the series, with the result that some plies are stretched beyond what they should be. The fewer the plies in a belt the less is the tendency to subject some plies to more strain than others, on account of the above causes. A thick belt is very likely to be so strained and its total strength is therefore not in proportion to the number of plies, whereas with a thin belt this is more nearly the case.—Mines and Minerals.

ELECTRICAL NOTES.

A new form of electric radiator has been devised in which the radiating material, comprising resistance wire, is wound round square porcelain tubes with concave sides, each tube constituting a separate unit. These tubes are placed in a casing in such a manner that rapid circulation of the air without deterioration or burning may be attained. The heat is regulated by switching on separate tubes or units.

We learn from an exchange that an Indiana genius proposes to utilize cats for the generation of electric current for lighting. His purpose is to round up the cats and drive them through a chute, so that they will pass under rotating brushes which will abstract the desired current. The invention might be further improved by the employment of mice, so that the cats could be drawn through the chute by induction. Just how much feline power is required to light an incandescent lamp has yet to be ascertained.

Owing to the frequency of the fatal cases of electrocution that have occurred upon the electrified section of the North-Eastern Railroad of Great Britain, the railroad authorities are carrying out a series of interesting and important experiments, with a view to minimizing the risk of shock from the "live" rail. A new type of ballast almost white in appearance is being laid down in substitution for the ashes which have heretofore been employed. This new material is composed of small chippings, and is being laid down for a distance of two or three inches below the wooden railroad ties. This new ballast material is of less conductivity than the ash ballasting, and consequently much safer for the employes to walk upon.

Various metals which are themselves non-magnetic may form alloys which display magnetic qualities; some of these have been produced in recent experiments. Aluminium, copper, and manganese are all non-magnetic, but when combined in certain proportions an alloy of considerable magnetism is produced. As no alloy of copper and aluminium alone is magnetic, this effect must be ascribed to the manganese, and yet this metal alone, as well as copper and aluminium, remained non-magnetic when cooled to the temperature of liquid air. An alloy of manganese with iron is practically non-magnetic, but with the same manganese a magnetic copper alloy can be made.—Engineering Review.

It is suggested by German electricians that one of the solutions of the photography of colors may be found in the employment of electrolytic processes by the use of a body which like selenium has an electric resistance variable with the light and of utilizing the body as electrode. The image to be produced being then projected on this electrode, a galvanic deposit would be formed with more or less rapidity, according as the spot might be illuminated with more or less intensity. The application of this principle presents at first sight numerous difficulties. Experiments have been made in preparing plates of different kinds and of employing them as anodes, after exposure to the light, in a bath containing lead oxide in solution in a potash lye. The experiments are not yet concluded.

The telekin is the name applied by Mr. L. Torres in the Comptes Rendus to an apparatus by which the movements of a machine may be regulated from a distance, either by means of an ordinary electric telegraph or by electric waves impelled through the air without the aid of wires. The inventor distinguishes between a simple telekin, wherein only a single motion is considered, and a multiple telekin, which permits of a complexity of motions. The simple Telekin consists of a sort of needle telegraph, in which the needle slides over a number of contact points, whereby the circuit of an electric motor is closed. The motor imparts motion to the apparatus to be steered, for example the rudder of a boat. According to the plans of the inventor, there are three methods of steering: 1. The needle functions like a commutator; that is, three separate positions of the needle correspond with the three requirements—ahead, rest, and astern. 2. Upon the axis of the needle there is adapted to move freely a contact disk which contains two metallic segments of nearly 180 deg. each. The needle contacts slide over these segments, and the motor continues to turn the disk until the needle comes to a point of insulation, when it will be found that the disk has revolved through the same arc as the needle. 3. Steering by the compass, in which case the compass touches contact points, and the motor acts direct upon the rudder.

In the multiple telekin several distinct apparatus are actuated by means of a wireless system. To bring each one of these separate appliances into action, a system of long and short electric impulses is employed. Long impulses actuate the individual devices by cutting the circuits belonging to them in through the medium of a distributor. This distributor consists of a heavy metallic disk, which is revolved by a spring motor, being at the same time provided with a locking pin. Through the action of an electro-magnet this pin is periodically withdrawn and the disk freed; whatever contact points are in touch with the disk at the time close the circuit of their respective apparatus.

ENGINEERING NOTES.

Comparison of Metal and Wood Crossties for Railways.—Herr Benkenberg publishes in Stahl und Eisen a comparison based on recent investigations. According to his figures one kilometer of iron track would, after deduction of the value of the old ties, cost 8,117 marks; with metallic crossties of the model 51 E of the Prussian State, only 7,656 marks. A duration of a dozen years can be counted on for the first, and of fifteen years for the second, so that the saving by the latter is 23 or 24 per cent.

