NOTES ON NEW DISCOVERIES AND NEW APPLICATIONS OF SCIENCE.

SAVING SULPHUR FROM SULPHURETS.

In last week's "Notes" we estimated the value of the sulphur dissipated in the Swansea "copper smoke" at a quarter of a million sterling per annum. We based this estimate on the calculation made by Leplay, which is quoted in the first volume of Dr. Percy's "Metallurgy." Mr. Peter Spence, of the Pendleton Alum Works—the largest alum works in the world, we believe—has put forth, however, a much higher estimate of the value of the sulphur in the copper smoke. The quantity of copper ores smelted weekly at Swansea is about 5,000 tuns, and the proportion of sulphur in them averages from 24 to 28 per cent. "This," says Mr. Spence, "is equivalent to 3,300 tuns of brown oil of vitriol, and this weight I would undertake to produce therefrom. The present value of this weekly quantity is £9,900," which is at the rate of £514,800, or more than half a million sterling per annum. Mr. Spence proceeds, "this quantity of acid would meet the requirements of our staple chemical manufactures, or nearly so; while these manufactures have never been so pressed for a supply of sulphur ores as now. Spain, Portugal, Germany, Belgium, Norway, and even Iceland are being ransacked, but have so far failed to yield them in sufficient quantity. Shall this dearth on the one hand, and needless waste on the other, continue?" There is certainly no good reason why it should.

Mr. Spence invented about four years ago a "Copper Ore-calcining Furnace," which has, over M. Gerstenhofer's furnace, which we described last week, the great advantage, besids several others, of not requiring that the ores calcined in it should first be ground. This furnace Mr. Spence has had in constant work for the last three years—all the sulphuric acid which he has used during that period, whether at his works at Pendleton or at those at Goole, having been produced by its agency. It is of considerable length, measuring about fifty feet from end to end, and consists of two chambers, one above the other, separated by a thin partition of fire-brick. The fireplace is at one end of the lower chamber, the other end of which communicates with the chimney, and the products of combustion are confined to that chamber. It is in the upper chamber—between which and the lower chamber no communication exists—that the ores are calcined. In each side of this upper or ore-chamber are six apertures, placed at equal distances apart, and ordinarily closed by suitable doors. These apertures are for the purpose of enabling the workmen to move the ores gradually from one end of the furnace to the other. At one end of the ore-chamber is an opening through which a current of air is forced continuously while the furnace is in action; the other end communicates with a sulphuric acid chamber. In commencing working, a batch of ore, usually about ten hundred weight, is introduced through the pair of doors which are furthest from the fireplace, and so at the coolest part of the furnace, for, by reason of its length, and of the position of the fireplace, the furnace is very much hotter, of course, at one end than at the other. Having been spread evenly on the floor of the upper chamber, this first batch of ore is then allowed to remain undisturbed for two hours. At the end of that time it is raked eight feet forward, and a second batch of raw ore is introduced into the place the first has thus been removed from. At the end of the second two hours the first batch is moved a further eight feet forward, and the second batch is also moved eight feet, making room for a third batch; and so the process goes on continually. At the end of twelve hours the first batch is withdrawn, and thereafter a batch is withdrawn, as well as a batch introduced, every two hours. The action of the furnace is thus unintermittent, and it calcines about six tuns of ore every twenty-four hours. The ores, as they pass from one end of the furnace to the other, are exposed to a gradually increasing temperature, whereby clotting is entirely prevented, and under the influence of the heat to which they are thus gradually subjected the sulphur in them combines with the oxygen of the current of air which is passed over them, to form sulphurous acid, which is afterward converted into sulphuric acid, in the usual way. The cost of calcination by his furnace, Mr. Spence states to be only 2s. 1½d. per statute tun of ore, which is less than the cost of calcination by the furnaces at present in use, while for every five tuns of ore calcined in Mr. Spence's furnace £9 worth of sulphuric acid is obtained, at a cost of not more than £1, from constituents of the ore, which the ordinary furnaces turn to no account whatever. Whether M. Gerstenhofer's furnace will prove capable of yielding better results than Mr. Spence has thus for the last three years been obtaining from his, may be fairly doubted. Be that as it may, we really seem at last to have reached the beginning of the end of the enormous waste which has so long been going on at Swansea of a substance which is quite as important to the chemical arts as iron is to the mechanical ones.

