all men should have the same rate of pay. It was pleasant to be informed that the smith who made it was an Englishman, and it was generous of the Americans to give the information so freely.

Comparatively few of the founder's tools or appliances were brought to the Exhibition. There was one example of a mechanical apparatus for ramming sand around the pattern in moulds, but it did not appear to be very efficient. In the foundries, however, were to be seen numerous peculiarities that were interesting to Europeans. One of them is the mode of clearing out the cupola when the cast is over. The bottom is hinged and kept up by a prop; when the prop is removed the bottom drops, and the viscous slag with the burning fuel falls upon the floor, without assistance. Another point to note is the manner of using the drying stove, a revolving table in the center on which the cores are laid, handed in through an aperture in the wall, thus avoiding entrance and loss of temperature. In moulding the smaller class of articles, but one flask or box is employed; when the pattern is withdrawn, the entire mould is laid on the floor ready for casting at the end of the day; but the box is hinged at the corners, and the founder deftly removes it, leaving the sand mould intact; in this manner one box may serve for fifty moulds, which are ranged upon the floor flaskless, until casting time. As in our own more advanced foundries, they employ the stereotyped system of patterns for almost every class where there is repetition. Some of the more advanced draw the stereotyped patterns through the iron plate, even in articles of large dimensions—pulleys up to 5 feet in diameter. With such refined means the castings are simply perfect. They also shift the sand by machinery, trim the castings by the emery wheel, and clean the surface by sprinkling with a weak solution of acid, the castings being laid in heaps upon an inclined plane, and polish off the surfaces in a revolving drum.

All through the Machinery Hall there was an extraordinary profusion of every sort of tool and appliance for the use of engineers and machine makers, too numerous to be referred to except in general terms. In the art of drilling metal the Americans for years have taken the lead. They were the first to introduce the systematic use of the twisted drill. This instrument has important advantages over the common drill. It forms a correct guide for itself to bore a straight hole, it cuts out the substance as a shaving, and it maintains its diameter to the end. Mr. Morse did for drilling implements what Sir J. Whitworth did for screwing apparatus, by systematically assorting valuable tools in neat cases, thus introducing almost refining influence into the workshop.

USE OF GLYCERINE.

By M. H. HERBERGER.

ALTHOUGH glycerine has long ago found industrial applications, and though it is used in certain large establishments where the practical advantages which it offers are fully recognized, we still find people who are afraid of a substance so valuable in dyeing and printing, or who, at any rate, have no knowledge of its utility.

Glycerine, in the first place, is one of the best lubricants for the moving parts of machinery, especially for such as are exposed to the air or to alternations of temperature. It neither thickens nor turns rancid nor congeals in winter nor dries up in summer. If pure glycerine is not desired, it may be mixed with half its weight of olive oil. It does not attack metals as do many oils which, to give them weight, are sophisticated with acids (?).

Glycerine dissolves readily the coal-tar preparations, such as the aniline colors, alizarine, etc.

It is particularly important in tanning and in the treatment of skins, contributing to the preservation of the natural weight, and preventing them from becoming brittle or turning mouldy. In tanneries it has received the following application: The hides, lightly tanned, are plunged for 24 hours into glycerine, which has been previously diluted with an equal weight of water, so as to mark about 15° Baumé, and are then dried.

Glycerine is not less important in weaving. By its use the sizing never acquires a bad smell, and the weaver may work with open windows and in dry weather without the slightest danger of his warp becoming brittle. Moreover, the addition of glycerine to the sizing prevents the warp from turning mouldy or fermenting, and thus prevents the formation of spots. The following receipt has done good service: 11 lbs. dextrine, 26 lbs. glycerine at 28° B., 2 lbs. 3 ozs. sulphate of alumina, and 26 quarts of water.

As already mentioned, glycerine serves to dissolve the aniline dyes and various other colors. It serves also to preserve for a long time in a soft state the compositions of albumen, of casein, and the solutions of gum used for mordanting and finishing, because from its antiseptic nature it hinders these substances from becoming putrid.

It is also very useful for printing colors on woolen, because before steaming the colors thus printed are kept in a permanently moist state. For printing colors on cotton it is employed to accelerate and increase the oxidation of the mordants before topical dyeing.

