[For the Scientific American.]

ON REFRIGERATING MIXTURES AND THE DEPRESSION OF TEMPERATURE PRODUCED BY DISSOLVING SALTS IN WATER.

New and very thorough experiments have been made on this subject by Mr. F. Rüdorff, who has published the results obtained in the reports of the German Chemical Society.

Mr. R. there announces the following considerations and conclusions:

The depression of temperature produced by the dissolution of salts in water will generally be the more considerable the more salt is dissolved. But as a certain quantity of water does not at a certain temperature dissolve any more than a well-defined quantity of salt, the lowest temperature will be obtained by mixing salt and water in such proportions that they will form a saturated solution at that low temperature which is expected to be thereby produced. Any amount of water or salt in excess of this proportion will only increase the quantity of matter which has to be cooled down, and therefore prevent the mixture from attaining the lowest possible temperature. This circumstance has been disregarded in all previous experiments made on this subject, and it is owing to this neglect that the results obtained by different experimentalists did not perfectly agree.

If, on the other hand, salt and water are used exactly in the proportion necessary to produce a saturated solution, it lasts very long till the whole of the salt is dissolved, and the influence of the higher temperature of the surrounding air becomes then perceptible, depressing the cooling effect of the mixture. This shows how important it is to effect the solution in as short a time as possible. It is therefore advantageous to use the salt in the shape of an extremely fine powder, to stir the mixture and to have a little more salt in it than is required for saturation, a small excess of salt being less injurious than an excessive prolongation of this dissolving process.

The table given below shows for a number of different salts the most favorable percentages to be used. It also contains the general results of the experiments made by Mr. Rüdorff. These experiments were conducted in the following manner:

The finely-powdered salts and the necessary quantity of water were kept for 12 to 18 hours in a room of even and constant temperature, and before being mixed. The water was then poured over the salt and stirred with a sensitive thermometer. The mixture reached its lowest temperature in less than one minute.

The results given in the table are averages from several experiments, the results of which did not vary over two tenths of one degree Cels.

The quantity of water used was from 250 to 500 grams. The influence of the mixing vase and of the air on smaller quantities of solution is quite marked, and is always perceptible when less than 300 grams of water are used. All experiments made with more than 300 grams of water were not perceptibly influenced by the surrounding temperature; their results agreed perfectly with each other.

NAMES OF SALTS.	Quantity soluble in 100 parts of water.	Quantity mixed with 100 parts of water in the experiment.	Temperature in degrees Cels.		
			Before mixing.	After mixing.	Difference.
Alum	10·	14	10·8°	9·4°	1·4°
Chloride of sodium (common salt)	35·8	36	12·6	10·1	2·5
Sulphate of potassa	9·9	12	14·4	11·4	3·0
Phosphate of soda, crystalline	9·0	14	10·8	7·1	3·7
Sulphate of ammonia	72·3	75	13·2	6·8	6·4
Sulphate of soda crystalline	16·8	20	12·5	5·7	6·8
Sulphate of magnesia, crystalline	80·	85	11·1	3·1	8·0
Carbonate of soda, crystalline	30·	40	10·7	1·6	9·1
Nitrate of potassa	15·5	16	13·2	3·0	10·2
Choride of potassium	28·6	30	13·2	0·6	12·6
Carbonate of ammonia	25·	30	15·3	3·2	12·1
Acetate of soda, crystalline	80·	85	10·7	— 4·7	15·4
Chloride of ammonium	28·2	30	13·3	— 5·1	18·4
Nitrate of soda	69·	75	13·2	— 5·3	18·5
Hyposulphite of soda	98·	110	10·7	— 8·0	18·7
Iodide of potassium	120·	140	10·8	—11·7	22·5
Chloride of calcium crystalline	200·	250	16·8	—12·4	23·2
Nitrate of ammonia	55·	60	12·6	—13·6	26·2
Sulpho-cyanide of ammonium	105·	133	13·2	—18·0	31·2
Sulpho-cyanide of potassium	130·	150	10·8	—23·7	34·5

Mr. Rüdorff found, by special experiments, that the depression of temperature created in the mixture is less whenever a larger proportion of salt is used than that given for each kind in the above table. He also found that the depression of temperature was more variable when the salt had not been pulverized very fine.

As the solubility of some of the salts mentioned in the table rises considerably with the temperature; and as the cold produced by a refrigerating mixture depends on the solubility, or rather on the easiness and quickness with which the salt is dissolved, different results will be obtained with a different initial temperature of the mixing materials. For example, in dissolving a proper percentage of saltpeter in water the temperature sunk in one case from 23·0° to 10·2° = 12·8°; in another case from 13·2° to 3° = 10·2° only. It may be seen from this that a difference in the initial temperature of the material used in such experiments must produce a difference in the results finally obtained.

The low temperature created by the dissolution of a salt in water can never be below the freezing point of the solution, but it may reach that point under favorable circumstances.