THE MOST FUSIBLE ALLOY.

The most fusible alloy at present in use is a compound of two parts by weight of bismuth with one of lead and one of tin. It is called "fusible metal" *par excellence*, by reason of its melting at so low a temperature as 93·75° Centigrade. Dr. C. R. von Hauer has found, however, that by the addition of cadmium to alloys of bismuth with lead and tin, compounds may be produced which will fuse at a lower temperature still. An alloy of four equivalents of cadmium, with five equivalents each of lead, tin, and bismuth is quite liquid, he states, at 65·5° Centigrade. In parts by weight this alloy would consist of cadmium 224, lead 517·5, tin 295, and bismuth 1,050. An alloy of three equivalents of cadmium with four each of tin, lead, and bismuth fuses at 67·5° Centigrade, and an alloy of one equivalent of cadmium with two equialents each of these three other metals at 68·5° Centigrade, which is also the fusing point of an alloy of one equivalent each of all the four metals. Dr. von Hauer made these alloys by fusing their ingredients in a covered porcelain crucible at the lowest practicable temperature. Their melting points were determined—under hot water, and also by placing a thermometer in the fused mass, without water—after they had been melted and cooled several times. They all become pasty at low temperatures than those given above; the temperatures quoted are those at which the alloys are perfectly fluid. It should be added that, unfortunately, all these alloys very rapidly oxidize when placed in water.

INDIUM.

Profs. C. Winkler and Schrotter, who are the only chemists, other than its discoverers, MM. Reich and Richter, who have yet experimented on that latest discovery and as yet least known of all the elements, have each recently published some new researches on indium. Winkler finds the atomic weight of that metal to be 35·918, instead of 37·07, which Reich and Richter estimated it at. Schrotter states that the magnificent blue line in the spectrum of indium, from which the metal derives its name, does not coincide with any of the dark lines in the solar spectrum, and hence deduces the conclusion that this element does not exist in the atmosphere of the sun. Both Winkler and Schrotter agree with the discoverers as to the physical characteristics of the metal, which seems to closely resemble cadmium in color and luster, but to be softer than cadmium, marking paper easily. The streak produced by it on paper is bright, with a very slight shade of gray. Reich and Richter believe that indium was not preceptible by sulphureted hydrogen, but Schrotter finds that gas will precipitate it from any solution which is sufficiently dilute and not too acid. The precipitated sulphide cannot be distinguished, as regards color, from sulphide of cadmium. Indium seems, indeed, to bear in all respects a very close likeness to cadmium.

REDUCTION OF POTASSIUM BY ALUMINUM.

According to the "Zeitschrift fur Chemie und Pharmacie," Beketoff has found that potassium may be reduced by means of aluminum more readily than by any other agent yet tried. If we had cheap aluminum, therefore, it would enable us to cheapen potassium; but, of course, aluminum will never be used on any extensive scale for the reduction of potassium so long as aluminum has itself to be obtained by means of sodium. The potassium compound best adapted for reduction by aluminum is the hydrate.

REAL RUBIES MADE ARTIFICIALLY.

