SCIENCE AT THE BRITISH ASSOCIATION.

We continue below our brief abstracts of the more important papers read at the recent session of the British Association at Plymouth, England.

EXPERIMENTS ON THE ELASTICIY OF WIRE

have been begun in the University of Glasgow. Thus far the investigation has extended to the effect of continued application of force on the breaking weight of steel wire and soft iron wire. It is found that, when a weight nearly as great as the breaking weight is kept for a long time—several days for instance—and applied to pull out a soft iron wire, the effect is to increase the strength of the wire as much as 6 or 7 per cent. The

CONDITIONS UNDER WHICH LIQUID CARBONIC ACID EXISTS IN MINERALS

was the subject of a paper by Mr. W. N. Hartley. A method was described of determining the exact temperature at which the carbonic acid sometimes found inclosed in minerals becomes gaseous. This has been determined to be 30° 92 C. The investigation has led to some interesting results concerning the motions of the bubbles in fluid cavities when influenced by heat. Bubbles in certain cavities approach the heated source, in other cavities they recede. A rise of temperature of 5° C. causes apparent attraction, while a rise of ½° C. in some cases causes repulsion. In certain cases a bubble which receded from the source of heat at ordinary temperatures approached it when raised to 60° C., the source of heat always being from ½° C. to 5° warmer than the specimen. Mr. Hartley has also examined a remarkable vibration of minute bubbles in fluid cavities. It was found that these bubbles approached a warm body brought near them, and that they ceased moving and clung for some time to the warmer side of the cavity. The conclusion arrived at for these phenomena is that an easily movable particle, which can be set in motion by exceedingly slight differences in temperature, will make the transference of heat from one point to another plainly visible. The minute bubbles in the cavities are such particles, and these vibrator motions afford ocular demonstration of the continual passage of heat through solid substances.

Mr. Silvanus P. Thomson, discussing

BINOCULAR AND MONOCULAR VISION,

stated that light is more powerful in producing an effect when concentrated upon one eye than when equally distributed to the two, though according to what law experiments are not yet sufficiently numerous or exact to determine; but, on the other hand, the light so concentrated on one eye does not produce the sensation of twice as much illumination as the half of the light viewed by both eyes at once.

TEMPERATURE COEFFICIENTS OF INSULATING ENVELOPES.

Mr. Bruce Warren had already shown that the rate of variation in the insulation resistance of a core or cable under changes of temperature could be determined for any period of contact. He now points out that an important consequence of the phenomenon of electrification being reducible to an intelligible variation is that we can calculate not only the changes in the resistance due to variation of temperature, but we can ascertain with the same precision any required change due to prolonged contract at any required temperature. It also appears that electrification, which is an inseparable property of all insulators, follows some law of variation in which the temperature coefficient of the insulator itself is a function.

ACTION OF FATTY OILS ON COPPER.

Mr. W. H. Watson stated that paraffin and castor oils have the least action upon copper, whilst the action of sperm and seal oil is slight. Linseed, olive, almond, colza, sesame, and neatsfoot oils all act considerably upon copper, the action of linseed oil being especially great. The author concludes that the comparative action of different oils cannot in all cases be decided upon from the appearance of the oils after exposure to copper plates, though minute quantities of the metal may be easily detected in most oils from the color produced.

CHANGES IN CANDLES PRODUCED BY SEA WATER.

Professor Gladstone had examined some candles taken from the wreck of a Spanish vessel which had been submerged for 173 years. The fat had been converted mainly into calcium and sodium salts. Although, however, the fats have been in contact with a practically unlimited quantity of sea water for the above lengthy period, and a chemical change between them has been possible, the double decomposition has proceeded so slowly that the reaction is only about half completed at the present time.

CONSTITUTION OF ARCTIC COAL.

Mr. T. Wills has examined some coal from the side of a mountain gorge about two miles from Discovery Bay. By comparing the results of an analysis with those of obtained from another analysis of a mixture of specimens from thirteen different seams in English coal fields, Mr. Wills has found that arctic coal possesses very nearly the same composition.

PROTECTION OF IRON SURFACES BY FORMATION OF BLACK OXIDE.

Professor Barff stated that a perfectly adherent and coherent coating of black oxide which will protect iron from corrosion may be formed as follows: A wrought iron muffle, containing the iron articles to be operated upon, is heated to a dull red heat, all the openings closed, and dry steam turned in. The muffle is kept filled with steam for from three to five hours. The fire is then raked out, and the articles are allowed to become black in an atmosphere of steam. After this the steam is turned off, and the muffle and its contents are allowed to cool slowly. The temperature to which the muffle is heated varies according to the nature of the articles operated upon, from 662° to 1,292° Fah.

