as that for a thin plate, which well represents an ordinary damper or flue register, $Q = 0.625 A V$, or $\frac{5}{8}$ ths the theoretical discharge.

The numbers in the body of the table show the quantity of air in cubic feet per minute that will be drawn through a register, or other similar opening one foot square, by a vertical flue of 100 feet effective height at the given temperatures.

To adapt these numbers to flues of different heights, multiply them by one-tenth the square root of the effective height in feet.

It is to be understood that the area of cross-section of the flue is not less than that of all the openings for which the flow is computed; otherwise the computations must be based on its area instead of theirs.

Fahr.	60°	80°	100°	120°	150°	200°	250°	300°	450°
0°	1020	1167	1281	1380	1500	1665	1796	1896	2124
10°	940	1092	1215	1320	1450	1622	1760	1866	2100
20°	840	1010	1145	1256	1395	1580	1725	1833	2075
32°	705	904	1046	1181	1342	1530	1675	1795	2045
40°	594	826	995	1125	1285	1490	1645	1765	2027
50°	426	723	904	1054	1225	1441	1606	1758	2002
60°	0	581	810	975	1163	1394	1566	1697	1980
70°	'	415	699	892	1095	1342	1525	1661	1950
80°	'	0	575	798	1025	1291	1480	1625	1925
90°	'	'	415	688	950	1238	1436	1590	1900
100°	'	'	0	562	866	1178	1391	1550	1874

The small table appended below gives the proper factors to be applied as above, for flues less than 100 feet high :

Height of Flue.	Factor.
10 feet.	0.316
20 "	0.447
30 "	0.547
40 "	0.632
50 "	0.7
60 "	0.774
70 "	0.836
80 "	0.894
90 "	0.948

On the Spheroidal State of Bodies. By ARTHUR H. CHURCH, Esq.
To Dr. Tyndall, F.R.S. &c.*

The successful method by which, in your last lecture, the existence of a space between water in the spheroidal state and the containing vessel was proved by the complete interruption that space offered to the passage of a galvanic current, has induced me to devise a few experiments on the subject.

I have to describe in the present communication, in the first place, some experiments I have just performed for the purpose of obtaining decisive evidence of the isolation of all bodies in the spheroidal state from the surfaces on which they roll; and in the second place, to offer a few suggestions as to the probable causes of the phenomena under consideration.

*From the Lond., Edinb., and Dubl. Philosoph. Magazine, April, 1854.

It was found by Boutigny, that if into a clean, red-hot platinum capsule acids and alkalies be placed, the acid and alkaline liquids will roll about, repelling one another violently. This, though an interesting example of the suspension of chemical affinity, does not prove the existence of a space between the platinum vessel and the spheroids.

The first experiment I have to mention was this:—I took a copper basin, three inches in diameter and rather more than half an inch deep, polished its concave surface, and covered it with a thin film of silver by the galvanic process. The plated basin was now brought to a very high temperature, and while thus heated, a few drops of a slightly alkaline solution of sulphide of sodium were poured into it. These drops instantly assumed the spheroidal form and rolled about, making, however, no mark or track upon the silver. The source of heat was now withdrawn: the temperature was soon so far reduced that the liquid exhibited its normal properties, the space between it and the silver no longer existed, and a black stain of sulphide of silver covered the dish.

Another instance of the assumption of the spheroidal state has been often noticed. It occurs when ether is placed on the surface of boiling water. Now, if a fixed inorganic acid be dissolved in ether, and the water be colored with litmus, no reddening of the latter will take place as long as the ether remains in the spheroidal state. The acidulated ether and the tinted water cannot, therefore, be in communication; they are separated by a film of air or of vapor.