Many chemists have endeavored to produce artificial diamonds, but hitherto with invariable insuccess. Most of the other gems, however, have been produced artificially, the artificial stones having exactly the same composition and properties as the natural ones. Rubies have till now been the most difficult gems to produce artificially, but MM. Ste. Claire Deville, Caron, and Troost have just communicated to the Academy of Sciences a method by which they can be made with ease. A mixture of fluoride of aluminum with a small quantity of fluoride of chromium is placed in an earthen crucible which has first been carefully lined with calcined alumina, after the fashion in which it is customary to line crucibles with charcoal. In the center of this crucible, in the midst of the mixture of fluorides, is placed a small platinum crucible containing boracic acid. The outer crucible having been well covered, the whole is exposed to a temperature sufficiently high to volatilize both the boracic acid and the fluorides. The vapor of the boracic acid then decomposes that of the fluorides, with formation of fluoride of boron and deposition of crystals of the mixed oxides of aluminum and chromium. If the fluorides were originally mixed in the right proportions, these crystals will have exactly the same composition, and exactly the same color, luster, specific gravity, and other properties, as the most perfect natural rubies.—*Mechanics' Magazine.*

Strength of Iron.

A very extensive and interesting test of the relative strength of iron has just been completed, as will appear by the subjoined report, at the gunboat yard of Messrs. Snowdons & Mason, South Pittsburgh, under the immediate supervision of Jos. S. Kirk, general manager of that establishment. The object of the test has been to determine the strength of the cylindrical boilers of different diameters and thicknesses of iron; the best method of riveting; proper size of rivets, and space between them to produce the greatest strength:—

MESSRS. LYON, SHORB & Co.—*Gentlemen:*—Agreeable to your request, the four boilers marked "A," "B," "C," and D," I submitted to a hydraulic pressure, with a view of testing their relative strength. The gages used in these experiments were two,—one of the celebrated manufacture of Schæffer and Budenberg Buckau, Madgeburg, Germany, with a range of 66⅔ atmospheres; the other, Ashcroft's make, of 40 atmospheres; water used at a temperature of ninety (90) degrees.

Boilers "A," and "B," were not ruptured, owing to a disproportion between the size of rivets, diameter and thickness of iron, resulting in a general leak through the entire length, at the rivets and calking: four blows with an eighteen-pound sledge, applied under the greatest pressure, produced no material effect.

Boilers "C" and "D," were ruptured by tearing out through the center of outside course of rivets, in the direction of the length, for a space of about eighteen inches. The following table will furnish you with such detailed information as it is hoped will be satisfactory.

Respectfully yours, JOSEPH S. KIRK.

Pittsburgh, Oct. 25, 1865.

	A	B	C	D
Brands of Iron	Sligo.	Sligo.	Sligo.	Tyrone.
	Inch.	Inch.	Inch.	Inch.
Inside Diameter	50	48	[illegible]	[illegible]
Length	73	73	67	67
Thickness of Iron	[illegible]	5 16	[illegible]	[illegible]
Size of Rivets	[illegible]	⅝	[illegible]	[illegible]
Rivets staggered and centered on	[illegible]	1⅝	[illegible]	[illegible]
Space between center of rivets in parallel lines	1⅛	1⅛	1⅛	1⅛
Rivets in parallel lines centered on	2 5-16	2 5-16	2 5-16	2 5-16
	lbs.	lbs.	lbs.	lbs.
Pressure per square inch	383	438	583	502
Tensile strength of iron per sq. inch force as applied in boilers	80,246	105,722	132,842	114,386

A Boat Propelled by a Pump.