For dissolving aniline colors, 3 parts of alcohol at 88 per cent. are digested upon the dry color, and 1 part of glycerine at 28° B. is then added. On thickening with albumen and analogous bodies the glycerine opposes the precipitation of the aniline colors, and is the best agent for keeping them in perfect solution.

For articles soluble in water, sizes, finishings, colors or mordants, 1¾ oz. of glycerine may be added to every 35 fluid ounces.

For dyeing, printing and finishing, glycerine does not require to be white, and is as useful if of a pale yellow, when its price is much lower. It is only for the most delicate colors, such as ultramarine, that a white quality must be selected.

Glycerine is generally chosen of from 26° to 28° B., free from acid or alkali, and consequently neither turning litmus paper red nor blue. Glycerine at 30° B. is rarely used.

Glycerine should be free from lime if it is to combine kindly with colors. To detect this impurity it is mixed with an equal measure of water, placed in a test glass, and a few drops of oxalate of ammonia are added. If lime is present, a white turbidity will appear.

The chief adulteration of glycerine is with solution of sugar.—*Teinturier Pratique.*

ECONOMY IN INDIGO.

STIASSNY, as a novelty, produces dark blue with catechu topped with indigo, a process long known in the trade. He also grounds with aniline black, and professes thus to save 80 per cent. of the cost. The white goods are padded with a solution containing 7 per cent. of tartrate and muriate of aniline, to which a quarter its weight of sal ammoniac and of chlorate of potash and a very little sulphate of copper are added. They are then dried, dyed for 24 hours at 110° Fahr., taken through slightly acidified water at a hand heat, washed, winced through weak soda, washed again, and dyed to shade in the vat. When applied to the production of a pattern the case is more difficult. Ordinary resists contain sulphate of copper, and consequently promote the formation of aniline black. Soda is therefore added, in order to prevent the decomposition of the chlorate of potash and the development of aniline black. The goods must be padded with a cylinder machine, and pass from thence over steam plates. The production of the aniline black can also be hindered by printing on a mixture of zinc powder and hyposulphate of soda.—*Textile Manufacturer.*

THE ADULTERATION OF GROUND MADDER AND ITS PREPARATIONS.

THE ordinary methods of sophisticating madder, says M. C. Benner, in the *Moniteur Scientifique Quesneville*, is to substitute for part of the active coloring matter an inert powder, with which either the action of a dyewood or a powerful astringent has been incorporated. The spent bark from the tanneries, dried and powdered, and mixed, as may be requisite, with extract of chestnut, dry extract of pine bark, limawood or logwood, or sometimes with various proportions of all these extracts, is the adulterant generally selected. The reagent for detecting this fraud consists of slips of white bibulous paper steeped in a solution of stannic chloride at 2° B., allowed to drain, and laid upon a plate of glass. Another reagent consists of the same kind of paper steeped in a solution of copperas at the same strength, drained, and laid upon the glass by the side of the tin-paper. A portion of these papers is dusted over, while still moist, with the powder under examination. Upon a second portion of the paper is sprinkled a perfectly genuine sample, and upon a third portion a mixture which the operator has made up with the different extracts in known proportions. After the lapse of fifteen to twenty minutes, the under side of the glass is exposed to a gentle heat till the paper is very dry; the adherent powder is then shaken off, and then the spots of various shades, which the extracts of dyewoods and of astringents have produced, are examined. Pure madder, madder-flower, and garancin produce no spots, but if the smallest quantity of dyewoods or of astringents has been added, one or other of the papers will betray the frauds by spots more or less numerous. The green tannin of certain resinous woods, and especially of pine-bark, is not easily detected by this method. The following method may, therefore, be used: Five grains of the madder, etc., in question are weighed out, mixed with 65 grains of distilled water at 50°, and 35 grains of commercial alcohol are then added. The infusion is stirred, allowed to stand for fifteen minutes, and is then filtered into a porcelain capsule. Strips of filter paper are steeped in this liquid as uniformly as possible, dried in the air, and, when perfectly dry, submitted to the following re-agents. A paper should always be prepared for comparison with a perfectly pure specimen. The re-agents are: (1) Acetate of copper obtained by the double decomposition of sulphate of copper, 10 parts; sugar of lead, 10 parts; distilled water, 100 parts. (2) Acid chloride of tin, prepared with stannous chloride, 20 parts; hydrochloric acid, 5 parts; distilled water, 100 parts. (3) Nitrate of silver, at 10 per cent. of the salt. (4) Copperas, at 10 per cent. (5) Carbonate of soda, at 10 per cent. A piece of white calico is rolled up so as to form a kind of brush, dipped in each of the test liquids, and with it one or two transverse strokes are made upon the paper saturated with the alcoholic extract. The paper is then allowed to dry for three-quarters of an hour, without exposure to the sun. The colored reactions upon the papers are then compared with those of the standard sample. The better to detect pine bark, the infusion of the suspected madder may previously be allowed to ferment. 100 grammes of the sample are infused in 375 grammes of water at 40° C., some beer yeast is then added, and the mixture is allowed to stand overnight at 40°. In the morning 500 grammes of water at 50° and 200 grammes of alcohol are added, allowed to stand for half an hour, filtered, and in the filtrate slips of paper are steeped, and examined as above. Or slips of filter paper may be suspended so as to dip into the alcoholic liquid, and left hanging overnight. The liquid ascends by capillary attraction, and the coloring matters becoming oxidized give the paper a different shade, according to the nature of the foreign bodies which have been added to the madder.

