depth of mines—the number of workmen employed in the mining of any particular ore, the method and necessity of transporting it from the place were it is found for the purpose of smelting, either from the people not knowing how or for want of coal, etc.—great inconvenience of this in a commercial point of view, from having to transport so large a proportion of the ore which is useless (there may be other substances mixed with it which are useful).

"When a mass of matter is to be removed, a certain force must be expended; and upon the proper economy of this force the price of transport will depend. A country must, however, have reached a high degree of civilization before it will have approached the limit of this economy. The cotton of Java is conveyed in junks to the coast of China, but from the seed not being previously separated, three quarters of the weight thus carried is not cotton. This, perhaps, might be justified in Java by the want of machinery to separate the seed, or by the relative cost of the operation in the two countries. But the cotton itself, as packed by the Chinese, occupies three times the bulk of an equal quantity shipped by Europeans for their own markets. Thus the freight of a given quantity of cotton costs the Chinese nearly twelve times the price to which, by a proper attention to mechanical methods, it might be reduced." (BABBAGE *on the Economy of Machinery*).

Again, the mode of separating the metal from the different ores—in some cases breaking it into small pieces and roasting it—thus driving off volatile substances, which become vapour at a comparatively low temperature—why breaking it before this process—smelting—that when a mass of any particular ore is heated to the point at which the metal fuses, it sinks down in this fluid state to the bottom of the furnace;—to point out how certain other substances are sometimes used, called fluxes, to assist in the fusion of minerals; that when a sufficient quantity has accumulated in a fluid state, and sunk down from the earthy and other matter in the ore, the furnace is tapped, and it runs off into moulds—called pigs, sows, etc., by the workmen.

Swansea, in Wales, is a place where a good deal of ore is carried for this purpose—from Ireland, and also foreign ores are taken there.

One mode of separating silver from the other substances in the ore is by pouring in quicksilver, which unites with the silver, and is afterwards pressed out.

The metals themselves, pointing out those which are called precious metals, those which are most useful—the particular properties which make them so useful, such as being fusible, ductile, malleable, and the different degrees in which they are so; their melting-point, and the temperature at which they do melt, showing a very wide range (by calling their attention to these extremes, the instruction becomes more striking, and is more attended to)—their specific gravities which may be pointed out from a table, making them handle the substances—platina and gold, how heavier than any of the others—twice, three times, etc., heavier than some—the property of welding only belonging to iron and platina—how much this increases the usefulness of the former.

It is easy to see the rougher and more every-day purposes of life for which the metals are used, but it will be also useful, more particularly in the schools in our large towns, to call their attention to the uses in the arts; why one metal oxidising rapidly in the atmosphere or in water, and another not, would, in certain cases, make the latter preferable, as in the copper sheathing of ships, etc.

Again, a union of metals is called an alloy—when one is quicksilver, an amalgam; an instance of the former, bronze, consisting of copper, with a small proportion of tin, and sometimes other metals, and used for casting statues, cannon, bells, etc.; of the latter, and amalgam of tin, with which looking-glasses are covered on the back surface; mercury very readily combines with gold, silver, lead, tin, bismuth, and zinc, but more difficultly with copper, arsenic, and antimony, and scarcely at all with platina and iron. Mercury, from the circumstance of its dissolving completely many of the less valuable metals, is very often adulterated.

Some metals have so little of affinity for each other, that they have never yet been known to form an alloy, and even many whose fusing point is nearly the same will not unite; the density of an alloy is sometimes greater than the mean density of the two metals of which it is made up, which shows that a decrease of volume has taken place, as bronze:—others again are lighter, showing an increase of bulk.

Alloys which consist of metals that fuse at different temperature will often be decomposed by heating them to a temperature at which one of them melts; this is practised in extracting silver from copper. The copper containing silver in it is melted with three and a half times its weight of lead, and this alloy of three metals is exposed to a sufficient heat—the lead carries off the silver in its fusion, and leaves the copper in a spongy lump—the silver is afterwards got from the lead by another operation.

Alloys containing a volatile metal may be decomposed at a strong heat, driving off the metal which is volatile, as water is driven off at a less temperature from any salt it may contain.

The specific gravity of an alloy is a means of finding out the proportion of two metals in a given substance.

The substances used for soldering are instances of alloys; they are mixed metals for the purpose of uniting metallic bodies, but it will be necessary that the solder should melt at a lower temperature than the bodies to be soldered.

Those which are called hard solders will bear hammering, and are generally made of the same metal with the one to be soldered, mixed with some other which makes it more fusible.

Soft solder, such as tin and lead in equal parts, used by the glaziers, melts easily, and cannot be hammered; tin, lead, and bismuth, in equal parts, melt still more easily. In the operation of soldering, the surfaces should be made clean, otherwise they would not unite so well. The glaziers use resin with the solder, to prevent the metals rusting, uniting with the oxygen of the air.

Again, on the absorption and radiation of heat by different substances a few useful lessons may be given, and the simple and well-known experiments of Leslie, which are easily tried, may be made very instructive.

From these it is shown that smooth polished surfaces of metal reflect heat, and absorb comparatively little; that scratching or in any way roughening the surface of a metallic body increases its power of absorption, and blackening it with anything increases it still more.

Experiment. Take, for instance, three circular pieces of metal, as tin, nine inches in diameter, and raised on a stand of a few inches high—one smooth, another scratched and roughened, the third blackened—the back of each being smeared with tallow, or some substance which melts at a low temperature; then placing a red-hot ball of iron at equal distances from any two of them, it will be found that the tallow on the blackened one will very soon melt, that on the roughened surface next, while the smooth surface would remain nearly at the temperature of the room; of course this experiment might be tried with different substances, and metals scratched and blackened in different degrees.

(To be continued.)

Directions for Reading.

1. In reading, as well as in talking, always sit or stand erect; hold up your head, and throw back your shoulders. This will give expansion to your chest.

2. Attempt not to read when out of breath. Renew your supply of breath in time, by taking advantage of the divisions which sentences have in composition.

3. Pronounce distinctly, correctly, and in a manly tone, each letter, syllable and word. Make your reading perfectly plain to those who are teaching you, or hearing you read.

4. Let the pitch of the voice be such as to give you a command over it.

5. Read neither too fast nor too slow. Keep your voice perfectly natural, and read just as if you were telling the same thing, or giving the same information to those present, without a book. The best readers are those who talk the exercise the best.

6. Look to the words which follow those you are reading; this will enable you to read more confidently, and to lay stress on the right syllables and words.

7. Guard against singing tones. Read in a smart lively tone. Never hesitate, nor drawl your words. First know the words well, then *unite* them in the reading so as to give the proper sense of the clause or sentence.

8. Previously study well the meaning of words, that you may be able to read with the understanding. This is necessary to enable you to convey easily and naturally the sense of what you read.

9. Study the piece so as to enable you to enter into its spirit, and to give the feelings and sentiments of its author. To do this effectively train the voice both orally and in reading, so as to enable you to regulate your voice, to suit the subject.

10. Some subjects require quick and animated reading; other compositions require a slow, full and distinct utterance.

11. Train the voice with reference to the following points:

1. Good *quality* of voice;
2. Due *quantity* or loudness;
6. *Appropriate pauses;*
7. *Right emphasis;*