Correspondence.

Discovery of a New Comet.

To the Editor of the Scientific American:

It was my good fortune to discover this evening, at 6 h. 45 m., February 23, 1883, a new bright telescopic comet in the constellation Pegasus. Its right ascension was approximately 22 h. 50 m.; north declination, 28°. It has a large bright head, very condensed, and a delicate straight narrow tail. Its motion is eastward, and is probably approaching the earth. It was discovered with my 9-inch reflecting telescope, but may be well observed with telescopes of moderate aperture. Telegraphic announcement was at once made of the discovery. WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y., Feb. 23, 1883.

NOTE.—Observations on this comet made at Harvard observatory show that it is moving away from the sun and earth, and is growing fainter every day.

Electricity in Gold Mining.

Among other uses to which electrical currents are applied, the purification of mercury seems to be likely to take a very important place; a place so important, indeed, that the subject deserves considerable attention. The results obtained are not only singular and striking, but they are to a certain extent still unexplained. That is to say, particular effects are produced, but precisely why and how has not yet been settled. In order to make what follows intelligible, it will be necessary, in the first place, to say something concerning the modern commercial system of gold mining as distinguished from the finding of nuggets and the washing of river sands. Gold is found in almost all countries in greater or less quantity. The principal supply is obtained, however, from quartz "reefs." Through some of these reefs the gold is disseminated in veins, visible to the eye. In other cases it appears as nodules or nuggets; but for the most part it exists in a state of extreme subdivision in the quartz rock. To obtain it the rock is broken to a fine powder in stamp mills; this powder is then sprinkled on inclined wooden tables, some 15 feet long and 3 feet wide, down which a stream of water flows continuously. At intervals, across the table, depressions or troughs are provided, in which mercury is put to a depth of half an inch or so. As the water and gold bearing quartz powder run down the table or "riffle," they pass over the surface of the mercury in the troughs. The mercury seizes the gold *in transitu*. After a time the mercury becomes saturated with gold, about 3 ounces of gold being in practice sufficient to saturate 75 pounds of mercury. The mercury is then drawn off and "retorted;" that is to say, it is heated in special stills, and evaporated like so much water; the mercury vapor or fumes being condensed and used over again in the form of mercury, much as the feed water in a surface condensing engine is used and reused. At the bottom of the retort when the mercury has evaporated is found a button of gold, or rather of gold and a very little mercury. This button is then treated with nitric acid, and a number having been collected, they are melted in a crucible and cast into ingots. There is a certain loss by waste of mercury at every retorting, which is made up by fresh supplies.

Now if the miner had nothing but clean quartz and gold to deal with, he would have no trouble in carrying out this process, but he seldom meets with conditions so favorable. Indeed, the quartz is constantly found impregnated with sulphides of arsenic and other metals, and these are found to "sicken" the mercury in the troughs in the riffle. The surface of the mercury must be absolutely bright and clean, or it will not take up the gold. To illustrate our meaning, let us suppose that the riffle troughs were filled with melted tin. Copper and tin have a considerable affinity for each other, and if bright copper filings were permitted to pass over the surface of the tin, they would sink and alloy with that metal. If, however, the tin were coated with oxide, it will be clear to any of our readers who has used a soldering bit, or tinned a piece of brass or copper, that the filings would pass away down the riffle untouched by the tin. The arsenic and other impurities found with the quartz have an analogous effect. They adhere to and foul the surface of the mercury, and amalgamation becomes impossible The moment fouling or "sickening" takes place the riffle becomes useless, and the mercury must be all drawn off and retorted. Nor is this sickening a tedious process. It can be effected in half a minute. Thus two or three drops of oil from a bearing will instantly sicken twenty or thirty pounds of mercury. The practical effect of all this is that there are very rich quartz reefs which cannot be worked, because there is no known method of getting the gold out of the ore. We may cite one case in which there are no less than 42 ounces of gold to the ton, but the quartz is so "foul" that it cannot be worked. Thus, then, we have an ore worth £126 per ton, which, as it happens, could be mined and treated for about £4 per ton, and which is entirely valueless, all attempts to work it having hitherto failed. A great many cases might be cited in which promising mines have entirely collapsed for this reason. A laboratory analysis of the ore has shown that it is rich in gold, carrying perhaps 5 ounces or 6 ounces to the ton, but owing to the sickening of the mercury the most that can be got out will be a couple of pennyweights perhaps—hardly enough to pay for the working.

