of silver, the lowest limit, to 60 melts, the higher limit, in a single crucible. I have no doubt that a careful study of the principles of the manufacture of black lead crucibles here developed, somewhat fully, and even perchance their further development, beyond my conception, can improve their quality so as to double the life and strength ascribed to them.

U. S. MINT, PHILADELPHIA, Dec. 31, 1884.

NOTE ON CAMPHOR MOTIONS.

BY P. CASAMAJOR.

On the 4th of October, 1877, I read a paper "On the Motions of Camphor on the Surface of Water," before the American Chemical Society, in which I described experiments, which had led me to the conclusion that these motions were due to electricity.

The extraordinary motions which give an appearance of life to pieces of camphor, swimming on the surface of water, are not to be seen at all times. Very often camphor will remain motionless, while at other times the pieces gyrate with great animation. One of the earliest observers of these singular motions, Romien (1748), came to the conclusion that they were due to electricity, while subsequent investigators, among whom may be counted the great Volta, have generally decided that there is no connection between electricity and the motion of camphor on water.

I was led to believe that camphor motions were due to electricity by the results of experiments, of which I will give a brief account.

When pieces of camphor are thrown on water, they may remain torpid or they may gyrate with every appearance of life. In the latter case, the motions may be instantly arrested by dipping a finger in the water on which the camphor moves. If we have pieces of camphor lying quietly on water, they may be made to move by dipping into the water a rod of either glass, sealing wax or vulcanite, electrified by friction. After every immersion the glass is to be dried by wiping with a dry cloth or a piece of bibulous paper; and, before every immersion, the rod is electrified by rubbing with a piece of silk or flannel. After one or more immersions of the electrified rod, the camphor motions invariably start, and by a few additional immersions they increase in intensity. The fact that these motions could be started by means of an electrified rod was a new one. Those who had decided that camphor motions were not due to electricity were not acquainted with it, and I was led to believe by this fact, and by others which I gave at the time, that camphor motions were electrical phenomena. There was, however, something unsatisfactory in this method of applying electricity to the water on which pieces of camphor floated, but, at that time, no other method occurred to me. Afterwards the whole subject slipped from my mind, but, quite recently, the following experiment has suggested itself, which seems to show that camphor motions are not due to the state of electrical tension of the liquid on which pieces of camphor float.

The experiment was performed in a glass dish about two inches deep, and of five inches diameter. This was filled with water up to within an inch of the top. The bottom of the dish and the sides, up to within an inch of the top, were covered with tin foil. A metallic wire dipped in the water of the dish, with one end out of the water, but having no connection with the outside lining of tin foil.

This glass dish was the equivalent of a Leyden jar, which could be charged with electricity from the plate of an electrophorus by touching the wire dipping into the water with this plate, laying a finger at the same time on the outside armature.

A few pieces of camphor were placed upon the water in the dish, and these were reduced to immobility by dipping a finger in the water. After this the water in the dish was charged with electricity by repeatedly placing the plate of an electrophorus in contact with the wire dipping into the water, while the outside armature was touched with a finger.

There was no effect produced on the pieces of camphor floating on the water of the dish. These remained motionless, not exhibiting the slightest tremor. There could be no doubt that the water surface was in a greater state of electrical tension in this experiment than when the water is electrified by dipping an excited rod in it, for, by placing one hand on the outside armature of the dish, and slowly approaching the water surface with a finger of the other hand, a perceptible spark was obtained.

There seems to be a discrepancy between the results to be obtained in these two classes of experiments.

By dipping an electrified rod successively in water the camphor motions always take place, while, when we electrify by applying the plate of an electrophorus to the water in the dish, as described, not the least tremor can be perceived. As these results were obtained over and over again, there cannot be any doubt as to the difference of the effects in the two modes of operating.

The conclusion that may be drawn is that camphor motions are not caused by electricity. In the case of an electrified rod, dipped successively in water, I am inclined to the opinion that electricity acts indirectly by removing physical impurities from the surface of the water, as shown by the following experiment :

Take a glass of water, and on its surface place a few pieces of camphor. If these are inclined to move, they may be stopped by dipping a finger in the water. Then blow a cloud of lycopodium powder over the surface of the water, so as to cover this surface uniformly with the powder. If now an electrified rod is dipped repeatedly in the water, wiping it dry after every immersion, and, rubbing it with a piece of flannel before dipping in the water again, the result will be that the pieces of camphor will move as if gifted with life. It will be noticed at the same time that the surface of the water will be almost entirely free from lycopodium, as the powder has been gradually removed by each successive immersion of the electrified rod, which attracts lycopodium like all other light bodies. If now we suppose that films of oily matter are removed in the same way by an electrified rod, we may conceive how electricity can act indirectly in removing impurities from the surface of the water.

There would remain to explain why films of oily matter or other impurities act as a check on camphor motions while a physically clean water surface is a favorable condition in producing these motions. Towards the solution of these questions I will venture the following explanation, which may serve as the base of further researches.

It is a well ascertained fact relating to camphor motions, that when these motions take place the camphor dissolves in water more quickly than when the camphor is at rest. I think that a connection exists between camphor motions and the three following facts :

1st, that camphor dissolves in water quite easily at times ; 2d, that its density allows it to float on water; and 3d, that the solution has a density slightly different from that of water. I am not prepared at present to develop these ideas, which would require further experiments to establish.

I will confine myself to the well ascertained fact that a piece of camphor wears away much faster when in motion than when at rest. This being established, it appears more than probable that if a piece of camphor is perfectly free from oily matter it will dissolve in water more readily than if protected by a greasy film. The slightest film of this nature, in contact with camphor, becomes a saturated oily solution of camphor. and if any excess exists, over what will cover the camphor, the greasy film will extend over the surface of the water.

When things are in this condition, if an electrified rod is dipped several times in the water, every immersion will remove a portion of oily film from the surface, until finally the film on each piece of camphor becomes so thin that the water reaches the pieces of camphor, and these immediately become gifted with motion.

ON THE METHODS OF INDIGO TESTING.

BY HENRY M. RAU, PH. D.

IT appears strange, when the high price of indigo and its large consumption in the industrial arts are considered, that the methods commonly employed in this country for its valuation should, from a scientific standpoint, be so crude and inaccurate.

Taking the average price of the various grades of indigo in the market as a basis for calculation, it may be stated that a single per cent. of indigotine represents, to the consumer, from two to two and one-half cents for each pound of goods purchased.

Under these circumstances it would seem highly desirable to employ tests as accurate as possible, even though these should not be as time-saving as the greater number of commercial tests.

Nevertheless, it is a fact, that the ordinary indigo "analyses" are so wide of reliable results, that guess work might quite as well be substituted for them, and this in face of the fact that we have in the gravimetric determination by the reduction methods, a means for a closer valuation of indigo than can be applied in the case of almost any other dyestuff.