Correspondence.

The Diamond Toothed Circular Stone Saw.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN SUPPLEMENT of 1st inst. is an illustration of a stone sawing machine described by Mr. James T. Pearson, of Burnley, Lancashire. In 1875 at the Cincinnati Exposition I had and operated a diamond stone sawing machine, operated on substantially the same principle, and sawed more than 40 tons of freestone into slabs of 1, 1¼, 1½, and 2 inches in thickness and never made a miscut nor lost a single diamond. I set the diamonds as shown in our hand book for dressing emery wheels. The same machine was successfully used at the Philadelphia World's Fair in 1876, and that machine is still in existence.

But carbons became expensive, and no matter how much water was forced into the cut, they soon became dull, and the enterprise was abandoned. It is now claimed by a party that they have discovered a method of producing carbons, but of small sizes yet, but hope soon to produce them of larger sizes, and very cheaply. I am hoping for success in this line, when I may become interested again in the business.

J. E. EMERSON.

Beaver Falls, Pa., April 3, 1893.

How to Convert Incandescent Lamps into Geissler Tubes.

To the Editor of the Scientific American:

The idea of utilizing burned-out incandescent lamps for performing Geissler tube experiments may be new to many of the readers of your valuable paper, and if so, would be pleased to submit it.

The experiment may be performed as follows:

Procure a burned-out lamp, if possible one in which a piece of the filament has been broken off, leaving the ends separated about an inch. Solder a piece of wire to each terminal of the lamp, and connect to the secondary terminals of an induction coil yielding about a one-eighth inch spark. Start the coil in action, and holding the globe in one hand, begin to file off the glass point where the lamp has been sealed. This operation must be performed very cautiously, using a fine file with a gentle pressure.

The filing should be continued until the discharge diffuses the bulb, and then the point is quickly sealed in the flame. It is, of course, apparent that the object in filing the point is to allow a certain amount of air to enter the globe, producing a low vacuum, through which the discharge will readily pass.

The writer has obtained quite a number of beautiful and varied luminous effects in this manner by using the lamps of different manufacture and with very little trouble.

E. M. LA BOITEAUX.

Strange Effects of an Earth Current.

To the Editor of the Scientific American:

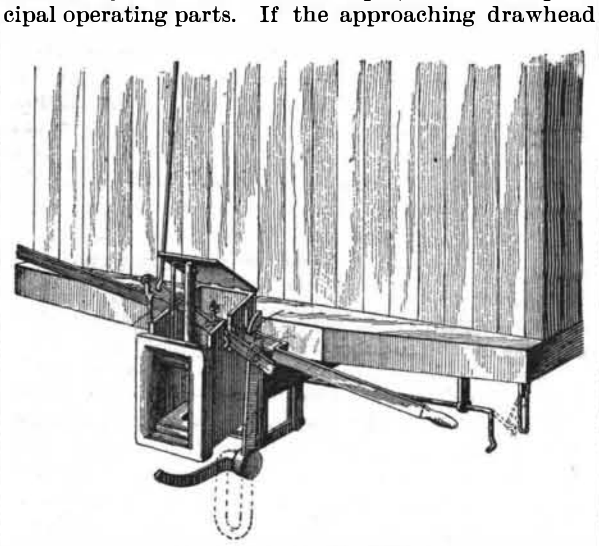
I give you below an account of the strange effect an earth current (I say earth current, because I cannot attribute its manifestations to any other cause) had on a telegraph line on March 15, 1893. The Atlantic and Pacific Railroad and the Southern Pacific run almost parallel for several hundred miles in Arizona east and west, converging at Barstow, California. A military telegraph line running in a general north and south direction connects Holbrook, Arizona, on the Atlantic and Pacific with Willcox, Arizona, on the Southern Pacific. The distance between these two points is about 250 miles. It was on this telegraph line that the earth current manifested itself. I at first supposed that either the operator at Holbrook or Willcox had made temporary connection with one of the lines of the railroads, but the operator of the military telegraph office at Holbrook (the northern terminus of the military telegraph line) states that his office is at least 100 yards from the railroad station, and that connection with the railroad telegraph line at that point was impossible. The military line was broken between Fort Grant and Willcox, so a connection with a railroad wire at Willcox was also impossible. The operator at Fort Grant grounded the line south at his office, that those between there and Holbrook might transact their business. In the forenoon of the date mentioned a powerful current on the military line was felt. It was so strong that it attracted the armature of all the relays on the line with such force as to cause the armature levers and trunnions to bend. The operator at Fort Grant, having had a galvanometer in circuit, states that the earth current was of an opposite polarity to that furnished by the battery, and that it threw the needle 90 degrees from the zero point in an opposite direction to that produced by the battery. Every operator on the military telegraph line distinctly heard "Hn," calling "N," "W," and "U" at intervals, these being not the call letters of any of the offices on the military, but those of offices on the Southern Pacific telegraph line. Curiosity prompted me to attempt to break in and ascertain if I could locate "Hn," but my attempt proved unsuccessful. As I said above that the wire on the military telegraph line was broken between Fort Grant and Willcox, it is apparent that the signals were reproduced through the agency of the earth current, which was felt for nearly half an hour. If you deem this article worthy of a small space in your valuable journal, it may prove interesting to many readers. J. FETZER,

Sgt. Sig. Corps, U.S.A., Operator.