We need hardly say that chemists and others have for years attempted to hit on some expedient for cleaning "sick" mercury without retorting, and the result can be attained in two ways. Thus, a small quantity of sodium added to the metal restores its power of amalgamating with gold, owing, no doubt, to the remarkable power which sodium possesses of making metals alloy. Thus, if a little sodium amalgam be rubbed on a bit of hoop iron, the iron may be dissolved in a pot of melted zinc. The mercury can also be cleaned by blowing chlorine gas through it. Neither plan has, however, met with much practical success. Sodium is not easily obtained in sufficient quantities, and it is not a very nice thing to carry up country to wild and out of the way districts. There are obvious troubles, again, connected with the use of chlorine, and so neither have, as we have said, met with much, if any, favor from practical gold miners.

Some months ago Mr. Richard Barker, of Norfolk Street, a member of the Geological Society, discovered—for we cannot say invented—a very curious phenomenon, namely, that if mercury be used as a cathode, while a copper or other metallic electrode is immersed in water covering the mercury, the mercury will immediately begin to expel any impurities which it contains, except metals. This principle he has applied to the purification of mercury in gold riffles, and with remarkable success. The invention—for the discovery referred to above had to be reduced to a practical form, in the shape of suitable apparatus—has been taken up by the Electro Amalgamator Company, and a riffle has now been at work in Southwark for some little time. This riffle consists of a wooden trough, about 3 feet wide, and 12 feet or 14 feet long, with the usual mercury troughs across it. Along one side of the trough run two iron bars, one of which forms one side of an electric circuit, while the other forms the other. Rods of iron dip into all the mercury troughs, and put the mercury on the negative or return side of the circuit; similar rods are connected with bars, one of which lies across the riffle over each mercury trough, and from this bar strips of copper about 1 inch wide and 8 inches long extend and lie horizontally over the mercury, which is thus under, so to speak, a huge comb, the teeth of which are about 8 inches apart. The distance between the mercury and comb teeth is about one-fourth of an inch, and so long as the riffle is dry no current can pass. Close to the riffle is a very simple and inexpensive dynamo, wound for quantity only, with very coarse wire. Over each comb is fixed a small roller or axis of wood in which are stuck pegs, which pegs dip into the mercury between the comb teeth. The dynamo is driven by a small gas engine, and the pegged rollers are caused to revolve at the same time, the pegs agitating the surface of the mercury. The ground quartz and a full stream of water descend the riffle from the top, as already explained, and the water flowing over the mercury and touching the comb teeth, contact is at once made and a current flows from the whole lower surface of each comb tooth through the water to the mercury. The effect produced is magical. No matter how "sick" or foul the mercury is, the moment the current is turned on the impurities fly from the space below the comb tooth, and collect in narrow ridges in the intervening spaces, from which they are washed away by the current of water, and the surface of the mercury at once becomes as bright as silver. We have seen quartz used, heavily charged with sulphur and arsenic from sulphur pyrites. One shovelful of this stuff sufficed to sicken all the mercury in the riffle, and the mercury was brought back to condition in less than one minute after the current was turned on. With the current flowing, the mercury could not be made sick. One experiment which we witnessed showed in a startling way the effect produced by the passage of the current. Four or five pounds of clean mercury being put into a china bowl, some oil was added, and the whole beaten up with a stick to a species of ointment, a process which occupied five or six minutes. A sovereign dropped into this mixture of oil and mercury came out untouched by the mercury. For all purposes of amalgamation the mercury was useless, and must remain so until retorted. The bowl was now nearly filled with water, and the end of a negative wire from a battery was plunged into the metal and oil, while the positive wire was just dipped into the water, which stood two or three inches deep. The moment contact was made with the water the oil began to rise in streams from the mercury, which could be seen collecting itself into little drops, two or three of which would coalesce. In about three minutes the whole of the oil had come to the surface of the water, and the mercury lay pure and bright at the bottom of the bowl.