Nearly a year ago a dreadful accident occurred in Glasgow Harbor. About six o'clock on a dark winter evening the Clyde-street Ferry (a small open boat, pulled by one man with a pair of oars) with upward of thirty souls, was swamped by the waves of a passing steamer while crossing the stream, and the whole of the passengers were precipitated into the river, whereby twenty of them were drowned. Immediately after the accident the whole affair was carefully investigated by the Clyde trustees. Various schemes and remedies for the prevention of such another catastrophe were proposed by themselves, and laid before them by others, when, after due consideration, it was determined to try a steam ferry as an experiment, and, if successful, have a number of boats built and put upon the principal stations. Messrs. Hedderwick & Co., shipbuilders, of Govan, were entrusted with the construction of the hull, while the engines and a novel mode of propulsion were to be furnished by Messrs. Howden & Co., engineers, Scotland street, Glasgow. Last week the first boat was finished and launched, and the following is a description of the craft:—She is an open boat, 30 feet long by 12 feet broad, and draws about 2 feet 6 inches of water; both ends of the boat are alike; or, in other words, she has two bows. She is nearly flat-bottomed, and, although after the trial they affixed a keel, they have since cut the first greater portion of it off, finding it superfluous. The floor of the boat is about the water level, and between the bottom and the floor are tight-water compartments. The first intention was to have small ports or scuppers pierced through the sides flush with the floor, to carry off any accumulated water in the boat; but, as she draws rather more water than was at first expected, this object has been frustrated. A light hand-rail runs round the gunwale, open at both bows, for the ingress and egress of passengers. The engine and boiler are placed about the center of the boat, in such a position that the passengers can freely walk round about them. The boiler is an upright cylindrical one, with one furnace; it is neatly incased in wood, with brass hoops, and the funnel has an external covering of brass, polished. The boat is propelled by means of a pump worked by the engine in any direction required. The following is the manner in which this is accomplished: Underneath each of the four quarters of the boat there is an aperture or tube open to, and always submerged in, the water in connection with the pump, but these waterways are not parallel to, or straight fore and aft the vessel, but run at a considerable angle from the pump in the center of the boat to the port or starboard side, as the case may be; thus we have four pipes in connection with the pump diverging from the center of the boat in the form of a St. Andrew cross, their apertures all open to the water. The pump is fitted with suitable valves, so that the water can be admitted by any of the apertures and expelled by the others. It will now be easily understood that by arranging the valves to allow the water to flow into the pump by the two stern apertures, for instance, when the pump is set in motion the water will be expelled with force through the two apertures at the bow, which will cause the boat to move stern first, and *vice versa*. Thus, without a helm, the boat can be propelled either backward or forward, broadside on, or made to revolve on its axis, simply by shifting the valves; its rate of speed is about five miles per hour. It has not yet been put on any station, as the trustees wish the ferryman to gain experience how to work it before carrying passengers, but it is expected it will be quicker, more easily steered and managed, and safer than the present laborious system of pulling with oars.—*London Engineer.*

[What a roundabout way this is? Why not put in a screw at once? pumps, valves, and pipes are much more liable to get out of order, and more costly to keep in repair than a propeller would be, to say nothing of the hull of the boat being pierced full of holes below the water line.—EDS.

THE "ST. JOHN" BOILER EXPLOSION.

The public has reason to congratulate itself we think, on the manner in which disasters are examined into of late, and the determination evinced to get at the root of the trouble. "Died by visitation of God" used to be a common verdict with coroners' juries, anxious to be relieved from an unpleasant duty, and "nobody to blame," has not been so long out of fashion but that we can recall many instances of it.

The boiler explosion on the steamer *Arrow* was rigidly investigated, and the cause disclosed. The boilers were old, worn out, and unfit for duty, and the proprietors of the boat were indicted for manslaughter. In the recent explosion on the steamer *St. John*, whereby many persons lost their lives, the boilers were entirely new, and were perfectly sound, except in one place, and that place was where they gave way, as the appended examinations of the principal witnesses will show:—

Capt. Peck, on being examined, said:—I am Captain of the *St. John*, and have been one for many years; I have not had charge of an engine, neither am I acquainted with the management of them.

After some other particulars not essential to the point, a juror said:—

Did you notice any mark on the boiler where the fracture took place? A.—Yes, sir.

Q.—Was it a cut with a chisel? A.—Yes, sir.

Q.—Do you think that cut was made by the calker in chipping the sheet? A.—I think it might have been so made.

Q.—Do you think that cut weakened the boiler? A.—I think it did weaken it some.