A furnace has been designed by M. A. Gomes for the purpose of obtaining very high temperatures, using the reflected solar heat. Temperatures above 3,500 deg. C. are said to be anticipated. The reflector is built up of 6,170 elementary mirrors, each 122 millimeters by 100 millimeters, arranged side by side in parallel rows, and are attached by threaded standards to a series of parallel angle irons, which run horizontally across the frame. The width at the top is 35 feet, at base 18 feet, and depth 35 feet.

Tests made by a French engineer to ascertain the tractive resistances of various forms of tires for motor car work gave the following results: Solid rubber, 33 pounds to 39.6 pounds per ton; pneumatics, 90 millimeters cross-section, 44 pounds to 53 pounds; pneumatics, 90 millimeters, not fully inflated, 53 pounds to 61.6 pounds; pneumatics, 120 millimeters, 64 pounds to 70 pounds; non-skidding band of leather with studs, 8.8 pounds in addition to the above. The results were obtained on good dry macadam, free from dust, at 13 miles per hour.

Two Belgian industries which owe their existence to the release of methylated alcohol from duty, viz., the production of ether and the manufacture of artificial silk, have already become important; the amount of alcohol used in these two industries in 1903 exceeded 880,000 gallons. A rapid increase has taken place in recent years in the amount of methylated alcohol used for industrial purposes consequent upon relief from taxation. In 1896 the consumption was only about 100,000 gallons, whereas in 1903 it rose to 1,323,784 gallons.

Recent Development of the Siderurgical Industry in Upper Silesia.—At a late sitting of the Metallurgic Association, Herr Witte presented a communication which is reproduced by Stahl und Eisen, from which it appears that the production of castings rose from 531,000 tons in 1894 to 748,000 tons in 1903. The iron ores used proceed principally from Sweden, Styria, Hungary, and southern Russia. The native iron does not represent more than a sixth of the production, and is not half as rich as some of the ores from other points. The transportation of the Swedish costs 7 marks ($1.75) per ton from the port of Stettin to the foundries; that of Hungary and Styria from 7 to 10 marks ($1.75 to $2.50) from the mines.

Since the attention of the people in Colorado has been turned to the subject of oil, and the possibility and probability of petroleum deposits below the surface, some curious natural phenomena have been observed which in several cases have led to the putting down of wells in search of the coveted petroleum. Chief among the phenomena are volcanic dikes, usually of basaltic lavas, in various portions of the State, which on being broken show a considerable amount of oil in their pores, and between their crevices. A popular, but we think, erroneous idea as to the origin of oil in these volcanic rocks is that it came up in some manner, difficult to conceive, in the lava when it was in a hot molten state. One can hardly imagine how so volatile and inflammable a matter could be brought up and retained in lava when it was in a molten condition. We know that lava when it first comes to the surface is so highly charged with steam that it pours forth more like steaming hot porridge than a molten rock.—Mines and Minerals.

According to the authority of Mr. J. M. Gledhill, of Armstrong, Whitworth & Co., ordinary crucible steel containing 1.30 per cent carbon is suitable for small turning and planing tools, drills, small cutters, razors, and surgical instruments; 1.15 per cent carbon for heavier turning, planing and slotting tools, drills, cutters, reamers, and engraving tools; 0.90 per cent carbon for large circular cutters, reamers, taps, dies, heavy turning tools, and large drills; 0.80 per cent carbon for cold chisels, hot sets, small shear blades, and large taps; 0.75 per cent carbon for dies, cold sets, hammers, swages, minting dies, miners' drills, blacksmiths' tools, punches, and shear blades; and 0.65 per cent carbon for snaps, dies, drifts, hammers, and stamping dies. The steel that is suitable for making a razor is obviously totally unfit for a stamping die, although it is of much higher grade and more costly. Much of the trouble encountered in the average shop in the use of tool steel is that no record is kept of the carbon content of the various steels kept in the tool room, and very often an entirely too high grade steel is used for a purpose where one of perhaps half the carbon content would be much better suited. Some shops paint one end of all steel bars in colors and combinations of colors which correspond to an arbitrary classification. As these bars are used, the stock is cut off the opposite end, and the marked end remains until the bar is completely used up. Where this or a similar system is employed, a large part of the trouble of the toolmaker should be avoided.—Machinery.

TRADE NOTES AND RECIPES.

Waterproof Coating.—Resin oil, 500 parts; resin, 300 parts; white soap, 90 parts. Apply hot on the surfaces to be protected.—Science Pratique.