We are unable to explain to what this action is due, nor are we aware that any chemist or electrician is in a better position to supply information. There are two or three theories at the service of our readers, all more or less—principally less—satisfactory. According to one of these, the impurities on the surface of the mercury, or mixed with it, become electrified, and are repelled by the mercury, because they are not metallic. According to another, the molecules of mercury are polarized, and, changing their relations to each other, expel all foreign bodies. Another theory attributes the action to the formation of nascent hydrogen, which acts chemically on the impurities; and this theory finds confirmation in the fact that pure water acts more effectively than any other liquid, the addition of any other liquid to the water, or of any substance soluble in it, apparently weakening the action of the current. It is a noteworthy fact that if the poles be changed, the cathode or negative end of the wire being in the water, while the anode or positive wire is in the mercury, the action is very trifling. If both ends are plunged in the mercury, there is no action whatever. If a quantity of sickened, "floured" mercury be put into a large iron pan, and covered with water, experiments may be carried out which demonstrate the action of the current very clearly. Taking the positive insulated wire in the hand, an inch or so of the wire being left bare, while the other wire is plunged in the mercury, we can cause the impurities on the surface of the mercury to go in any direction we choose. They always fly away when the positive wire is pointed at them, just as dust will go before a blast from the nozzle of a pair of bellows. Indeed, it requires small exertion of the imagination to believe that a current of air proceeds from the end of the wire, and brushes the dirt before it. It has, we may add, long been known that the passing of a current of electricity through mercury tended to clean it, but the action was too feeble to be of any importance, and so far as can be seen, the whole virtue of the Barker system resides in the use of water on the top of the mercury. As to the importance of the invention our readers can judge for themselves. It is to be hoped that a really satisfactory explanation of the action of the current will be forthcoming ere long.—*The Engineer.*

The Last Railway Census of the United States.

The census report of 1880 relating to railways shows that for the fiscal year ending 1880, there were operated in the United States 86,781½ miles of railway, the cost and liabilities for which were a little over five thousand six hundred millions of dollars ($5,658,914,158).

The average cost of the railways, counting capital paid in and borrowed, has been approximately $62,552 per mile.

The aggregate transportation earnings for 1880 were $580,450,594, and the expenses were $352,800,120. Net earnings $227,650,474. After paying interest and other fixed charges the amount available for dividends was $110,344,597.

The total railway stock subject to dividend was over two thousand six hundred and thirteen millions of dollars ($2,613,606,204), on which a trifle over 4½ per cent average dividends were earned, and an average of 2·70 declared, the balance of 1·80 being held.

The earnings per mile were $6,688. Expenses per mile, $4,065. Freight trains earned $1.65 per mile, and cost to run 98 cents per mile. Passenger trains earned $1.19 per mile, and cost to run them 76 cents per mile. In round numbers 291,000,000 tons of freight were carried; average distance each ton, 112 miles. Passengers to the number of 270,000,000 were carried; average distance each, 23 miles.

Number of passengers killed	143	Injured	544
" employes "	923	"	3,617
" other persons "	1,475	"	1,513
	2,541		5,674

Total killed and wounded for 1880, 8,215.