In dissolving.	The temperature decreased.	Freezing point of the saturated solution.
Saltpeter	from 0° to — 2·7°	— 2·8°
Carbonate of soda	" 0° to — 2·0°	— 2·0°
Nitrate of ammonium	" 0° to —16·7°	—16·7°

Among the substances named above the sulpho-cyanide of potassium is particularly adapted to show the depression of temperature produced by the dissolution of a solid substance. When 500 grams of sulpho-cyanide of potassium are dissolved in 400 cubic centimeters of water and stirred with a large glass half filled with water, the latter will be converted into a solid cylinder of ice within two or three minutes. Sulpho-cyanide of potassium would therefore be very useful in the manufacture of ice.

The numbers contained in the first column of the above table are those found by Mr. Mulder, with the exception of the two last ones, which Mr. Rüdorff determined by special experiments. He found that 100 parts of water dissolve at a temperature of 0° Cels. 177·2 parts, and at 20° Cels. 217·0 parts of sulpho-cyanide of potassium; and that 100 parts of water dissolve at 0°, 122·1 parts, and at 20°, 162·2 parts of sulpho-cyanide of ammonium.

How Gems are Cut in Ceylon.

A writer in *Once a Week* gives the following description of the fabrication of imitative gems and the cutting of gems in Ceylon:

"The Moor traders are very expert in the manufacture of false gems. On the occasion of the building of a church in Kandy, a Moorman bought up all the broken colored glass from the painted windows; and on being asked for what purpose, confessed that it was 'to make precious shtone for English steamer-passenger at Galle.'

"They also imitate the rough stones, and occasionally even deceive the more experienced. They are sometimes themselves taken in. On one occasion a Moorman endeavored to induce one of a party of native diggers to sell him a sapphire surreptitiously, to which the Cingalese agreed; and the next day the Moorman came prowling about and watching the digging and sifting, till a beautiful rounded blue stone appeared shining among the wet gravel; a bargain was struck by a few signs, and the money and stone exchanged with the utmost secrecy. The Moorman disappeared to gloat over his knavery and his gains; but to his dismay, found that his beautiful gem was a piece of roughed glass, which the Cingalese had provided himself with and quietly slipped into his basket.

"The Ceylon ruby is seldom free from a tint of blue; and it is a remarkable fact that while the blue color can be expelled from such stones by heat, the red color is indelible, and the native jewelers avail themselves of this peculiarity to improve the color of their rubies.

"It is very common to find stones one half blue and the other half colorless, and some have merely a crust of blue on one or more sides. The native lapidaries take advantage of this in cutting, and by leaving the colored part on the under surface, form a foil which gives a fine blue to an otherwise valueless stone.

"The opalescence above mentioned is found in rubies and sapphires as well as in topaz; it is worse than any flaw in depreciating their value; a crack or cavity can be cut out, but opalescence, which is most difficult to detect in an uncut stone, reveals itself in the cutting, and often runs in a pencil through the whole breadth or length of a gem, destroying its clearness and color, and rendering it comparatively worthless. When such stones are cut hemispherical *en cabochon* at a certain angle to the axis, they form the star stone, showing a star of six rays in a strong light. This is very pretty as a fancy stone, but is of no value as a gem.

"We will now take a look at the proceedings of the native lapidary. His means and appliances are few, consisting of a pair of laps attached to spindles by a composition of resin and sand melted together. One lap is of lead, on which pounded corundum or adamantine spar is used for reducing the stones and shaping them in the rough. The other is of copper, for polishing the facets. Instead of diamond powder they use for this purpose a fine silex extracted from the calcined husks of rice. The laps are lodged in a frame and worked by a bow. The native lapidaries use no gem pegs or mechanical instruments for regulating the angles, but work entirely by eye and touch, and it is wonderful the precision they attain, although it is difficult for them to bring the gems to a perfect level by hand, and consequently all native-cut stones are known by a slight beveling of the facets. In the towns they have now adopted the European horizontal laps and fittings. The stone to be cut is fixed on the end of a stick with the same luting of resin and sand, and applied by the left hand to the vertical plate, while the right hand works the bow.

"In cutting a stone, the natives sacrifice everything to size. Gems, to show their most beautiful light and color, should be cut across the axis; but as in most cases the stones are longest in the direction of the prism and pyramid, they cut them parallel to the axis, and their brilliancy is lost. They rarely use a slicer, and the waste of gems is consequently great—the whole mass being ground away to form the end, which is largest and clearest.

"I have before noticed the combination of colors in sapphire—the Ceylon ruby being never found without a tint of blue. To expel this, when the stone is formed or polishing, it is rolled in a ball of wet lime, and placed in a pan of charcoal, which is gradually raised to a white heat with a primitive bellows or blowpipe made of a tube of bamboo; after being kept at a white heat for about twenty minutes or half an hour, the ball is taken out and allowed to cool, and when broken open, the stone will have lost the blue tint without injuring the crimson. By the same process, the tint of blue can be expelled from a stone which is nearly white; if, however, there is any crack or flaw in the stone, it is liable to fly to pieces. I should imagine that the natives discovered this evanescent quality of the blue color by accident. I knew a gentleman who had been very successful in digging, and had a number of fine blue sapphires; unfortunately his bungalow was burnt down, and among the ashes of his furniture he found many of his gems, but all as white as glass.