Another Waterproof Coating.—A good coating may be produced by mixing 1 part of yellow wax and 3 parts of linseed oil prepared with litharge. For preserving stone walls from moisture, heat strongly; it will penetrate the stone.—Science Pratique.

Fireproof Coating.—A fireproof coating (so-called) consists of water, 100 parts; strong glue, 20 parts; silicate of soda, 38 deg. Baumé, 50 parts; carbonate of soda, 35 parts; cork in pieces of the size of a pea, 100 parts.—Science Pratique.

Solid Anti-rust Preparation.—Dry tallow, 25 parts; white wax, 23 parts; olive oil, 22 parts; oil of turpentine, 25 parts; mineral oil, 10 parts. Apply with a brush at the fusing temperature of the mixture.—Farben Zeitung.

Detection of Counterfeit Bank Notes.—To ascertain whether a French bank note is genuine or counterfeit, a blank part of the note is rubbed with a silver coin; or a mark is drawn on the note with a piece of silver. If the mark is black, the note is genuine; otherwise, it is counterfeit. This results from the chemical composition contained in the paper pulp from which the notes are made.—Le Matin.

To Improve the Odor of Carbon Sulphide.—Add to carbon sulphide one per cent of corrosive sublimate, and let stand, but stirring from time to time for several days. Then distill. The liquid obtained has a much less disagreeable odor than the original carbon sulphide.

An excellent result may also be secured by mixing with the sulphide one-third in volume of the oil of bitter almonds. The distilled sulphide has then an agreeable etherized odor.—Chemiker Zeitung.

Preventing the Putrefaction of Strong Glues.—The fatty matter always existing in small quantity in sheets of ordinary glue deteriorates the adhesive properties and facilitates the development of bacteria, and consequently putrefaction and decomposition. These inconveniences are remedied by adding a small quantity of caustic soda to the dissolved glue. The soda prevents decomposition absolutely; with the fatty matter it forms a hard soap, which renders it harmless.—Revue des Produits Chimiques.

Clarification of Honey.—For 3 kilogrammes of fresh honey, take 875 grammes of water, 150 grammes of washed, dried and pulverized charcoal, 70 grammes of powdered chalk, and the whites of three eggs beaten in 90 grammes of water. Put the honey and the chalk in a vessel capable of containing one-third more than the mixture and boil for three minutes; then introduce the charcoal and stir up the whole. Add the whites of the eggs while continuing to stir, and boil again for three minutes. Take from the fire and after allowing the liquid to cool for a quarter of an hour, filter, and to secure a perfectly clear liquid refilter, on flannel.—Le Lait.

A Liquid for Polishing Metals.—I. Melt 8 parts of paraffine and work into it 16 parts of rotten stone. To this add when cold 16 parts of common petroleum and a little of the oil of mirbane. II. Pulverize ½ part of crystals of oxalic acid, and mix it with 10 parts of rotten stone; now melt 2 parts only of paraffine, which are to be added to 30 parts of petroleum, and mix the powdered ingredients with this, adding a little oil of lavender. III. Mix together 2 parts of powdered pumice stone, as much of rotten stone, and the same quantity of iron carbonate. Now melt 2 parts of paraffine, which is thrown while still hot into 16 parts of petroleum oil, to which the solid powders just prepared are added and well stirred in.—Nouvelles Scientifiques.

For Cleaning Silverware.—Mix 2 parts of beechwood ashes with 4-100 of a part of Venetian soap and 2 parts of common salt in 8 parts of rain water. Brush the silver with this, using a pretty stiff brush. A solution of crystallized permanganate of potash is often recommended, or even the spirits of hartshorn, for removing the grayish violet film which forms upon the surface of the silver. Finally, when there are well-determined blemishes upon the surface of the silver, they may be soaked four hours in soap maker's lye, then cover them with finely-powdered gypsum which has been previously moistened with vinegar, drying well before a fire; now rub them with something to remove the powder. Finally, they are to be rubbed again with very dry bran.—Metallarbeiter.

Inexpensive Electric Battery.—We give herewith for amateurs or those using electricity on a small scale two receipts, which will enable them to make a battery at low cost, but sufficient for an electric bell, an office telephone, or for other limited use.

First Receipt.—Mix equal parts of manganese peroxide, in pieces the size of a pea, with coke or retort coal, also in small pieces. Put the whole in a wire-cloth bag, and in the middle a piece of retort coal. Tie the upper part of the bag and immerse in a preserve kettle or jar containing a solution of chlorhydrate of ammonia and a piece of zinc.