Fort Apache, Arizona, March 28, 1893.

AN IMPROVED CAR COUPLING.

An automatic coupler, which permits of the cars being uncoupled from either side or the top of the car, so that the brakemen do not have to go between the cars at any time, is shown in the accompanying illustration. It has been patented by Mr. A. G. Vogt, of Boerne, Texas. The drawbar is hollow and open at its rear end, so that the buffer spring of the ordinary drawbar may be used. The link holder, operating in the flaring link mortise, consists of two pivoted jaws, one above the other, and slightly separated, a spring holding the jaws normally nearly closed, while at their forward ends they have vertical openings for the coupling pin. By means of an adjusting frame, from which a lever extends to each side of the car, the lower and upper sections of the link holder may be adjusted as desired, both jaws being moved together or either separately, to hold the link to properly enter a meeting drawhead. The pin-lifting lever is connected with the upper link-adjusting section, though having a limited independent movement, a rod also connecting this lever with the top of the car to facilitate uncoupling from that position. A pivoted and weighted latch holds the coupling pin in elevated position, the impact of the cars as they come together causing the pin to fall to effect an automatic coupling. A casing with a hinged lid, which is raised and lowered by the movement of the pin, incloses the principal operating parts. If the approaching drawhead



VOGT'S CAR COUPLING.

also has a link in it, the link-operating lever is set to eject one link, which is caught by a receiving hook supported to swing below the drawhead, as shown in dotted lines. With this form of coupler all of the old styles of links, pins, keys, and bumper springs can be utilized, and automatic coupling is readily effected with cars fitted for the old style of link and pin coupling.

"Piperazine."

BY W. MAJERT AND A. SCHMIDT.

Erroneous statements have appeared in several modern text books regarding the physical and chemical characters of piperazine, $C_4H_{10}N_2$, which have been confused with those ascribed by A. W. Von Hofmann and by Ladenburg to the impure substances of like composition discovered by them, and termed respectively diethylenediamine and ethyleneimine or diethylenediimine. Our attention has been directed to the fact that this misunderstanding has partly arisen from a misconstruction of our views (*Ber.*, 1890, 3719) as to the identity of these substances; we, therefore, desire to correct this impression.

Piperazine, which was not known in its pure crystalline condition until prepared by us in August, 1890, by treatment of dinitrosodiphenylpiperazine with alkali, is a crystalline substance melting at 104—107° in capillary tubes, although when the melting point is determined on large quantities it is found to be 112°, the differences being due to the hygroscopic nature of the base. It boils at 140—145°. It is very readily soluble in water and alcohol, the aqueous solution having a distinctly alkaline action. It is very hygroscopic and readily absorbs carbon dioxide, being thereby converted into the carbonate melting at 162—165°.

Piperazine is especially characterized by the formation of an insoluble pomegranate red double salt with bismuth iodide and by a dibenzoyl compound melting at 191°.

The basic substance diethylenediamine prepared by Hofmann by the interaction of ammonia and ethylene bromide consisted of a liquid mixture of bases boiling approximately at 170°. That this mixture contained a small quantity of a base identical with piperazine is undoubted, but it was only after piperazine had been prepared from dinitrosodiphenylpiperazine that Hofmann succeeded in identifying it and isolating the pure crystalline product from the mixture, which, besides higher ethylene bases, contained also a number of vinyl compounds.

Owing to the difficulty of purifying small quantities of the base, Ladenburg's experiments with diethylenediimine, obtained by the decomposition by heat of ethylenediamine hydrochloride, were unsuccessful. The product described by Ladenburg as the base was undoubtedly impure piperazine carbonate, as proved by its melting point, 159—163°.

In conclusion, it may be interesting to mention that we have succeeded in preparing the following series of hydrates of piperazine, that most readily formed being a hexhydrate which crystallizes from dilute aqueous solutions:

$C_4H_{10}N_2 \cdot H_2O$, m. p. 75°,
" $2H_2O$, " 56°,
" $3H_2O$, " 39—40°,
" $4H_2O$, " 42—43°,
" $5H_2O$, " 45°,
" $6H_2O$, " 48°.

—*Chemical News.*

The Metals and their Physical Properties.