Manufacture of Elastic Sponge.

We extract from the *Hub* some particulars of the manufacture of elastic sponge for upholstering purposes.

"The raw sponge is received in hard dirty masses, filled with sand and bits of shell. Being soaked in a large tank of water, it expands into such condition that its quality may be determined, and it is sorted into two kinds; the "soft" for mattress stock, and the "hard" for cushions. The cleansing process, which is an exceedingly important one, then begins in another room. In order to effect this, the sponge is first cut and washed, by passing for an hour through a huge tub, in which there is a series of knives through which the sponge is made to pass by means of the movement given to the water by a wheel. The water, too, is constantly changing, so by this process the sponge is nicely cut, and its filth separated in part. It is next soaked for twenty minutes in a tank of water, containing two degrees (hydrometer) of soda ash, and heated to 150°. It is next passed into a tank containing a hot solution of very strong detergent soap, where it is soaked for half an hour with constant and violent agitation. It then returns to the first tub, where it is washed another hour and cut more finely.

"The cleansing process is then complete, and after the water has been pressed out by a passage through rollers, it is carried by the elevator to the "drying room," two stories above, where a high degree of temperature is maintained, and it is dried in large revolving cylinders. It is then clean and without smell, but hard and inelastic in character, and in its present condition, totally valueless for the purpose of stuffing. It was at this point that the inventor's skill was necessary. The pores of the sponge closed when the water had evaporated, and no permanent elasticity could be had unless these could be held open permanently. Glycerin, being a non-evaporative substance, was found to answer the purpose. The remainder of the process is then as follows:

"The dry hard sponge is placed in a solution of glycerin and water, in the proportion of about half and half, and after passing through heavy rollers it is again dried in the cylinders. The aqueous portion then evaporates, and leaves the bits of sponge dry and sweet, and so permeated with the glycerin, that a permanent elasticity is maintained. It is then at last taken to the packing room, highly compressed into bales of about forty pounds each, and is ready for market. It will be seen upon examination that the principle of the manufacture is very simple; it is necessary only *to cleanse and saturate with glycerin*, but the working out of the details, by which these two ends have been performed satisfactorily, has been the work of years. Elastic sponge, like all novelties, has had its lessons to learn and its drawbacks. These were natural consequences of its novelty, and were necessities. An invention is never born perfect. Just as a child must grow from infancy to maturity, so an invention of novel character must improve by age and experience, before it can succeed to perfection. But the days of its experiments seem to be over, and it has settled down into a standard article, upon which reliance can be placed."

The Diameter of one Pulley, the Length of Belt, and Distance between Centers of Pulleys being Given to Find the Diameter of the Other Pulley.

Mr. John Mersom, of Charleston, S. C., sends us the following method for solving the above problem, which we place before our readers for criticism, as we have not found time to determine its truth or falsity. He says:

"The question divides itself into two parts, as the pulley whose diameter is required is greater or less than that of a pulley which is known. When this point is uncertain, multiply the radius of the known pulley by 3·1416, and increase the product by the distance between the centers of shafts. If this sum is greater than half the length of the belt, the required pulley is less than the given one; but if less, than the required pulley is the greater. In both cases divide the difference between the trial number and half the length of the belt by the distance between the centers of the shafts. In the first case call the quotient, A, and the second, B, and apply the following rules:

"1st. Take double the number A from 2·4674011 and subtract the square root of the remainder from 1·5708, and call the difference D.

"2d. Multiply the number D by the distance between the centers of shafts, and the remainder taken from the radius of the large pulley will give the radius of the less one.

"3d. When the required pulley is greater than the given one, add double the number B to 2·4674011, from the square root of the sum, subtract 1·5708, and call the remainder E.

"4th. Multiply the number E by the distance between the centers of shafts, and the product added to the radius of the given or less pulley, will give the radius of the required or greater pulley."

APPLICATIONS FOR EXTENSION OF PATENTS.

HEAD AND TAIL BLOCKS FOR SAW MILLS.—E. H. Stearns, of Erie, Pa., has petitioned for an extension of the above patent. Day of hearing March 30, 1870.

HAY AND COTTON PRESS.—Simon Ingersoll, of Brooklyn, N. Y., has applied for an extension of the above patent. Day of hearing March 30, 1870.

MACHINE FOR SOWING FERTILIZERS.—Warren S. Bartle, of Newark, N.Y., has petitioned for an extension of the above patent. Day of hearing April 6, 1870.

MACHINE FOR TUNNELING AND QUARRYING.—George G. Merrill, of Shelburne Falls, Mass., has petitioned for the extension of the above patent. Day of hearing April 6, 1870.

FURNACE FOR SMELTING IRON.—Thomas H. Powers, Milwaukee, Wis., has applied for an extension of the above patent. Day of hearing April 20, 1870.