Second Receipt.—Take a porous vessel of about 0.15 meter in diameter and pile up around a piece of charcoal small pieces of coke mixed with a little chloride of lime. Add a little melted pitch in order to avoid the odor of chlorine. Put in an outer vessel salted water (240 grammes of pure kitchen salt to 1 liter of water) and a piece of zinc. A little salted water four times a year is sufficient for this battery.—Journal de l'Electrochimie.

SELECTED FORMULÆ.

To Fasten Wood and Glass to Metal.—Grind together 2 parts of protoxide of lead (litharge) and 1 part of white lead in 6 parts of boiled linseed oil, to which add 6 parts of copal varnish.—Practische Wegweiser.

Cucumber Cream.—Mix together 3 parts of white wax, 3 parts of spermaceti, 8 parts of benzoin lard, and 3 parts of cucumbers. The cucumbers are cut up small and shaken into the mixture of the other ingredients. Now stir it until it becomes cold, and let it stand about 24 hours, melt it again, and strain it, stirring again until cold.—Drog. Rundschau.

Liquid Soaps.—According to credible authority, these soaps can only be obtained by treating hard soaps with a base of pure olive oil, which are dissolved in alcohol with the final addition of a certain quantity of potassium carbonate. Grate the soap fine and put it into a receptacle over a water bath, together with the alcohol and the carbonate, stirring constantly and letting the temperature rise little by little. At the end of at least an hour the solution is complete, and perfectly transparent if white soap has been used. Perfume may be added to suit the taste, but it must be done at the moment when the decoction is removed from the bath. The alcohol used ought to be 80 deg. proof.—Nouvelles Scientifiques.

Perfuming and Coloring of Toilet Soaps.—

Jockey Club Soap.

White ground soap	50 kilos.
Artificial oil of neroli	100 grammes.
Oil of bergamot	100 grammes.
Terpineol	80 grammes.
Artificial musk	15 grammes.
Oil of orange berries	75 grammes.
Heliotropine	100 grammes.
Iso-eugenol	20 grammes.
For coloring:	
Wax yellow	10 grammes.
Rhodamine	3 grammes.

Mimosa Soap.

White ground soap	50 kilos.
Mimosa	200 grammes.
Vanilline	10 grammes.
Oil of bergamot	40 grammes.
Oil of orris	10 grammes.
Artificial musk	2 grammes.
For coloring:	
Fine pink	80 grammes.

—From the French of H. Ziolkowsky in La Perfumerie Moderne.

Triple and Quadruple Extracts.—

Royal Amber.

Infusion of amber	1,000 grammes.
Infusion of musk	500 grammes.
Tincture of rose	500 grammes
Tincture of jasmine	500 grammes.
Artificial musk	10 grammes.
Tincture of vanilline	500 grammes.
Infusion of benzoin	300 grammes.

Gardenia (Cape Jasmin).

Infusion of rose	1,500 grammes.
Infusion of violet	500 grammes.
Infusion of tuberose	500 grammes.
Tincture of vanilline	250 grammes.
Eglantine	20 grammes.
Hawthorn	5 grammes.
Terpineol	30 grammes.
Artificial neroli	5 grammes.
Infusion of musk	30 grammes.

French Heliotrope.

Tincture of heliotropine	1,600 grammes.
Tincture of vanilline	2,400 grammes.
Extract of mignonette	2,500 grammes.
Extract of ylang-ylang	100 grammes.
Extract of musk	1,500 grammes.
Tincture of jasmine	1,000 grammes.

Royal Cologne Water.

Alcohol	23,000 grammes.
Oil of lemon	350 grammes.
Oil of bergamot	300 grammes.
Oil of lavender	20 grammes.
Oil of peppermint	12 grammes.
Acetic ether	12 grammes.
Artificial oil of neroli	5 grammes.
Oil of thyme, white	5 grammes.
Oil of rosemary	5 grammes.
Artificial oil of rose	3 grammes.
Rose water	200 grammes.
Orange flower water	2,000 grammes.

Shampooing Liquid.

Distilled water	10,000 grammes.
Alcohol	5,000 grammes.
Sal ammoniac	150 grammes.
Bicarbonate of soda	600 grammes.
Oil of bergamot	25 grammes.

Shampooing Powder.

Bicarbonate of soda	500 grammes.
Carbonate of ammonia	50 grammes.
Borax	50 grammes.

Perfume as desired; for example, take 1,000 grammes of the above powder and add to it:

Oil of bergamot	20 grammes.
Oil of cananga	15 grammes.
Ionone	3 grammes.

—From the French of H. Ziolkowsky in La Perfumerie Moderne.

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