Chemical Colors.

There is nothing to which chemistry has been applied which is more wonderful than the results which have followed the utilization of common gas or coal tar.

Thirty years ago the refuse of the retorts in gas works was utterly useless, and manufacturers did not know what to do with the material. Practical chemists were then applied to, and one of their first achievements was to discover that naphtha could be extracted from this refuse. After the naphtha was extracted, the tar was left, in the form of a heavy oil, and this was still more of a nuisance than the original compound. Faraday next awoke interest in coal tar by his discovery of benzine as a product of the tar oil.

In the year 1857, however, Perkins made a wonderful discovery. He found that it had aniline properties, and this discovery has almost revolutionized the trade in dyestuffs. These he found were capable of producing, under a different chemical reaction, the most brilliant and gorgeous dyes. This discovery made the long detested coal tar a most desirable product of the retorts, and then a valuable solvent for India rubber was made out of the material.

After these properties were extracted from the tar there were left heavy oils, and a residuum for which chemistry was puzzled to find a practical use. It was not until 1869 that any satisfactory result was obtained by experimenting on this refuse, and then the great discovery of alizarine was made. The importance of this discovery may be understood when it is known that in the first ten years following the introduction of the artificial alizarine into the dyestuff trade it exceeded the total amount of natural alizarine, or madder root Thousands of acres of land that had been used for growing madder were saved for corn and other cereals.

This material is shown in many forms at the Inventions Exhibition, and there is no more instructive part of the display than that which contains the stands of the various manufacturers who are producing this composition. In one part may be seen a mass of black, filthy-looking rubbish, and close by tubes of the most brilliant dyes, which are extracted from this refuse. A diagram is made to show in a graphic manner most of the products which this system of utilization is capable of giving. We have an idea that alizarine may be adopted with great results in the manufacture of printing inks, and would advise any one with a turn for chemistry to investigate this subject. It is only a few years since the discovery of a cheap oil completely revolutionized the printing ink trade, and gave us good inks at prices previously unheard of. Similar changes may still be in store, and if this useful product could be thus utilized, a fortune would await the successful experiment.

We have adduced this instance simply to show that all kinds of scientific knowledge can be made of use to the practical man. If space permitted, we might draw illustrations from the circle of all the sciences. No more useful result could follow the extremely successful exhibition at South Kensington than the drawing attention of artisans to inventions outside their own particular craft, and to show them that every species of knowledge may be brought to bear on their everyday vocation.—*Printer and Stationer.*

A New Incandescent Lamp.

Mr. Max Muthel has patented in Germany an incandescent lamp which possesses the advantage of requiring no vacuum in the globe. He has very ingeniously overcome one danger that experiments of this kind have hitherto presented, and that is the fusion of the incandescent wire. The wire used by him consists of a mixture of bodies that are conductors and non-conductors of electricity.

He takes magnesia, silicate of magnesia, etc., and porcelain clay, and forms a fine thread of them which he heats to incandescence and saturates with a solution of platino-iridium salts, and afterward raises several times to incandescence in order to reduced the absorbed salts to a metallic state. Instead of the foregoing mixture, filaments of clay may be taken and saturated with a solution of a metallic salt, which is then reduced to a metallic state through incandescence and the use of oil of lavender or some other organic substance, or through an electric current. With wires thus prepared fusion is absolutely overcome, the presence of the non-conducting substances preventing the metallic parts from melting. Mr. Muthel supposes that the electric spark jumps, so to speak, from one particle to another. and in this way causes a heating of the other substances, which, brought to incandescence, emit a more intense light.

In order to make the filaments stronger, they may be covered with chrome, the melting point of which is still higher than that of platinum. To effect this, the filament is placed as an anode in a bath of chloride of chromium.—*La Lumiere Electrique.*

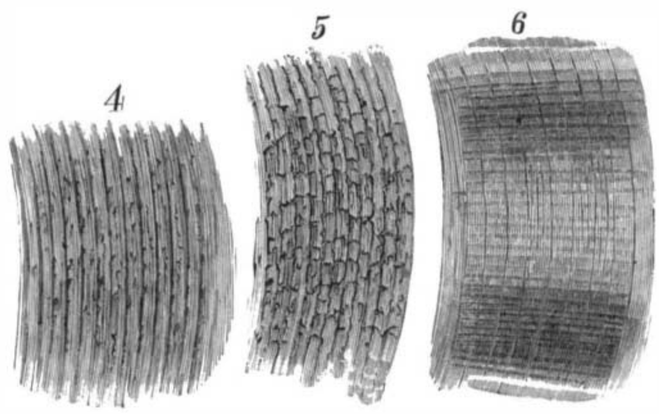
THE MICROSCOPE IN THE MECHANIC ARTS.

BY GEO. M. HOPKINS.

Without, for the present, taking into consideration the pleasures springing from the use of the microscope in its application to the study of the exquisite works of nature, let us see how the microscope may be applied to advantage in the mechanic arts, with the hope that its usefulness here may finally lead to something higher than its mere utilitarian application.