IMPROVEMENT IN MANUFACTURE OF BETON.

BY JOHN C. GOODRICH, JR., OF NEW YORK.

In the method now employed of making béton or concrete, cement and sand are used without previously preparing the cement. In the Coignet methods sufficient water only is added to make a plastic pulverulent paste. This does not contain sufficient water to form hydrates, unless lime enters largely into the composition, in which case the moisture held by the lime is taken up by the cement during its crystallization, the lime absorbing its moisture from the air; but lime in a large quantity weakens the béton, from having but a low adhesive power in comparison with cement. Neither is it able to withstand the action of water or fit for underground work, as it does not become hard when kept constantly damp, nor does it become hard in the interior of large monoliths when it is removed from the effects caused by the atmosphere.

In the other and ordinary methods a larger quantity of water is used, sufficient to make a semi-liquid mass that will flow. This excess of water is forced out of the concrete by the contraction of the cement during its crystallization, and leaves the stone porous. It also prevents the proper ramming of the béton, and gives rise to the difficulty known as "*laitance*," hereinafter described. On the other hand, a béton containing too little water becomes friable.

My process is as follows: When, in the construction of large monoliths or structures, largely underground, the checks and efflorescence which usually appear are not a serious objection. Sand and cement may be mixed in the proportion of from three to six parts of sand to one of cement. This may be done by means of machinery or by hoes, shovels, and rakes. During this process water is added by means of a hose or watering pot having a rose jet. The water is added gradually until the sand and cement contains so much that a handful of béton will, if tightly squeezed, allow a little water to exude, but will, when laid down, still retain the impression of the hand. The béton so mixed will have about the consistence of melting snow. It can be compacted in the same way, and pressure will force the moisture out of it. This condition, though difficult to describe, is learned at sight by the workmen, and the correct amount of water is more accurately gauged by trying the béton from time to time in the hand during its mixture (as it varies in different cements) than can be done by any rule of measurement. The béton is then placed in position and rammed, as described below.

The quantity of water thus gauged will be enough to form hydrates, in combination with the components of the cement, leaving no excess to be forced out during crystallization, and does not prevent the proper ramming of the béton, while there is not sufficient to cause *laitance*. But to obtain a perfect result where a finished surface is requisite, and to make a béton free from the deleterious ingredients that are found in all cements, and to insure the use of a proper quantity of water, I proceed as follows: Having obtained the heaviest slow-setting cement, the first step in this process is to separate from it the light, earthy impurities—the uncombined lime and clay and the soluble salts. This can be done to a considerable extent by a regulated current of air being driven against the cement while falling from a height, and in a proper inclosure; or it can be done by revolving screens, or by means of a centrifugal mill; and I claim these methods to be equivalents of the following. But the method which I prefer, and recommend as much more perfect, is to allow the cement to fall slowly into a box filled and constantly fed by a stream of water, the entrance of which is preferably near the bottom of the box. One side of the box is lower than the others, for the overflow of the water. Where a constant stream of water cannot be had the result may be obtained by agitating the cement with water in a swinging box or other convenient way, pouring off the water and supplying its place with fresh water from time to time.

A box may be placed in and on the bottom of the larger box to collect the cement as it settles. The portion thus preserved consists of the heavy, gritty, and inactive parts of the cement, which is without adhesive power, and which acts simply as so much sand. This equals about ten per cent of the whole mass of cement.

Cements containing a larger amount than usual of this gritty portion may, when mixed pure, stand a high test, but will not bear a large admixture of sand. With this gritty part settles the true cement, which we call the "matrix." This is that portion which is capable of crystallization or hydro-silicatization called "setting." This portion of the cement is the only one of value, and is about 80 per cent of it.

The third or lighter portion, which is washed away with the overflowing water, consists of impurities, light earthy matter, uncombined lime and clay, and soluble salts. This portion of the cement is entirely without adhesive power, and, when separated from the other portions of the cement, acts in all respects like the impure and dirty clays. When dry it shrivels and contracts, and when wet expands and becomes slippery. This portion of the cement is the cause of the unsightly checks, and what appear to be cracks, but which are simply projections of this earthy portion, which, by its own action in contracting and expanding, and the crystallization of the cement, has become separated from it. With this earthy portion the alkaline salts, consisting mainly of soda and potash, escape. This is the portion that causes the efflorescence or white appearance on the stone as heretofore made, and also what is known as *laitance* on concrete laid in water.