The equipment is as follows:

No. of locomotives	17,412
No. of passenger cars	12,230
No. of mail, express, and baggage cars	4,475
No. of freight cars	375,312
No. of all other cars	80,138
Cost of equipment	$418,045,459

The number of railway employes is as follows:

General officers		3,375
General office clerks		8,655
Stationmen		63,380
Trainmen—Engineers	18,977	
Conductors	12,419	
All others	48,254	
		79,650
Shopmen—Machinists	22,766	
Carpenters	23,202	
All others	43,746	
		89,714
Trackmen		123,489
All other employes		51,694
Aggregate		418,957
Amount of pay rolls for the year		$195,350,013

White Bronze.

Experiments are being made, according to the *Polytechnische Notizblatt*, in Paris with a new alloy having a white color yet containing no nickel. It is said to be very strong and malleable. It is made of copper and ferro-manganese, the proportions being varied according to the purpose to which the alloy is to be employed.

An alloy of forty parts of copper and sixty parts of ferro-manganese, with a suitable quantity of some appropriate flux, produces a metal of such tenacity that it surpasses the best steel armor plates. The melted mixture is cast in blocks and is perfectly malleable. To obtain a white metal that can be rolled out in sheets, the above alloy is melted again, and 20 or 25 per cent of zinc or white metal added, which imparts to it the desired quality.

A plate of the first named alloy two inches thick was found by experiment to offer more resistance to a cannon ball than a steel armor plate of the same thickness.

This new kind of "white bronze" is not to be confounded with the alloy used in this country under the same name for gravestones and monuments, and which consists principally of zinc.

A Throat Electric Lamp.

At the last meeting of the Leeds and West Riding Medico-Chirurgical Society, Mr. Margetson, of Dewsbury, exhibited an incandescent lamp, designed by himself, and used by him since October last in examining the mouth and throat. The globe was about half the size of a walnut. It can be held in the mouth for two minutes without discomfort from the heat.

Novelties in Varnishes and Shoe Polishes.

Reinhardt has devised a method of destroying the stickiness of varnish, which consists in placing the article in a closed vessel or chamber where it can be exposed to the action of ozonized air in motion.

A leather varnish or polish is prepared by Gunther, of Berlin, by mixing a filtered solution of 80 parts of shellac in 15 parts of alcohol, with 3 parts of wax, 2 parts of castor oil, and a sufficient quantity of pigment. The mixture is evaporated in a vacuum to a sirup. The varnish is applied to the leather with a brush moistened with alcohol or with a colorless alcoholic varnish.

Nicolet, of Lyons, prepares boot blacking by dissolving 150 parts of wax and 15 parts of tallow in a mixture of 200 parts of linseed oil, 20 parts of litharge, and 100 parts of molasses, at a temperature of 230° or 250° Fahr. After this 103 parts of lampblack are added, and when cold it is diluted with 280 parts of spirits of turpentine, and finally is mixed with a solution of 5 parts of gum lac and 2 parts of aniline violet in 35 parts of alcohol.

Hein, in Kaufering, makes another kind of shoe blacking by melting 90 parts of beeswax, or ceresine, 30 parts of spermaceti, and 350 parts of spirits of turpentine, with 20 parts of asphalt varnish, and adds 10 parts of borax, 20 parts of lampblack, 10 parts of Prussian blue, and 5 parts of nitro-benzol.

Brunner uses 10 parts of bone black, 10 parts of glucose sirup, 5 parts of sulphuric acid, 20 parts of train oil, 4 parts of water, and 2 parts of (carbonate of) soda. The bone black and glucose are stirred with the acid in a porcelain vessel until the whole mass is homogeneous and has a shining black surface when at rest. The soda is dissolved in a little water, and boiled with the oil under constant stirring until it forms a thick liquid, and then the other mixture is stirred into it. By varying the proportions of these two mixtures, the blacking is made thinner and softer, or harder and firmer. The substances sold as French polish are mostly composed of these ingredients. In this and all other kinds of shoe blacking made with bone black and sulphuric acid, the precaution must be observed of stirring rapidly and evenly after the acid is added, otherwise lumps will be formed that are difficult to crush, and the blacking will have a granular condition that does not belong to it. Good shoe blacking must always remain soft, and show a smooth uniform surface when applied to the leather.—*Neuste Erfahrungen.*

THE "PEERLESS" ENGINE.