Q. Was not the line of the fracture directly along the cut or chisel mark? A.—Yes, sir.

Q. Do you think that mark was, in any way, a damage, or that it caused the disaster? A.—I think it was the principal cause.

The first assistant, Joel Wright, was then examined, and testified that the boiler had plenty of water at the time of the accident. Some firemen were also examined as to the general conduct of affairs in the engineering department of the boat, and the Chief Engineer was also examined, and corroborated the testimony of the Captain—that the sheet tore along the line of the chisel cut before mentioned.

THE GOVERNMENT INSPECTOR AND HIS MAGNIFYING GLASS.

Mr. J. W. Hopper was the next witness. He testified that he was inspector of boilers and steamers; examined the boilers of the *St. John* after they were placed in the boat, and found they were properly braced and safe. [The witness then described the mode by which boilers are tested.]

Question by Mr. Fox—How were you appointed Inspector? A.—The Secretary of the Treasury appointed me.

Q.—What is necessary to be appointed? A.—I was nominated for the office by a Government committee appointed for the purpose, consisting of Hiram Barney, Ex-Collector, Mr. Thomas B. Stillman, and a Judge of the United States Circuit Court; they recommended me for the office, and the Secretary of the Treasury appointed me

Q.—Were you examined as to your fitness for the office by them? A.—No; I was employed before that as an engineer on a revenue-steamer.

Q. Did you run the engine on the steamer? A.—No, my assistants did; it is usual for them to do so.

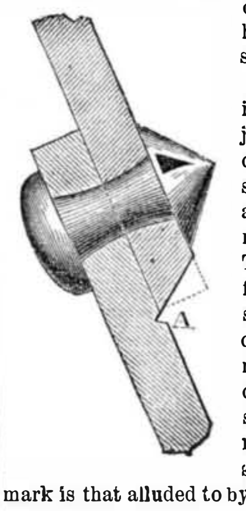
[The witness then testified that Mr. Secor's boilers were braced in the same way as the boilers of the *St. John.*]

Question by Mr. Fox—You say you made a very careful examination of the boilers of the *St. John* after they were placed in the boat—did you see a chisel cut on it? A. No, I did not; I examined it with a magnifying glass, and did not see a chisel cut on it.

Here Mr. Fox took the piece of the boiler with the chisel cut on it, and exhibited it to the witness, remarking—"You say you failed to discover this chisel cut with a magnifying glass, which I observed several feet off. How is that?"

[The witness made no answer, but subsequently gave it as his opinion that the explosion was caused by a bad plate of iron. He then left the stand.]

As many of our readers do not know the nature of this technicality, we give herewith a diagram representing it.



When two sheets of boiler iron are lapped to form a joint, the outside sheet is chipped off on the edge, as shown by the dotted lines, and afterward calked or riveted tight on the edge. The tool used is an ordinary flat chisel, made thin and sharp, and unless common care is used by the work man the lower corner of the chisel will rest on the lower sheet and cut a slight channel all the way along, as shown at A. This chisel mark is that alluded to by the witnesses above mentioned.

If any person reading this article has ever had a pair of boots cut in the upper by the carelessness of the shoemaker in paring off the sole, he will know the nature of this damage done by the chisel. Since the skin of the iron is the strongest part of it, it follows that the plate is weakened to that extent by being so cut. In view of the fact that the rent followed the line of this chisel mark, it does not seem difficult to account for the accident.

The makers of the boiler, no doubt, took every precaution against disaster—it is unreasonable to suppose otherwise. Men who make boilers do it for money, and a desire to build up a reputation, not to have them explode. Moreover, as these boilers were built by the pound, and not by contract, every additional sixteenth of thickness in the plate was just so much in their pockets.

We have always endeavored to get at the real cause of these disasters, and are wary of the theories which are so volubly uttered on all such occasions.