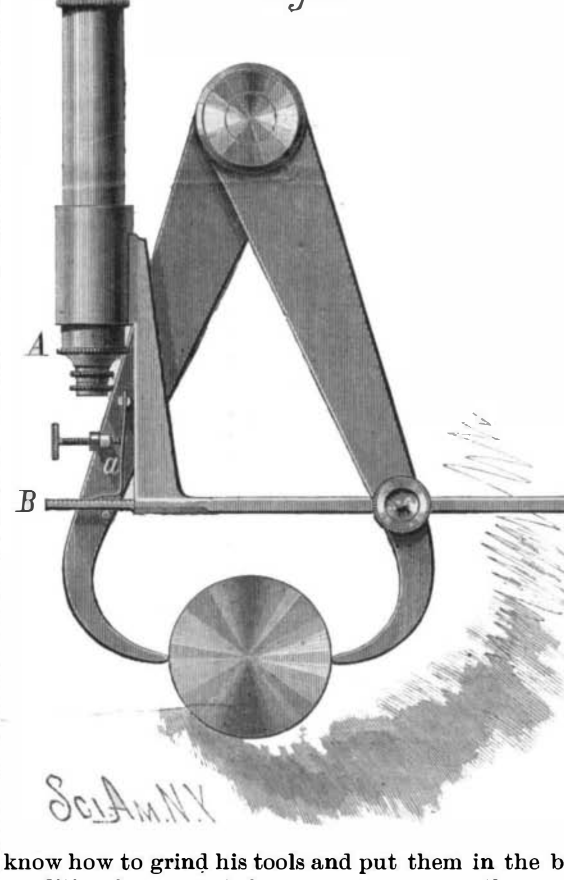
When line shafts were made of wood or cast iron, hexagonal or octagonal in form, with unbored wheels fitted with wooden or iron wedges or keys, and when other machinery was made in an equally crude way, and an eighth of an inch was considered a minute quantity, to have talked of the application of the microscope to mechanical work would have been as inappropriate as would be the application of the microscope of a few years ago to the high class of work of which the recent instruments are capable.

But in mechanics, and in optics, and in every other branch of scientific and practical work, great advances have been made, so that the highest perfection can be reached only by the employment of all available means for securing that perfection, and the use of instruments capable of revealing the minutest defects. The microscope has its application in mechanics not only to the finer measurements, and to the inspection of the quality of work, but its most useful application, perhaps, is to the selection of materials and the study of their behavior under different conditions.



Beginning with metal working tools and their action upon materials; while every machinist is supposed to know how to grind his tools and put them in the best condition for use, yet, for one reason or another, even the best mechanic will find that of two tools forged, tempered, and ground in apparently the same manner, one tool will work much freer, will cut cleaner, and do better work than the other.

Fig. 7



Now, it must be admitted that the portion of the tool that really does the work is microscopic in its dimensions, and a comparison of two such tools by the aid of a microscope will reveal the cause of inferior work with one tool, and the reason of good work with the other tool. The character of the cutting edge depends altogether upon the temper of the tool and the means and methods employed for sharpening it. A tool ground upon a coarse emery wheel or grindstone will be merely serrated. If the emery wheel or grindstone happens to be out of truth, the cutting edge is liable to be rounded. If the cutting edge is produced by a true wheel, and finished by means of a fine oilstone so that a clean, sharp edge is secured, the tool will not only turn out better work, but its edge will be found very much more durable than one of a serrated character.

These peculiarities of the cutting edge can be seen to some extent with the unaided eye, but of course the microscope reveals their defects or their perfections to a far greater extent. The microscope for this purpose need not be necessarily one of the expensive sort; such a microscope or magnifier as any machinist may carry in his vest pocket will answer the purpose, although a larger and better instrument will often be found very useful.

Fig. 1 shows the edge of a diamond pointed tool as it appears under a magnifying power of about 20 diameters, showing the serrations produced by an ordinary coarse emery wheel.

Fig. 2 shows the same tool ground upon an emery wheel which is out of truth.

Fig. 3 shows a tool of the same form under the same magnifying power, the edge of which has been properly sharpened with a fine oilstone after grinding.

Fig. 4 represents the action of the tool shown in Fig. 1 upon its work; the surface of the steel turned with such tool is there shown covered with many grooves and needle-like projections.

Fig. 5 represents a piece of work under the same magnifying power, which has been done with the tool shown in Fig. 2. The microscope clearly shows that the metal, instead of being cut off, is simply bruised off.

Fig. 6 represents a piece of work done with the properly ground tool. The surface of this work needs no further finish; it is absolutely true and perfect, and would not be benefited in the least by the application to it of a file or any abrading material.

What has been said with regard to the diamond pointed tool shown in Figs. 1, 2, 3, may be said with equal propriety about tools of other forms.

Every foreman or superintendent of mechanical work knows how difficult it is to find a workman who is competent to perform the apparently very simple operation of calipering. It is not common to find ordinary machinists who are sufficiently accurate in this matter to carry on their own work by calipering merely, and it is entirely out of the question for one machinist to adjust calipers for another machinist to work by. The difference of touch between the two workmen may result in a difference of between the 1-5000 and the 1-100 of an inch.

To render the operation of calipering more positive, and to establish uniformity in calipering, the microscope, A, together with a micrometric scale, B, graduated to 5000ths, may be applied to calipers as illustrated in Fig. 7. When the workman has calipered his work in the usual manner, his personal equation, if such an expression may be used in this connection, may be discovered by noting the amount of spring of the calipers as indicated by the adjustable index, *a*, carried by one leg of the calipers over the scale, B, carried together with the microscope by the other leg, and other workmen using the same calipers will, of course, reduce his work to such size as will give the same indications under the magnifier. This will permit of great accuracy in the calipering or the measurement of work.

Coal Ashes for Heavy Soils.

A writer in one of our agricultural contemporaries says that for the purpose of making stiff soil friable, sifted coal ashes, where they can be readily had, are better than sand. They are more easily disseminated through the mass, and contain a small proportion of mineral salts likewise, though their merit is principally mechanical. I had a patch of clay over trap rock that, after a rain, took on the consistence of putty. I could do nothing with it. Vegetable manure it scorned, and the spade cut in it as though it was skim milk cheese. The place was made the receptacle of the winter's ashes. Two years after, it was dug up through a mistaken order in the fall. Next spring I manured it, and had it dug over. Then I planted it, of all things in the world, with melons. They were a striking success. More than that, the friability of the soil remained permanent.