The engine represented in the engraving is one of the simplest, most compact, and strongest in the market. The piston rod, valve stem, and pins are made of steel. The crank shaft and connecting rod are made of Chester steel. The main frame of the engine and the slides, as well as the bearings for the crank shaft, are cast in one piece, so that it is impossible for the working parts of the engine to get out of line or change their relation to each other.

The construction of the engine is such that the action of the piston rod is exactly central, and all lateral strains are avoided.

The "Peerless" engines do not require any masonry foundation, or extra care in setting up, thus saving expense to the buyer. They will stand upon any ordinary floor and do perfect work, even when out of plumb. Every engine is adjusted, and run for several hours, before leaving the shop, and is in complete order when sent out.

A detached engine has many features which recommend it to those wanting power. When small engines are mounted on boilers, the journals often become so heated that it is difficult to keep them lubricated, and the working parts of the engine are liable to be thrown out of line by unequal expansion of the different parts of the boiler to which they are attached, and the durability and efficiency of the engine greatly lessened.

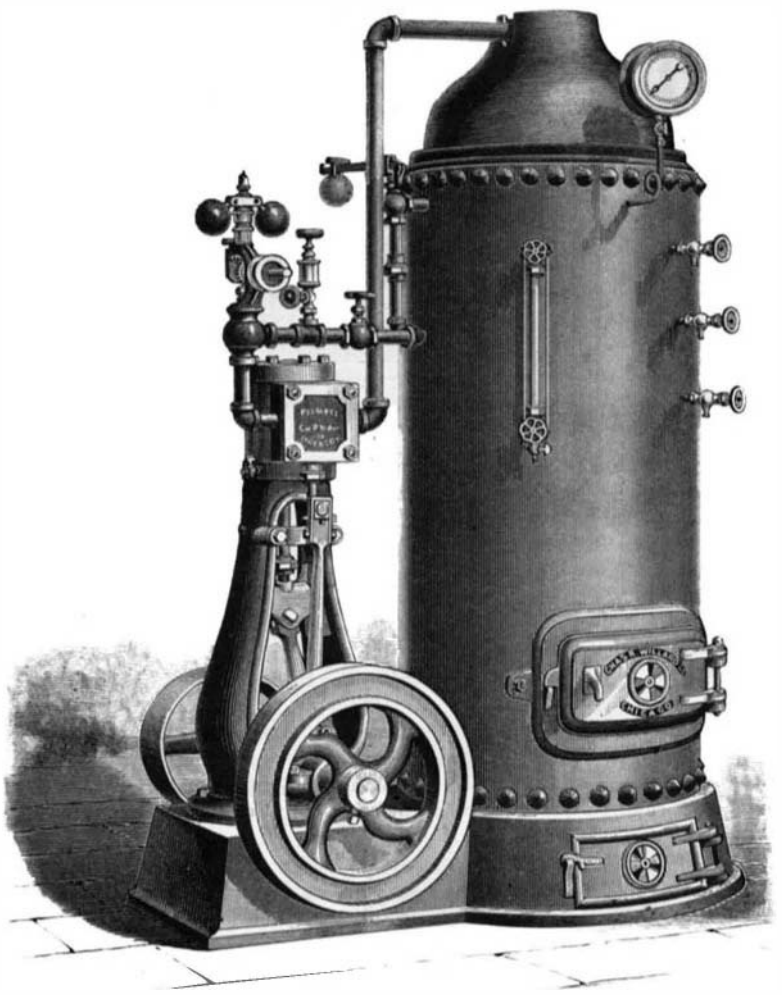
This engine occupies but little space, is convenient to work around, and makes a solid, substantial thing. Should it be necessary to move it at any time, the boiler can be taken off the base by simply unscrewing the steam and exhaust pipes.