The light, earthy, and soluble portions having been removed from the cement, the supply of water is turned off, and it is all allowed to escape from the wash-box.

The cement, freed from its deleterious portions, and being thus saturated or supplied with the proper amount of water, is thoroughly mixed by machinery, or by means of shovels, hoes, or rakes, with clean, dry, sharp sand, in the proportions of from three to six parts of sand to one of cement, according to the strength desired.

The béton thus mixed is rammed into position, layer by layer, with a pounder, having knobs or projections to make an irregular face. The irregularities made by the pounder on the top of the layer leaves it much the better bonding of the succeeding layers.

During the process of ramming and compacting, large stones of suitable shape to form a good bond may be put into the mold or mass, and the beton rammed around and between them, the stones not being allowed to come in direct contact with each other. This gives stronger work, and allows more thorough ramming and the use of larger stones than where in the usual way broken stone is mixed with the sand and cement before being put into the mold or mass.

The phenomenon of *laitance* is one of the gravest difficulties besetting the laying of concrete under water. It is caused by the impurities hereinbefore set forth. When the concrete is mixed in the ordinary manner, so as to form a semi-liquid mass, these impurities rise to the top of the layer in position, gradually subside and deposit an unctuous stratum. Thus between each layer of the concrete is interposed a slippery layer, utterly preventing any union or bond between the layers of concrete, and very seriously impairing the solidity and strength of the structure. The former of my processes prevents this, since the béton is sufficiently dry to prohibit any movement of its component parts. The second modification of the process prevents it for the same reason, and because the impurities forming the *laitance* are themselves eliminated.

Inventions Patented in England by Americans.

From August 21 to August 27, inclusive.

ELEVATORS.—C. Baldwin, Brooklyn, N. Y.
MOTIVE POWER ENGINE.—F. M. Townsend (of Memphis, Tenn.), Liverpool, England.
PLUMBERS' TRAPS.—J. E. Folk, Brooklyn, N. Y.
RAILWAY SWITCHES.—J. S. Williams (of Riverton, N. J.), London, Eng.
SPRING BEDS.—W. Peacock, New York city.
STEAM ENGINES.—G. B. Massey, New York city.
STOPPERS.—N. Thompson (of Brooklyn, N. Y.), London, Eng.
SURVEYING INSTRUMENTS.—H. Wadsworth, Duxbury, Mass.
UMBRELLAS.—W. H. Richardson, Philadelphia, Pa.
WIRE-DRAWING MACHINERY.—J. S. Winsor, Providence, R. I.

NEW BOOKS AND PUBLICATIONS.

ON THE SCIENCE OF WEIGHING AND MEASURING. By H. W. Chisholm, Warden of the Standards. Illustrated. Macmillan & Co., London and New York. Price $1.50.

This is a capital treatise written by one who is *ex-officio* an authority on its subject. The scope of the book includes the following general heads. Definition of weight and measure; ancient standards of weight and measure; English standard units of weights and measures; the restored standards, imperial standard pound and yard; secondary imperial standard; derived units of imperial weight and measure; the metric system, and weighing and measuring instruments and their scientific use. There is an abundance of valuable information gleaned evidently at the cost of industrious research, the engravings are many and good, and the work in all respects is fully up to the latest progress.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COMBINED DIVIDER AND SIDING HOOK.

Homer Sherman, Flushing, Mich.—The object of this invention is to furnish for carpenters an improved tool that combines the advantage of a pair of dividers and of a siding hook with a marking knife scale, bevel square, etc., forming a simple and handy implement for cutting and marking boards in siding and wainscoting. The invention consists of a siding hook having a straight back and a fixed point, in combination with a pivoted divider leg. The tool may be used as common dividers, or for setting off bevels and squares, by a swinging leg, when the straight back of the siding hook is placed against the edge of the board, or it may also be employed in siding, as dividers, hook, and marking knife may be used at will, and for wainscoting, and for other applications in carpentry.

IMPROVED PLANTER AND MANURE DISTRIBUTOR.

John Real, Double Springs, Miss.—This invention relates chiefly to the use of a harrow which is so arranged as to cover the cotton seed, and is also made vertically adjustable at its front end. Cultivating plows may likewise be easily attached place of the harrow.

IMPROVED PERFORATOR FOR PRINTING PRESSES.

James A. Carruth, Topeka, Kansas.—This invention consists in providing the frisket finger of a printing press with perforating teeth. The perforator is triangular in cross section, and is provided with a cutting edge that is serrated and with a square end piece, through which a hole is bored for receiving a bolt that secures it to the nipper frame. The perforator