is very great along the floor, immediately above the surface of the molten metal, falling off very rapidly as the roof of the tube is approached. It has always appeared to me probable that we are dealing with clusters of molecules, though there may be some simpler way of explaining the very steep density gradient. At all events, local heating of the denser portion of the vapour reduces its density, it seems to me, to a much greater degree than would be the case with an ordinary gas. The steep density gradient only occurs when the top of the horizontal tube is cooler than the floor, that is, cool enough to condense the vapour. The tubes I usually exhaust to a pressure of a millimetre or two, and I have always found it difficult to explain how it is possible to have a layer of vapour along the floor so dense that it is deep violet in colour, while along the roof the vapour shows no trace of colour at all. On the kinetic theory, it seems to me that we should expect the vapour to be moving rapidly from the floor to the roof, without, however, showing much difference in density at different points. It may be, however, that the traces of hydrogen which are present may be the cause of the phenomenon. What we call "very dense sodium vapour" along the floor of the tube may be pure sodium vapour at a pressure of only a couple of millimetres. Along the roof we may have nearly pure hydrogen at the same pressure, and at intermediate points mixtures of the two in varying proportion, the sodium working its way up through the hydrogen and condensing on the roof. It will be well to try a very highly exhausted tube.

Upon the whole, I think perhaps this is the most conservative way of looking at the thing, though my impression is that the hot wire produces a greater reduction of density than we should expect on this assumption.

Baltimore, February 5. R. W. Wood.

A New Chemical Test for Strength in Wheat Flour.

That different wheats make flours of very different baking values has been known for a long time, and is emphasised by the fact that English millers are at the present time paying several shillings per quarter more for certain foreign wheats than for home-grown wheat.

Baking value, or strength as the millers and bakers call it, is a subject of much interest, and many workers have tried to connect it with some definite physical or chemical property of the grain or flour. Thus it has been stated to depend on the percentage of gluten, the percentage of gliadin, or the ratio of gliadin to gluten.

None of these explanations has been found to meet all cases, nor is there any likelihood of finding any single factor which is capable of measuring so composite an idea as strength as understood by the miller or baker.

The value of a flour to the baker depends on at least four distinct properties:—(1) the volume of the loaf a given quantity will produce, which may vary more than 30 per cent.; (2) the amount of water which a given quantity will absorb in making a dough of proper consistency for baking, which may vary from one-half to three-quarters of its own weight; (3) the shape of the loaf; and (4) such points as texture and colour of the bread.

The baker, and apparently most of those who have attacked the problem, have confused these widely divergent properties under the single name of strength, and attempted to find one chemical or physical factor which will measure them all at once.

In taking up this subject, it seemed to me that the most hopeful line was to treat each property as a separate problem, and as the question of size of loaf seemed simplest, I have for the most part confined my attention to that aspect of the investigation.

In converting a given amount of flour into a loaf of bread, the flour is mixed with water and yeast, and allowed to ferment for some time. It is then put into the oven and baked. The yeast finds sugar in the flour, feeds on this, and converts it into alcohol and carbon dioxide, and the volume of the loaf must depend either on the volume of carbon dioxide evolved, or on the power of the flour to hold this gas.

To test this a number of flours were obtained from Mr. A. E. Humphries, chairman of the Millers' Association, who had kindly tested them in the bakehouse, and determined their strength. The scale of strength adopted is a purely arbitrary one. The mark 100 is assigned to the best flour on the market, and 0 to a flour which is quite unbakeable.

In each experiment 20 grams of flour were mixed with 20 c.c. of water and half a gram of standard yeast, incubated at 35° C., and the carbon dioxide liberated directly measured. The results are appended:—

Reference No.	Baking value or "strength"	CO_2 evolved cc.
1	96	270
2	90	325
3	73	274
4	68	227
5	65	205
6	45	156
7	36	131
8	20	287

It will be seen that with the exception of Nos. 1 and 8 the order of strength and of carbon dioxide evolved are the same. Perhaps the greatest confirmation of the idea that strength is directly dependent upon the capacity of a flour for acting as yeast food is found in the apparent exceptions. On inquiry from Mr. Humphries, I learned that the high mark assigned to flour No. 1 was based upon bakings made after the addition of malt extract, while the low value given to No. 8 was based on baking tests made some months earlier. The high carbon dioxide value actually found for the latter enabled me to predict that the flour must have changed in composition so as to have gained in strength, and this prediction was verified. On baking again it was marked 40, with the report that it made a large loaf, and would have been marked higher but for the bad shape.

The quantity of carbon dioxide given off by a dough will depend upon two things—the sugar present as such in the flour, and the diastatic capacity. Analysis showed that in the flours experimented with the sugar present varied from 2·56 per cent. in the strongest to 1·60 per cent. in the weakest, and followed very closely the order of strength throughout the series. Diastatic capacity has not yet been thoroughly examined.

The addition of sugar to flour was found always to increase the volume, the weight, and the height of the loaf. In a typical experiment made with household flour the increases were as follows:—volume, 13 per cent.; weight, 2 per cent.; and height, 30 per cent.

These experiments seem to prove conclusively that the volume of the loaf depends in the first instance upon the amount of sugar available in the dough, and a ready test is thus provided for that aspect of strength which is concerned with the size of the loaf. The other factors included in strength are at present under investigation.

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The Flight of an Elongated Shot.

Within the limits of accuracy of this discussion, it may be assumed that the sections of the shot normal to its axis of figure are circular, that its C.G. is in the axis of figure, and that this axis and all the diameters of the circular section at the C.G. give the directions of the principal axes of inertia at the C.G. Angular momenta will be referred to the C.G., the axis of the shot will be called simply the axis, and all directions will be understood as viewed from behind the shot.

The chief disturbing forces are the normal pressures of the air, the frictional forces being of a secondary order of magnitude. These normal pressures will be at a maximum upon the ogival head of the shot. The areas of such relatively smaller pressures as are due to vortex motion in the air, and to the partial vacua set up behind advancing surfaces directly presented to and against the air, will be situated towards the base of the shot, and upon the upper or the lower side of the shot, according as the axis is pointed above or below the tangent to the path of the C.G., *i.e.* the tangent to the trajectory.

Now, from the first moment of the free motion the tangent to the trajectory falls away more and more from the axis of the shot. The immediate result of this is the