ciple of quantity of heat, if we know the specific heat of the metal, all we have to do, to discover the initial temperature of the metal, is to fill in the specific heat in the same equation and this time leave the initial temperature as the unknown value. Suppose the weight of the platinum ball suspended in the furnace to be 177.6 grammes. Call the initial temperature of the ball fresh from the iurnace T. The final temperature of the calorimeter was 23.95° c. The specific heat of platinum is .0324. The heat evolved by the platinum ball is 177.6 (T-23.95) (.0324) or 5.75424 T - 137.814.

Supposing the heat taken up by the calorimeter to be the product of the weight of water into the rise of temperature, and suppose the weight of water to be 679 grammes and the factor of the calorimeter or grammes of water the instrument is equal to in the quantity of heat it will absorb is 11, then the amount of heat absorbed by the calorimeter will be 690 multiplied by the rise in temperature. The initial temperature of the water was 16.6°. The final temperature was 23.95. The rise in temperature of the water was 7.35. The heat taken up by water was $690 \times 7.35 =$ 5071.5. Therefore the quantities of heat given out and absorbed being equal we have—

 $5.75 424 T - 137.814 = 5071.5 T = 905^{\circ} c.$

The advantage of the calormetric method over the preceding ones is that the melting point of platinum is exceedingly high and at temperatures at which iron would instantly fuse, the platinum ball pyrometer can be used and is found to give satisfactory results.

A rough and ready method frequently used is to make alloys of various metals and of definite composition so that the melting point of each is known, and place the alloy in a muffle in the furnace. Some of them will melt and others remain solid. The lowest melting point of those remaining solid will be approximately the temperature of the furnace.

Siemen's electrical pyrometer has been used with The principle of the instrument is much success. based upon the fact that the electrical resistance of a wire is increased by an elevation of temperature. The increase in resistance is directly proportional to the increase in temperature. If, therefore, we take a wire of known resistance connected with a battery and pass it through a liquid of known temperature, say boiling water, and measure the increased resistance for the higher temperature, we can easily calculate an unknown temperature of the wire when a further increase of resistance is indicated. For example, suppose the increased resistance of a wire is 2 Ohms at 100° c., if the same wire passed through a furnace shows a resistance of 20 Ohms, then the temperature is 1000° c. The instrument is constructed as follows: A double thread is cut upon a cylinder of hard pipeclay and in this are coiled two platinum wires united at the lower end. The wire has a diameter of .or inch and a resistance of about 3.6 units per yard. The clay cylinder occupies the lower end of a platinum case fitted with a handle. Connections are made with leading wires at the upper end of the case. Voltameter tubes are used to measure the resistance. A voltameter is simply a tube employed to collect the gas given off from an acid solution when an electric current is passed through. The stronger the current the greater the quantity of gas given off in a given time, and the greater the resistance of the wire to the current the less the quantity of gas given off. It can thus be seen that if we have two wires of precisely similar resistance one passing directly through a bath of sul-

phuric acid and the other through the furnace and then through another bath of sulphuric acid a comparison between the volumes of gases given off will be a direct measure of the increased resistance of the wire passing through the furnace and consequently of the temperature of the furnace.

For example, suppose the amount of gas given off in the one voltameter is 100 c. Cms. per hour for a resistance of 4 Ohms, if the volume of gas given off in the voltameter connected with the heated wire is only 10 c. Cms., then the resistance of the wire is 40 Ohms or ten times as much and the rise in temperature is ten times as much as the rise in temperature of the normal wire previously experimented with. The subject of pyrometers could be enlarged upon indefinitely so numerous have been the methods used. The foregoing methods are merely an outline of what has been done in this direction.

NICKEL AND COBALT ASSAYING.

By M. E. D. Merry, Rossland.

A METHOD for nickel and cobalt assaying of which I propose to give an account was invented—if I may use the term—by my father, Mr. A. S. Merry, many years ago, and although in constant use for upwards of fifty years has never to my knowledge been published, and only those chemists who have at one time or another been connected with my family in business have heard of this particular method, which though old, is, I believe, as speedy and accurate as any yet published. And I may add that even the electrolytic method so much in use at the present day is no more accurate, if as much so.

In the first place nickel and cobalt metals are usually associated with copper, especially when found in the ore as sulphide, and arsenide, the only other form of ore found on a commercial scale being the carbonate found chiefly in New Caledonia, sometimes termed silicate of nickel, which is generally free from copper and carries, as does the Sudbury ore, only traces to one-half per cent. of cobalt. Iron is always present.

With regard to preliminary preparation of the ore, your readers will be well acquainted, so we will proceed from the time the ore is dissolved and all nickel and cobalt in solution, except perhaps in the case of a sulphide ore low grade, say I or 2 per cent. nickel and trace of cobalt, when the value of the cobalt is not taken into consideration, in which case 500 grains-or the equivalent in grams-is taken and melted with 10 per cent. of charcoal or finely pulverized coal dust, and 500 grains of borax glass, and as soon as melted, well covered with additional borax glass without taking out of the fire, allowed to remain in fire with a fire-clay cover over the crucible until fluid, poured into iron mould, allow to cool, resulting button of matte can all be dissolved, or weighed and proportionate amount taken for assay. Time, about 10 to 15 minutes.

Having nickel and cobalt in solution, it is well ^{to} evaporate nearly to dryness, all excess of hydrochloric acid to dispel nitric acid, dilute with tepid or cold water and pass a current of sulphuretted hydrogen through solution, which will precipitate copper, most of the arsenic, tin, antimony, etc., etc., adding a few spots (according to quantity of arsenic present) of hyposulphite of soda which assists the precipitation of the arsenic in a very great degree. If much arsenic is present this gas should be kept on for about fifteen minutes or until solution is saturated, which can be determined by smelling the solution, and well stirring, if thoroughly gassed precipitate will settle quickly and