

examined and its commercial properties determined by the blowpipe with great accuracy. Mr. George Attwood (eldest son of Melville Attwood, of this city), in his work on "Practical Blowpipe Assaying," gives the following methods of determining the character and properties of coal, by means of the blowpipe:—

The assay is divided into five heads:

1st. The moisture determination.

Select from the mass of coal to be examined a few lumps representing as nearly as possible the average quality. Crush them up in the agate mortar into small pieces about the size of a mustard seed.

Weigh out five grains, place in a small porcelain dish, and dry at a gentle heat over the spirit-lamp. Hard coals sometimes fly when heated, so it is best to cover the dish with a watch glass while heating. After about five minutes, remove the assay and weigh; then repeat the heating and again weigh. As soon as the weights agree the assay is ready to be converted into coke. Plattner states that the percentage of moisture is lowest in anthracite; in bituminous coals it is usually three to four per cent, seldom six to seven, and reaches its maximum in lignite and brown coals, which contain 20 per cent and sometimes more.

2nd. Determination of the coke production.

Take the dried coal and remove to a clay or platinum crucible, and cover with a small roasting clay dish or platinum cup. Place the crucible on a triangle of platinum wire on the blowpipe stand under the flame, using alcohol, and cover it with a small sheet-iron funnel (the same that is used in roasting copper ores). The heat is continued until all the volatile gas has escaped, when the assay generally will appear to possess a fused porous appearance, and to have a metallic lustre.

The coke so made is now removed and weighed. It should be weighed quickly, as coke absorbs moisture from the air rapidly. The coking takes about 10 minutes, and the crucible should not be allowed to get beyond a red heat.

3rd. The estimation of the amount of ash.

After the percentage of the coke has been determined, remove the assay to a small clay or platinum capsule, and, without using a cover, again heat over the lamp—this time to a bright red color—until all the carbon has been consumed. The operation is much facilitated by occasional stirring the assay with a piece of platinum wire, also by applying the blowpipe flame to the bottom of the cup when the assay is nearly finished.

If alcohol cannot be obtained, the assay for coke and ash can be conducted in the charcoal furnace by using the blowpipe flame, as in the copper assay, and if the ash amounts to more than five per cent, the value of the coal is much diminished. If the ash presents a brown, red, or gray color, sesquioxide of iron has been formed by the oxidation of the pyrites in the coal.

4th. Determination of the absolute heating power by Berthier's process.

Take an average sample of the coal and crush it up to the finest powder. Weigh out 0.3 grain of the coal dust and mix it with 12 grains of oxychloride of lead, and after placing the mixture in the crucible, cover it with an additional 12 grains of oxychloride of lead.

Oxychloride of lead fuses more readily than litharge; therefore, owing to the large quantity of material which must be brought into a state of fusion in this determination, it is employed instead of litharge.

The assay is next covered with a little powdered glass, also with a few spoonfuls of borax glass. A clay cup is placed over the crucible, and the assay is then fused in the charcoal furnace in a similar manner to the silver assay when litharge is used.

About seven or eight minutes suffices to melt the assay, and the lead button produced by the carbon in the coal acting on the lead oxychloride will be found lying upon the bottom of the crucible when the assay is cool and the crucible is broken.

The weight of the button, when cleaned from the slag, divided by 20, gives the quantity of lead that one part of the fuel under examination can reduce; and since one part of carbon reduces 34 parts of lead, the heating-power of the fuel may be easily ascertained. The amount of lead reduced by one part of coal varies with the different pit coals between 21 and 32 parts, with the lignites between 16 and 25 parts. In making this assay the heat must be applied at first very gradually, and afterwards increased to a bright redness.

Dr. Ure's experiments, published in the "Supplement to the Dictionary of Arts, Mines, and Manufactures," have appeared to be unsatisfactory in regard to the accuracy of Berthier's method. Mitchell, however, has found the method correct, and the author has found it equally so. The lead oxychloride should always be pure.

5th. Estimation of sulphur in a sample of coal.

Sulphur generally exists in coal as a sulphide of iron, and as the presence of more than two per cent of sulphur depreciates the market value of coal, owing to its destroying the iron boilers and grates under and over which the coal is consumed, it is always an important part of the examination of coal to ascertain the quantity present.

Mitchell, in his "Manual of Practical Assaying," recommends the following process:—

Take one part of the finely pulverized coal and mix with seven to eight parts of nitre, and 16 parts of common salt, and four parts of carbonate of potash, all of which must be perfectly pure. The mixture is then placed in a platinum crucible and gently heated at a certain temperature; the whole ignites and burns quietly. The heat is then increased until the mass is fused; the operation is finished when the mass is white. It must, when cold, be dissolved in water, the solution slightly acidulated by means of hydrochloric acid, and chloride of barium added to it as long as a white precipitate forms. This precipitate is sulphate of baryta, which must be collected on a filter, washed, dried, ignited, the filter burnt away, and the remaining sulphate of baryta weighed; every 116 parts of it indicate 16 of sulphur.

The above described methods of examining coal are all that are required for commercial purposes. The assay may be carried on still further by estimating the iron oxide contained in the ash. The ash can also be examined qualitatively for silica, lime, soda and potash.—*Mining and Scientific Press.*

An impervious enamel for paper, wood, etc., is a solution of shellac in methylated spirit. A coating of this is applied, and then another coating laid at a high temperature and under great pressure.

PREVENTIVE OF FOAMING IN BOILERS.—A writer in the *American Machinist* recommends the use of castor oil in boilers where alkaline water is used. He says that from two ounces to a pint of oil will prevent foaming all day. The oil is put in after the engine has started if foaming begins.