A valuable feature of this form of portable boiler and engine is, that it can be taken apart and carried up or down stairs, or into localities where it would be difficult and expensive to carry the same power engines and boilers if all fastened together.

All persons familiar with the mechanical principles involved will understand why this form of engine, detached from boiler and standing on a solid iron foundation, is superior to the lightly constructed engines which are bolted to the boiler shell. Aside from every other consideration, the greater power obtainable from an engine of this pattern, of same sized cylinder, owing to the higher rate of speed at which it can be run without serious vibration, should give it the preference among all careful buyers.

In a vertical engine no counter weight is required, because the recoil produced in a horizontal engine in overcoming the inertia of the reciprocating parts is here prevented by the perfect resistance of the earth, as the travel of the piston is in the direction of the line of gravitation and not across it, as with horizontal engines, and greater steadiness and freedom from vibration is obtained. In a vertical engine the wear is equal on all sides, which is not the case with a horizontal engine, in which there is always the heaviest wear on the under side of the cylinder.

Five sizes are manufactured, two, four, five, six, and nine horse power. Chas. P. Willard & Company, 20 La Salle Street, Chicago.

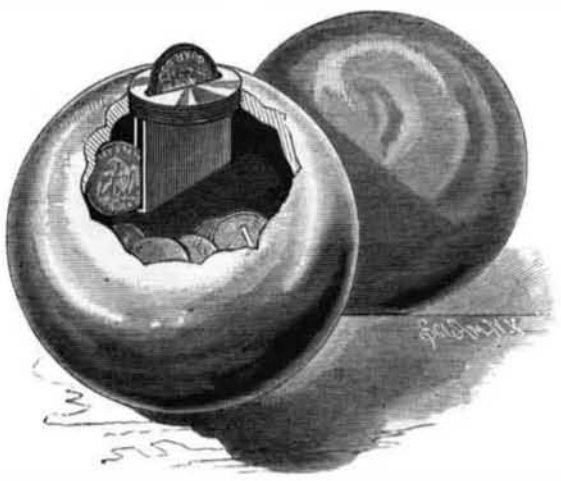


C. P. WILLARD & CO.'S VERTICAL ENGINE.

TOY MONEY SAFE.

The child's bank or toy money safe shown in the engraving serves as a secure and convenient receptacle for coins, and at the same time is a truly ornamental object, being of polished metal, nickeled, silvered, or gilded, bronzed or japanned. It may be made of rubber or any other suitable material. It can also be made of brass spun in spherical form.

The hollow sphere forming the money safe has a narrow flat base forming the stopper of the aperture through which the coins are removed. The stopper screws in with a fine, close-fitting thread, and with so much friction as to render it impossible for the child to remove it. In the stopper is a slot connecting with a short flat tube having an inclined bottom, which deflects the coins as they are introduced, and absolutely prevents their being shaken out.



HOTCHKISS' TOY MONEY SAFE.

This simple device can be made to sell for a very low price and yield a good profit; at the same time it admits of a fine finish, and may be made in various sizes to suit users.

This invention has recently been patented by Mr. J. F. Hotchkiss, of 84 John Street, New York city, who may be addressed for further information.

Laver Bread.

Laver bread is made of a seaweed (*Porphyra laciniata*) found growing on the low rocks. The women gather it in large baskets and carefully pick it over, wash it, and take out any other sort of seaweed that gets in with it. It is then thoroughly washed again to remove all the sand, after which it is boiled for about two hours, then chopped up with a knife, rolled into lumps, and sprinkled with oatmeal to keep it together and make it look clean. It is only made along the Glower and Devonshire coasts, where a great many women earn their living by making it. After it is cooked it will keep for about three or four days in summer, and for about a week in winter. Most of it is taken to the Swansea market, for which a great deal is sent from Devonshire, where the seaweed grows more abundantly than about Gower. It is sold at 3d., 4d., and 5d. per pound. The poor people are very fond of it, and eat it either fried with bacon grease, or else cooked like a vegetable with meat.—*Kew Report.*

A New Tar Explosive.