I pass on to notice in as few words as possible the remainder of my experiments. I have remarked that in certain circumstances spheroidal globules form upon the surface of liquids during the processes of filtration and distillation. The phenomenon to which I refer is exhibited by many liquids, more frequently and conspicuously perhaps by those that are the more volatile. I have observed it with alcohol, water, aqueous and alcoholic solutions, syrup, with essential oils and many other organic substances. I have sometimes, however, found considerable difficulty in its reproduction, and will therefore describe in detail a method which is applicable in most cases for obtaining in this manner an example of the spheroidal state. We will employ a particular instance. If we take cymole, a hydrocarbon belonging to the benzole series, and half fill a bottle two or more inches in diameter with it, placing in the neck of the bottle a perforated cork through which passes a funnel-tube filled with cymole, and having a piece of sheet India-rubber stretched over its mouth, we shall find that on adjusting the funnel-tube till its lower extremity is rather less than half an inch from the surface of the liquid in the bottle, and on letting fall a drop of cymole from it, beautiful spheroidal globules will be formed and roll about for some time, scarcely diminishing in size. This experiment may be performed with great advantage if the cymole be warmed first. An ordinary funnel with a filter may be substituted for the funnel-tube, and will answer well if the lower aperture of the funnel has a diameter of about $\frac{1}{13}$ of an inch. The experiment may be repeated with other materials with similar effects. That the spheroids are not in contact with the surfaces on which they roll, may be proved by saturating the liquid in the tube with something that shall have a visible effect upon a substance dissolved in the liquid

in the bottle. A beautiful illustration of this occurs when, under conditions similar to those before mentioned, we employ in the funnel-tube a solution of sugar containing sulphocyanide of potassium, and in the bottle a solution of sugar containing sesquichloride of iron; no red coloration takes place until the coalescence of the spheroids with the liquid beneath them. Many other chemical reactions may be made use of with similar results. It is very curious to see a solution of ferrocyanide of potassium floating upon a solution of sesquichloride of iron, while not a trace of Prussian blue is formed. These experiments must of course be recommenced whenever any union of the liquids employed has taken place. The cork spoken of above should have two perforations, one to admit the funnel-tube, and the other to allow the escape of air.

Is the employment of a volatile substance essential to the production of these phenomena? I imagined that this question might be answered by the following experiment. A dish of platinum might be heated strongly, and a drop of melted lead then placed upon it; now if the production of vapor from the substances employed were essential to the formation of the spheroidal state, the lead should at once dissolve and perforate the platinum; if, however, the spheroidal state occurs when two non-volatile substances are employed, the platinum vessel should not be perforated until its temperature has been considerably reduced. The experiment was tried with every precaution to prevent the oxidation of the lead and insure an accurate result; a perforation of the platinum ensued the moment of placing the melted lead upon it. This proves that the production of vapor is essential to the occurrence of the spheroidal state; for it cannot be urged that that condition is never manifested when metals only are employed; for a drop of a volatile metal, mercury (melted mercury, we may say, in order to render its relationship to melted lead the more apparent), placed on an intensely heated surface of platinum instantly assumes the spheroidal form, and evaporating slowly, dances about in the vessel with peculiar movements. Upon thin, sonorous vessels of copper, &c., this movement takes place with such rapidity as to produce a musical tone of high pitch. I have sometimes seen globules of mercury and water rise to the height of six inches from the capsules in which they had been formed.

A word or two in conclusion, as an attempt at an explanation of the phenomena observed may not be out of place.

Since a space always exists between the lower body and that in the spheroidal state, and since that state is not manifested by non-volatile substances, it seems reasonable to conclude that the vapor proceeding from those parts of the liquids nearest to the containing vessel or subjacent fluid tends to assist the internal molecular cohesive force of the drops in assuming and maintaining their spheroidal form. Other forces originated by the temperature may also be in operation.

I should premise that the solution of sulphide of sodium employed in my first experiment made a dark stain upon silver even in the cold. This renders the nullity of its action at a high temperature the more remarkable. It will be scarcely necessary to mention, that, for the successful performance of most of these experiments, considerable manipulative care is required.—*Royal College of Chemistry, March 18, 1854.*