coal, but then a fragment of crucible must loosely cover the hole *t*, to keep out charcoal dust, &c.

If copper turnings are to be oxydized for the purpose of organic analyses, the crucible C, (fig. 2) is filled with the turnings; the crucible covered with a convex dish *u, u*, pierced with four or five little holes by the point of a nail, the crucible is luted to the dish, and then inverted on the grate of the furnace. By bringing the crucible to a dull red heat, the copper is rapidly oxydated.

These two examples are sufficient to show the uses of this new kind of muffle.

Ibid.

New Apparatus for measuring very promptly the relative Refraction of Liquids.

This apparatus is composed of a converging lens placed on a plate of glass with a space between the two to be filled by the liquid. A very simple formula gives the relative refraction of the liquid, after observing, 1st, the focus of the apparatus when water is interposed; 2nd, the focus when the water is replaced by the liquid in question. The instrument is destined principally to shew the chemical properties of liquids, and thus to serve in some measure as a re-agent in the laboratory. For example M. Guérin suspected that if two equally concentrated solutions of tartaric and paratartronic acid were subjected to examination, a difference of refractive power might be found between these two isomeric acids. The apparatus is simple and the calculation from the observed difference very easy.

P'Institute, No. 237.

Leveling between the Black and Caspian Seas.

M. Fuss in a note on the accumulation of errors in the final results of the geodesic levelling between the two seas, endeavoured to show that the method of observing two signals by placing one's self in the middle point of the space between them, can give accurate results only when care is taken to make daily but a finite series of observations and to alternate them in the same order as that in which they are made. He showed to what an extent errors might accumulate, for want of this precaution, in the definitive result of the levelling between these two seas, in which a difference of level has been found of 1045.2 English inches, a result which, by discarding doubtful observations, is reduced to 995.2 inches, while the method by corresponding observations furnished only 887.1 inches. But by applying to the first result the correction for the accumulation of errors arising from the neglect of the condition which ought to have been regarded in observing two signals from the middle of their distance, the amount was reduced to 902.5 inches, which differs from that obtained by corresponding observations only by 25.4 inches. When this correction is made, we may then seek by the calculation of probabilities the weight of these two results, and deduce from them the probable definitive value of the exact depression of the Caspian Sea.

Ibid.

Formation of Silk. By M. H. STRAUS—DURCKHEIM.

It is generally admitted by naturalists that the thread of the caterpillar is produced by a simple emission of liquid matter through the orifice of the

spinner, and that it acquires solidity at once from the drying influence of the air. It was easy to imagine such an hypothesis, for nothing more simple than the formation of a very fine thread by such a process. But a little reflection will soon show us, even *à priori* that it is not possible; for how can we comprehend that so fine a fibre, liquid at the instant of its issue from the aperture should immediately acquire such a consistence as to bear the weight of the animal suspended by it, and at the same time that it is rapidly produced. Though the fluid, holding the silk in solution, should be quickly volatilised, it must still be a matter of conjecture how the animal suspended by this thread could be able to arrest its issue, holding on only by the thread itself, for it cannot pinch the thread, seeing that it is only in a liquid state inside, and the thread cannot be glued to the edge of the opening, for its rapid adherence would prevent its issue while the animal is spinning. A little examination would satisfy us that silk cannot be produced in this manner, but that it is *secreted in the form of silk* in the silk vessels, and that the spinning apparatus only winds it. The thread is produced in the slender posterior part of the vessel, the inflated portion of which is the reservoir of ready formed silk, where it is found in the form of a skein, each thread being rolled up so as to occupy in the silk worm (*Bombix mori*) a space of only about a sixth part of the real length of the skein. The fact is shown by the following experiment which I made for the purpose of ascertaining whether the silk is formed in the body of the caterpillars.

Take one of the animals when about to form its cocoon, clean it in common vinegar, in which it may remain from four to six hours, open it on the back and extract the silk vessels, there being one on each side of the alimentary canal. Take them up by the hinder end, just where they begin to swell, (further back the silk is not solid enough) and draw them out. The membrane forming the vessel is easily torn open, and the contents expand to six or seven times its original length. The skein having attained its full length by the letting out of its gathers, we obtain a cord perfectly equal in size throughout, except at the end, where it is attenuated. This cord resembles a large horsehair, and constitutes what fishermen call *Florence hair*. I ought to add that in simply drawing out the silk vessel, the *Florence hair* is found enveloped in a golden-yellow gummy matter, forming the glutinous portion by which the worm fastens its thread. This must be got rid of by drawing the cord through the fold formed on the inside of the joint of the left fore finger, converted into a canal by applying to it the end of the thumb. The glutinous substance and the membranes being thus separated, we have the naked hair. In this state, before the silk becomes dry and hard, not only will it be indefinitely divided longitudinally, which proves its fibrous structure, but in trying to split it by drawing it transversely, the little filaments of silk which form it are perfectly separated, forming a bundle of extremely fine fibrils.

Ibid. No. 291.

Progress of Civil Engineering.

Locomotive Excavator.

M. Gervais, a manufacturer of Caen, and a member of the Superior Council of Commerce, has lately presented to the Academy of Science a small model of a locomotive excavator, (*Terassier Locomoteur*). This machine may be usefully employed in the excavation of canals and formation