Name.	Atomic weight.	Specific gravity.	Specific heat.	Temperature of fusion F.	Linear expansion. 32°-212° F. 1 part in	Electric conductivity.	Heat conductivity.
Osmium	199·2	22·477	0·0311	3992	152	....	....
Iridium	198	22·4	0·0326	3992	1429	....	....
Platinum	197·4	21·46	0·0324	3592	1167	10·5	0·84
Gold	197	19·265	0·0324	2990	645	77·9	0·532
Uranium	118·8	18·33	0·0619	3632	....	....	....
Tungsten	184	16·54	0·0334	4352	....	....	....
Mercury	200	13·595	0·0333	—40	....	1·63	....
Ruthenium	104·4	12·26	0·0611	3935	1038	....	....
Rhodium	104·4	12·1	0·0588	3935	1176	....	....
Thallium	204	11·86	0·0335	529	331	9·30	....
Palladium	106·6	11·4	0·0593	3632	1000	....	....
Lead	207	11·256	0·0314	617	351	8·32	0·85
Silver	108	10·4	0·0570	1832	524	100	1
Bismuth	210	9·82	0·0308	507	719	1·19	....
Copper	63·4	8·94	0·0952	1990	581	94·4	0·736
Molybdenum	96	8·6	0·0722	3632	....	....	....
Cadmium	112	8·546	0·0566	442	428	22·10	....
Cobalt	58·8	8·5	0·1069	3272	809	17·22	....
Nickel	58·8	8·297	0·109	2912	781	13·11	....
Iron	56	7·844	0·1138	2012	819	16·81	0·119
Thorium	115·7	7·5	....	....	....	....	....
Indium	75·6	7·42	0·2934	176	237	....	....
Tin	118	7·29	0·0562	442	462	11·5	0·154
Manganese	55	7·14	0·0722	3452	371	....	....
Zinc	65·2	6·915	0·0956	707	321	29	0·190
Chromium	52	6·81	0·100	3992	....	....	....
Cerium	92	6·728	0·0447	....	....	....	....
Antimony	120·3	6·715	0·0508	842	923	33·76	....
Didymium	95	6·544	0·0456	....	....	....	....
Niobium	94	6·3	....	....	....	....	....
Tellurium	128	6·25	0·0475	752	596	....	....
Lanthanum	93·6	6·166	0·0448	....	....	....	....
Gallium	69·9	5·9	0·079	86	....	....	....
Arsenic	75	5 7	....	....	788	....	....
Vanadium	51·37	5·5	....	3992	....	....	....
Zirconium	89·6	4·15	....	887	....	....	....
Barium	137	4	....	1562	....	....	....
Aluminum	27·5	2·583	0·2143	....	450	19·6	....
Strontium	87·5	2·5	....	....	....	6·71	....
Columbium	94	2·1	....	....	....	....	....
Glucinum (Beryllium)	9·4	2	0·64	....	....	....	....
Caesium	133	1·88	....	....	....	....	....
Magnesium	24	1·743	0·250	1382	....	25·47	....
Calcium	40	1·578	....	1562	....	22·14	....
Rubidium	85·4	1·52	....	135	....	....	....
Water	....	1	....	....	....	....	....
Sodium	23	0·9735	0·293	194	....	37·42	....
Potassium	39·1	0·875	0·166	136	....	20·83	....
Lithium	7	0·594	0·9408	374	....	19	....
Erbium	112·6	....	....	....	....	....	....
Selenium	79·4	....	0·0701	....	271	....	....
Titanium	50	....	....	....	....	....	....
Tantalum	182	....	....	....	....	....	....
Yttrium	61·7	....	....	....	....	....	....
Terbium	?	....	....	....	....	....	....

NEWLY DISCOVERED METALS OF UNCERTAIN PROPERTIES.

Idunium.	Norwegium.	Columbium.
Davyum.	Vesbium.	Rogerium.
Mosandrum.	Neptunium.	Comesium.
Halmium.	Lavoisium.	Actinium.
Thalen.	Uralium.	Ya—Yb.
Samarium.	Barcenium.	

MECHANICAL PROPERTIES OF SOME OF THE LEADING METALS.

Order of hardness.		Order of tenacity.	
Platinum.	Tin.	Lead	0·1
Iron.	Selenium.	Tin	1·3
Antimony.	Bismuth.	Gold	5·6
Copper.	Lead.	Zinc	8
Silver.		Silver	8·9
Gold.		Platinum	13
Zinc.		Copper	17
Aluminum.		Iron	26

Malleability. Hammered.	Malleability. Rolled.	Ductility.
Lead.	Gold.	Platinum.
Tin.	Silver.	Silver.
Gold.	Copper.	Iron.
Zinc.	Tin.	Copper.
Silver.	Lead.	Gold.
Copper.	Zinc.	Zinc.
Platinum.	Platinum.	Tin.
Iron.	Iron.	Lead.

Steel Pontoons.

The draught of water through the Canadian canals, while nominally nine feet, is subject to season fluctuations, and anything over this draught requires pontooning. Mr. Lesslie, manager of the Collins Bay Company, has made two cylindrical steel pontoons, and with these placed alongside the vessel it is only necessary to ballast them with water to a sufficient depth, secure them to and under the vessel, and then pump out the water until the required draught of the vessel has been reached. The utmost success has so far attended the use of these steel pontoons, and it is expected that they will be largely used during the World's Fair season.