13·0 mm. long by 6·0 mm. wide. The fact that a continuum of metal having so large an area can be spontaneously deposited on the glass walls is of great interest, since it points to a perfectly homogeneous film structure.

The films were kept under observation for several hours, and were found to undergo a progressive transformation due apparently to gas diffusion through the metal, the skins slowly shrinking, and finally puckering. On passing a further discharge at this stage, the flaccid films became electrified, and consequently disrupted by contact with the walls of the tube. The continuous formation of minute gas bubbles upon the surface of the 'envelopes' confirmed the supposition of a gas diffusion through the film.

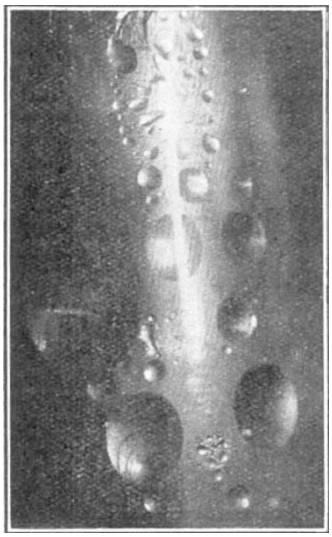

FIG. 1.—Silver bubbles produced by discharge through a 'sputtered' tube. Twice natural size.

Evidence of a granular structure in the metal deposit was sought, but was not confirmed by observation with a high-power microscope. An attempted measurement of the thickness of the films by observing the interference colours produced was rendered abortive, owing to a general 'browning' of the glass walls, but since a thickness of approximately 0·3 μ is requisite for visible interference phenomena, it is apparent that the observed deposits approximated to molecular thickness.

The discharge was maintained at a pressure of 5×10^{-3} mm. of Hg, using a 10 in. coil, with mechanical 'make and break,' to excite the tube.

D. R. BARBER.

University College, Exeter,
June 16.

A Century of Inventions.

PERUSAL of Sir Alfred Ewing's masterly review of "A Century of Inventions" (NATURE, June 16) brings to mind the singular accuracy with which Erasmus Darwin (1731–1802) foretold some of them. The forecast lies buried in his poem, "The Botanic Garden, or the Lover of the Plants," which incurred Canning's merciless parody, "The Loves of the Triangles," and was pronounced by Byron to be "pompous rhyme."

"The Botanic Garden" was published in 1789, fifteen years before Trevithick first made a steam carriage to run upon rails. Darwin did not live to see that, nor did he foresee the internal combustion engine; but his prophecy was of remarkable range.

"Soon shall thine arm, Unconquered Steam, afar
Drag the slow barge and drive the rapid car;
Or on wide-waving wings expanded bear
The flying chariot through the fields of air.
Fair crews, triumphant, leaning from above,
Shall wave their flutt'ring kerchiefs as they move;
Or warrior bands alarm the gaping crowd,
And armies cower beneath the shadowy cloud."

HERBERT MAXWELL.

Monreith.

IN the thirty-fourth James Forrest Lecture, delivered by him before the Institution of Civil Engineers on June 4, Sir Alfred Ewing omits to mention the source from which he has borrowed his title. The historian of science is not likely to forget that remarkable memoir, "A Century of Inventions" (1663), in which the steam-engine is first described. It has been often reprinted, and under this name, an abbreviation of the *original* has been translated into several European languages. The author, Edward Somerset, second Marquess of Worcester (1601–1667), was eldest son of Henry, the first marquess, by Anne, second daughter of John Lord Russell and of Elizabeth, third daughter of Sir Anthony Cooke, Knight of the Bath. By virtue of their common descent from the last-named statesman, he was a cousin once removed of Francis Bacon, Viscount St. Alban. His only son, Henry Somerset, first Duke of Beaufort, was a maternal ancestor of Augustus Fitzroy, third Duke of Grafton, grandfather of Admiral Fitzroy, the eminent meteorologist. THURKILL COOKE.

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MR. THURKILL COOKE is of course right in saying that I borrowed the title of my recent James Forrest Lecture from the Marquis of Worcester's well-known book. The title is so familiar in that connexion to students of engineering history that I imagined my audience did not need to be reminded of its origin. Mr. Cooke will find a reference to the original "Century of Inventions" in my book on "The Steam-Engine and other Heat Engines" (p. 4), where a brief sketch is attempted of early stages in the evolution of the steam-engine. J. A. EWING.

Valence and the Rule of Eight.

F. LONDON, in an interesting article (*Zeit. f. Physik*, **46**, 455; 1928), attempts to account for the difference in valence behaviour between nitrogen, oxygen, and fluorine on one hand, and phosphorus, sulphur, and chlorine on the other, in terms of absolute quantum restrictions. The chemist has been inclined to account for the limited valence of nitrogen, oxygen, and fluorine on the grounds of energy relations; that is, many compounds do not occur because they are 'unstable.' Such an explanation is admittedly unsatisfactory.

London's main premise is that the 'homopolar' bond between two atoms consists of a pair of electrons, one of which is contributed by each atom. If two electrons belong to the same atom and are 'paired,' that is, neutralise each other magnetically, they are not available as a bonding pair to form a link with another atom. This is, of course, quite a different postulate from the one made by G. N. Lewis, who assumed that the pair of electrons in the bond might both belong to one atom. London's postulate works well in that he can show that fluorine has only one 'free' electron, while chlorine may share as many as seven pairs of electrons in perchloric acid. This latter assumption, however, abrogates the rule of eight, which has its physical basis in the stability of the electron structure of the noble gases and is, after all, one of the main principles of the Lewis theory.

Apparently London naïvely accepts the old valence theory, which assumes that an element will show a different valence toward oxygen than toward hydrogen, without realising that this behaviour calls for some explanation. If $HClO_4$ exists, why not H_7Cl? The Lewis theory accounts for all this very nicely by the rule of eight.

Furthermore, oxygen and fluorine form compounds