with a single legitimate queen. Termites would, no doubt, save an extraordinary amount of labour if, instead of raising annually myriads of winged males and females, almost all of which (helpless creatures as they are) perish in the time of swarming without being able to find a new home, they raised solely a few wingless males and females, which, free from danger, might remain in their native termitary; and he who does not admit the paramount importance of intercrossing, must of course wonder why this latter manner of reproduction (by wingless individuals) has not long since taken the place through natural selection of the production of winged males and females. But the wingless individuals would of course have to pair always with their near relatives, whilst by the swarming of the winged Termites a chance is given to them for the intercrossing of individuals not nearly related. I sent to Germany, about a year ago, a paper on this subject, but do not know whether it has yet been published.

"From Termites I have lately turned my attention to a still more interesting group of social insects, viz., our stingless honey-bees (Melipona and Trigona). Though a high authority in this matter, Mr. Frederick Smith, has lately affirmed, that "we have now acquired almost a complete history of their economy," I still believe, that almost all remains to be done in this respect. I think that even their affinities are not yet well established, and that they are by no means intermediate between hive- and humble-bees, nor so nearly allied to them, as is now generally admitted. Wasps and hive-bees have no doubt independently acquired their social habits, as well as the habit of constructing combs of hexagonal cells, and so, I think, has Melipona. The genera Apis and Melipona may even have separated from a common progenitor, before wax was used in the construction of the cells; for in hive-bees, as is well known, wax is secreted on the ventral side: in Melipona on the contrary, as I have seen, on the dorsal side of the abdomen; now it is not probable, that the secretion of wax, when once established, should have migrated from the ventral to the dorsal side, or *vice versâ*.

"The queen of the hive-bee fixes her eggs on the bottom of the empty cells; the larvæ are fed by the labourers at first with semi-digested food, and afterwards with a mixture of pollen and honey, and only when the larvæ are full grown, the cells are closed. The Meliponæ and Trigonæ, on the contrary, fill the cells with semi-digested food before the eggs are laid, and they shut the cells immediately after the queen has dropped an egg on the food. With hive-bees the royal cells, in which the future queens have to be raised, differ in their direction from the other cells; this is not the case with Melipona and Trigona, where all the cells are vertical, with their orifices turned upward, forming horizontal (or rarely spirally ascending) combs. You know that honey is stored by our stingless bees in large, oval, irregularly clustered cells; and thus there are many more or less important differences in the structure, as well as in the economy, of Apis and Melipona.

"My brother, who is now examining carefully the external structure of our species, is surprised at the amount of variability, which the several species show in the structure of their hind legs, of their wings, &c., and not less are the differences they exhibit in their habits.

"I have hitherto observed here 14 species of Melipona and Trigona, the smallest of them scarcely exceeding 2 millimetres in length, the largest being about the size of the hive-bee. One of these species lives as a parasite within the nests of some other species. I have now, in my garden, hives of 4 of our species, in which I have observed the construction of the combs, the laying of the eggs, &c., and I hope I shall soon be able to obtain hives of some more species. Some of our species are so elegant and beautiful and so extremely interesting, that they would be a most precious acquisition for zoological gardens or large hot-houses; nor do I think that it would be very difficult to bring them to Europe and there to preserve them in a living state.

"If it be of some interest to you I shall be glad to give you from time to time an account of what I may observe in my Melipona apiary.

"Believe me, dear Sir, &c.,

"FRITZ MÜLLER"

*MARS**

IN the previous article were mentioned some of Professor Kaiser's conclusions. We are induced to add a few further remarks, from their general applicability. The delineation of the heavenly bodies, he says, is always a very difficult task, especially when, as in the case of Mars, we have to deal with features more or less indistinct, delicately and gradually shaded. With the most powerful telescopes the disc is but small; and on it we find a mass of ill-defined and frequently very feeble spots, which require close attention for their disentanglement, and it is hard to obtain a clear conviction as to the outlines and shadings that have to be drawn. The difficulty is much increased by the inces-

* Continued from p. 289.