METHOD OF RECOVERING INDIGO, COCHINEAL, MADDER, AND OTHER COLORING MATTERS FROM WOOL OR WOOLEN FABRICS.

By Messrs. SANCEAU and MELEVILLE.

WOOL or woolen fabrics containing indigo, cochineal, madder, or other coloring matters are placed in a digester of great strength, and exposed to the action of steam at a high pressure, until all the coloring matters they contained are entirely dissolved.

A weight of 1,000 kilogrammes (2,204·6 lbs) it is necessary to expose for six hours under a pressure of 40 to 50 kilogrammes per 3 centimeters square (75 to 94 lbs. per sq. m.).

When the solution is complete, water is added, and the whole boiled for some minutes to render the mass more fluid; pass through a coarse filter to retain foreign matters, and through a second filter to retain the indigo, cochineal, madder, or other coloring matters. These colors are washed with water, filtered again, and dried.

The solution which has passed through the filters can be used in the manufacture of prussiate of potash, sulphate of ammonia, or of artificial manure.—*Moniteur Industriel Belge.*

ANOTHER PLAN USEFUL TO CLEAN AND BRIGHTEN UP BRASS LAMPS.—Remove all oil and bronze from the exterior of the lamp by immersing it in a hot solution of soda or pearlash; rinse and well dry it; varnish it over with a thin and even coating of copal or a similar varnish. When nearly dry lightly dab it with some bronze powder on a piece of chamois leather, and stand it aside to get hard. Afterward varnish over thinly. For Brass:—Place the articles in a boiling solution of soda or pearlash for 15 or 20 minutes, take them out and scrub them with some fine sand, and rinse. Now dip them (held by a stout piece of brass or copper wire) two or three times in some dipping acid, and well wash them in plenty of clean water to remove all traces of acid, and dry mahogany sawdust or boiling water, and they are ready to lacquer, unless it is desired to burnish some part of them, which may be done with a polished steel burnisher wetted with dilute beer to prevent scratching, and the work dried with a piece of tissue-paper, crumpled up, after the operation.

VALUATION OF CEMENTS.

By W. MICHAELIS.

THE general results of the investigations of a commission appointed to inquire into the subject of valuation of cements were as follows:—

1. Portland cement should invariably be sold by one and the same system of weights and measures.

2. Slow-setting Portland cement is to be preferred for most purposes to that which sets quickly. Slow-setting cements are those which do not solidify before a minimum time of half an hour.

3. A cake of good cement, when placed under water for some time, should show no cracks nor exhibit any tendency to crumble.

4. Portland cement should be ground so fine that when passed through a sieve of 900 meshes to the square centimeter, not more than 25 per cent. remains on the sieve.

5. The binding power of a cement should be determined by a test made with sand. The experiment should alway be carried out under the same conditions and in the same apparatus. The apparatus and test materials of Frühling, Michaelis & Co., of Berlin, are recommended.

6. One part of Portland cement with three parts of sharp sand, after one day in air and 27 days in water, should bear a minimum weight of 8 kilos. per centimeter. The sand used must not vary in quality or in fineness. For details the original paper must be consulted.—*Dingl. Polyt. J.*

PROGRESS OF TELEGRAPH ENGINEERING.

