of 4 parts hydrochloric acid and 1 part nitric acid; this solution is precipitated by chloride of tin, but this confirmatory test is not always necessary. To another portion of the aqueous solution of corrosive sublimate add a drop of potassic iodide (KI); a beautiful red precipitate of iodide of mercury is formed. This reaction is very characteristic of mercury.

A solution of plumbic nitrate (nitrate of lead) also gives a black precipitate with hydrosulphuric acid, but unlike the mercuric sulphide, it dissolves in boiling nitric acid, and from this solution is again thrown down by sulphuric acid as a white precipitate of plumbic sulphate. With potassic iodide it gives a beautiful yellow precipitate, thus distinguishing it from mercury. Very small quantities of lead in drinking water are detected by hydrosulphuric acid.

The subnitrate of bismuth, being sometimes used in medicine, and also in cosmetics, can be procured from any druggist. It is insoluble in water, but dissolves readily in hydrochloric acid. Pour a few drops of the concentrated acid solution into a test-tube half full of water; a white precipitate is formed. This is quite characteristic of bismuth, as very few other salts are precipitated by water. For this reason, avoid diluting the acid solution when about to make a test. Into the acid solution, pass a current of hydrosulphuric acid gas; a black precipitate is formed, which, like the lead sulphide, is soluble in nitric acid, but unlike lead, the nitric acid solution is not precipitated by sulphuric acid, but by ammonia. These reactions suffice to distinguish it from the other metals of the group.

Sulphate of copper can be prepared by dissolving an old coin in sulphuric acid with the application of heat. A great deal of sulphurous acid is set free. The blue-colored filtrate remaining after the silver chloride is precipitated from the coin solution, mentioned in p 82, is principally nitrate of copper. Either this or the sulphate can be used in studying the reactions of copper. With hydrosulphuric acid, copper solutions give a brownish black precipitate, soluble in nitric acid and in potassic cyanide, a substance much used in photography, and very poisonous. In very dilute copper solutions ammonia produces a dark blue colour, but no precipitate is formed. Potassic ferrocyanide gives a reddish brown precipitate insoluble in hydrochloride acid, and this distinguishes it from other metals of this group.

Cadmium is one of the rarer metals, and is used principally in photography. In the analysis of common alloys and minerals it is seldom necessary to test for cadmium. The precipitate with hydrosulphuric acid is a beautiful canary yellow, soluble in nitric acid, but insoluble in potassic cyanide. This enables us to distinguish it from copper, which it closely resembles in some of its reactions.

As the student progresses he should tabulate the results of each series of reactions for convenient reference in future. Sometimes an impurity in his chemicals prevents the reaction from taking the precise form here given. When hydrosulphuric acid is passed into very acid solutions, more or less of it is decomposed, and a white precipitate of sulphur insoluble in nitric acid is formed. This is easily distinguished from a metallic sulphide by its specific gravity and combustibility.

SEPARATING METALS OF GROUP SECOND, FIRST DIVISION.

Supposing you have in solution the five metals of this division of group second, the solution is to be acidified with hydrochloric acid, when most of the lead will be precipitated as a chloride and filtered out, but traces of lead may still remain and must be sought for in this place. The hydrosulphuric acid gas, or a strong solution of it precipitates all these metals. The black precipitate is filtered out, then boiled in nitric acid, and the residue shown to be mercury by dissolving it in aqua regia and adding stannous chloride, or protochloride of tin ($SnCl_2$); a grey precipitate is formed. From the filtrate, the lead, if any is present, is thrown down by a drop of sulphuric acid as a white plumbic sulphate. Ammonia is next added cautiously to the last filtrate, when bismuth will be precipitated. This is recognised, after dissolving in aqua regia, by giving a white precipitate with water, if the solution is strong enough. The filtrate from the bismuth precipitate will be blue, if copper is present. A solution of potassic cyanide (KCy) is added, care being taken to avoid breathing the poisonous fumes given off, next pass more hydrosulphuric acid into it, when a bright yellow precipitate detects the cadmium. To confirm the presence of copper in this last filtrate, a little nitric acid and potassic ferrocyanide are added; the red precipitate is cupric ferrocyanide, or ferrocyanide of copper.

The separation of those metals precipitated by hydrosulphuric acid, and insoluble in ammonic sulphide, may be tabulated as follows:

Precipitated by H_2S

Mercury, black.	Lead, black.	Bismuth, black.	Cadmium, yellow.	Copper, brown.
		Boil with Nitric Acid.		
Residue: Mercury, black.	Lead	Bismuth	Cadmium.	Copper.
		Add Sulphiric Acid		
	Precipitate: Lead, white.	Bismuth	Solution: Cadmium.	Copper.
			Add Ammonia.	
		Precipitate: Bismuth, white.	Solution: Cadmium. Copper. With KCy and H_2S.	
			Precipitate: Cadmium, yellow.	Solution: Copper. Add nitric acid and ferrocyanide of potassium. Reddish brown precipitate.

The principal difficulties to be encountered here are the separation of lead from bismuth, if both are present, and of copper from cadmium. The student of analysis must repeat the reactions of these metals until he is able to separate them with certainty. Mercury, it must be remembered, forms two series of salts, only one of which is precipitated by hydrochloric acid, hence we see why mercury occurs both in the first and in the second group.

HENRY'S IMPROVED SPINDLE STEP.

The object of this invention is an improved construction of the steps of mill spindles or other vertical shafts, whereby they are made adjustable to compensate for the wear of the bearing surfaces.

The illustrations show, Fig. 1, a perspective view with a portion broken away, and Fig. 2, a vertical cross section. In the base, A, of iron, is formed a recess, the walls of which are screw-threaded to receive a correspondingly formed guide or bearing B. The latter is constructed with an inverted conical opening to inclose the toe of the spindle C, the end of which extends through and rests upon the upper of two or more hardened steel discs D, placed in a suitable cavity at the bottom of the recess. The top of the guide forms a collar E, which is bevelled off around the interior to receive oil for lubricating the spindle. The passages ', in the base also serve to conduct lubricating material to the spindle toe. G, is a lock nut screwed upon the guide between the collar and the base. In the engravings, Fig. 1 shows the guide let into the base to the full extent and locked in position by the nut G, screwed down to bear upon the upper surface of the latter. As the guide becomes worn by the rotation of the spindle, it is unscrewed and moved up, Fig. 2, to the requisite height to fit the toe snugly and prevent the spindle from vibrating or running out of true, thus, in short, compensating for the wear. The nut G, is then again screwed down to lock the parts in place.

By using a number of discs, D, one, two, or more can be removed as the spindle drops down, thus adjusting the step regularly to supply the deficiency caused by wear. The invention appears durable and simple.