It will be found in most cases that honest examination into boiler explosions will reveal the cause, whether it be bad workmanship, flaws in the material, or neglect. The true way is to try and find some mechanical or other defect—not to mislead engineers and the public into supposing that, in spite of all the care in building or running steam boilers there is some mysterious agency which will defeat all their efforts at any moment.

The jury returned the following

VERDICT.

The jury found that, at the time of the explosion, the boiler was in a weakened condition, from the force of the hydrostatic pressure brought to bear in testing its capacity by the United States Inspector in the use of cold water, by insufficient bracing on the circular part, above the flat surface, by the effects of chipping and calking, and by the corrosion of the boiler on the inside, at the high-water mark; but from the diverse views and opinions of the many witnesses who have testified before us, the jury are unable to say from which of the causes the explosion occurred, or whether from one or more combined. The jury find that this boiler was made of the best material, and braced in the usual manner of constructing such boilers by the best boiler makers, and approved by scientific and practical men: but the jury recommend that hereafter boilers be braced above the flat surface on the circular part. The jury recommend that steamboat boilers be inspected oftener than the practice now is, by competent inspectors, and that said inspections be made as often as once in three months; also, that the hydrostatic test with cold water be abolished, and that warm water be used in its stead. The jury also strongly recommend and urgently adjure all boiler-makers to extraordinary care in construc ing steam boilers, and that especial pains be taken to avoid breaking the fiber of the iron by calking or by other means.

We, of course, do not know what passed in the secret deliberations of the jury, but we shrewdly suspect that the same juryman whose searching cross-examination we report, used his influence to get in the significant words, "*by the effects of chipping and calking.*" After these the remainder of the verdict is of no consequence.

Rescue of Shipwrecked Mariners.

The Boston *Courier* gives the following account of the rescue of the crew of a schooner lately wrecked on the south side of the Island of Nantucket:—

"By means of a gun provided for such emergencies by the Massachusetts' Humane Society, a line was thrown over the vessel, and, after considerable delay, owing to the exhausted condition of the shipwrecked crew, a rope attached to the line was hauled on board and fastened to the masthead. When this was done, a chair made for the purpose was run off on a hanging block, and one of the crew got in to be hauled on shore. When his weight began to press on the small line from the masthead to the shore, it began to stretch and he to sink down toward the top of the raging billows beneath him. When a little more than half way to land, the small line of the vessel used to veer him along the line and pull the chair back, got foul, and, for more than an hour, there the poor fellow hung, the line stretching, and the waves ready to swallow him in case it parted. At last he was drawn within a few yards of the nearest breaker, in which he was submerged every time the vessel rolled toward the beach. A rope was thrown to him by men wading up to their necks in the breakers, and he was dragged to land. In a similar manner, after toilsome exertions, continued all day long, the other shipwrecked mariners were rescued, the last man reaching the shore just at sunset."

"Hands Off."

The futility of placing this notice on goods at fairs is well set forth in the spirited paragraph subjoined, cut from the Minneapolis *State Atlas:*—

"The people are very curious, and inspection is the order of the day. The great placards, 'Handle not,' might as well have been turned wrong side out. You can never keep the hands of the briarean public off anything. They were on the delicate embroidery and snowy quilt; they left the furs with a new gloss; they fumbled the stockings, the pin-cushions and tanned skins; they dirtied the picture glasses, and felt all the rough spots in the oil paintings; if the book covers were lifted once, they were lifted a million times; the bright stoves soon got dingy faces, and the oil on the machines was carried off on a thousand fingers. How many digits were punctured by the needles on the Grover & Baker, and Wheeler & Wilson, would be a hard sum for Greenleaf himself. The vegetables had to 'take it;' hard potatoes got soft; fresh melons went rotten under the pressure, and the smell of onions was upon all. The only real iron-clads were the pumpkins, which couldn't be dented except by a hammer. Segars were much sought after, and, apparently, the awarding committee on these articles was very large.