By Dr. C. W. SIEMENS.*

SIX years have now elapsed since I had the honor of addressing you as first President of the Society of Telegraph Engineers. The hopes which I then expressed as to the probable development of the society have been fully realized under the able guidance of my successors in office, combined with the active and ever-increasing support of our Honorary Secretary, Colonel Bolton. At the time I addressed you first the society was composed of only 110 members of every description. This number increased during my term of office to 353, while it has now reached up to nearly 1,000 members, a number quite sufficient, I should say, to insure a continuance of its prosperous career. The six volumes of Transactions issued by the society since its origin are proof of its activity as a scientific institution, while its status has been much advanced through the establishment of a scientific library, bequeathed to us in trust by the late Sir Francis Ronalds, containing a most valuable record of all publications having reference to the advancement of telegraphy. In order to make this collection of permanent value it will be necessary to complete the record always up to date, a duty which I trust will be faithfully and well discharged by the officers of the society. In reviewing the progress made in telegraph engineering during the last few years, I propose to notice in the first instance the subject of duplex and quadruplex telegraphy, which has recently much occupied the attention of the telegraph engineer. Duplex telegraphy has been known and practiced to a very limited extent since 1854 (?), when it was first announced by C. A. Nyström, of Orebore, Sweden, and by Dr. Gintl, of Vienna, and carried out practically by Frischen and Dr. Werner Siemens. Although quite successful in some of the applications made at that time in Germany, in Holland (between Amsterdam and Rotterdam), and in this country under my own superintendence between Manchester and Bowden, telegraphy itself had not advanced sufficiently to call for an application of this invention upon a more extended scale, and it has only met with favor on the part of telegraph administrators since its re-introduction to public notice by Mr. Stearn, of Boston, in 1872, who improved, however, upon the original arrangement by balancing the discharge from the line by the discharge from an arrangement of condensers. Another important advance in duplex telegraphy has been made by Mr. Louis Schwendler, who by the application of an improved Wheatstone bridge arrangement has produced the means of readily adjusting the effect of the neutralizing current during the working of the instrument, and has carried duplex telegraphy into effect with great advantage upon the long lines of India, with which he is connected.

The quadruplex telegraph, which may be considered to have been theoretically introduced by Dr. Stark, of Vienna, in 1855, and contemporaneously by Dr. Boscha, of Leyden, has been developed by Mr. Edison, of New Jersey, United States, and has been for some time established upon the line between New York and Boston, under the superintendence of Mr. Prescott, the engineer of the Western Union line. In this system the principle of duplex telegraphy is combined with the equally well-known system of producing different effects by currents differing in strength.

Our attention is next arrested by the great novelty of the day, the telephone. This remarkable instrument owes its origin to the labors of several inventors. In the year 1859 the late Sir Charles Wheatstone devised an arrangement by which the sounds of a reed or tuning-fork, or a combination of them, could be conveyed to a distance by means of an electric circuit, including at both stations a powerful electro-magnet. In striking any one of the tuning-forks differential currents were set up which caused the vibration of the corresponding tuning-fork at the distant station, and thus communicated the original sound. In 1861 Reiss enlarged upon this ingenious suggestion in attempting to convey the varying vibrations of a diaphragm agitated by atmospheric sound-waves. This instrument transmitted currents only of equal intensity, and produced therefore sounds of equal caliber, distinguishable only by their periods. Mr. Edison, by establishing contacts through the medium of powdered plumbago, has succeeded in transmitting galvanic currents varying in intensity with the amount of vibration of the diaphragm. As another step toward the accomplishment of the perfect transmission of sound, I should mention also the logograph, or recorder of the human voice, which Mr. William Henry Barlow, F.R.S., a member of our society, communicated in a paper to the Royal Society on the 23d February, 1874.

The beautifully simple instrument of Professor Graham Bell, of Cambridge, United States, must be regarded as a vast step in advance of all previous attempts in the same direction. In making the diaphragm of iron, and having recourse to Faraday's great discovery of magneto-induction, Mr. Bell has been able to dispense with the complication of electrical contacts and batteries, and to cause the vibrations of the diaphragm imparted by the voice to be accurately represented in strength and duration by electrical currents, thus producing the marvelous results of setting up analogous vibrations in the diaphragm of the receiving instrument,

* Presidential Address delivered at the Annual Meeting of the Society of Telegraph Engineers, January 23d, 1878.