Among the derivatives of coal tar, several kinds of explosives have long been known; but a new compound of this character has lately been made by Dr. Himly and Herr Von Frutzschler-Falkenstein, which is said to be suitable either for mining purposes or for firearms. It is described in the *Journal of Gas Lighting* (London) as a mixture of saltpeter, chlorate of potash, and a solid hydrocarbon, for which latter constituent paraffin, asphaltum, or pitch may be chosen. The solid ingredients are powdered and intimately mixed; and the mixture is then treated with a liquid volatile hydrocarbon, such as benzine or gasoline, which dissolves the solid hydrocarbon and forms the whole into a plastic mass. The cake is then rolled into sheets, and hardened by allowing the liquid solvent to evaporate; the product being afterward broken up into grains of any desired size, like ordinary gunpowder. By this mode of dissolving the hydrocarbon before or after admixture with the salts, the grains become coated, after drying, with a waterproof coating of varnish. The process of manufacture is simple and free from danger, because in the event of the paste catching fire the volatile hydrocarbon will first burn away entirely, after which the powder will burn slowly and quietly. The new compound is therefore only an explosive when confined in a close space. It possesses the same density as gunpowder, and is very hard. It can be made twice as strong as the latter; but the intensity of the explosion can be regulated at will by varying the proportions of the ingredients and the size of the granules.

Hearing in Insects.

The sense of hearing in insects has been recently studied by Herr Gruber. He found the cockroach (*Blatta germanica*) very sensitive. On sounding a violin note when a cockroach was running across the floor, the creature always suddenly stopped. Again, a number of these cockroaches were inclosed in a glass vessel, and on making a strong sound there was evident agitation and excitement; some would fall down from the glass as if paralyzed. A cockroach was hung by a thread from its hind leg; when it was quiet a bow was drawn sharply over the violin strings at the distance of about four feet, whereupon the insect was greatly excited, and struggled round, getting its head uppermost.

Beetles also were readily affected by sounds, but grubs and ants gave no certain indications. Of aquatic insects various kinds of corixa were tried. These would often remain quite quiet for several minutes, but on tapping the glass with a glass tube they rushed about with much agitation. A disk at the end of a long rod drawn to and fro in the water near a quiet corixa produced no effect, but on conducting the sound of a struck bell into the liquid by the rod, there was lively reaction; similarly when a glass bell stroked with a bow was brought to touch the water. These creatures were also sensitive to high violin notes in air, to the sound of a metal plate struck with a hammer, etc.

Still more sensitive to sound were various aquatic beetles (laccophilus, laccobius, *Nepa cinerea*, etc). On the other hand various larvæ, especially of ephemerides, were unaffected; but these were sensitive to mechanical agitation of the water. Herr Gruber considers the response the insects make to sound an indication of true hearing, and not mere reflex action.—*English Mechanic.*

The Dismal Swamp.

The Dismal Swamp in Virginia is much reduced in extent compared to what it was twenty years ago. It now contains, says a recent visitor there, some of the best farming land in the State. A railroad runs across it, and it is on its way to final extinction. The drainage of Lake Drummond, a central body of water lying higher than the average level of the swamp, would make the whole area fertile. This is a project of Gov. Benjamin F. Butler, who once had surveys made, but at length abandoned it. The one great industry of the swamp is lumbering. It is penetrated by small ditches in connection with larger canals, and by rude tramroads, over which the logs are hauled to be sawed up into shingles, railroad ties and fencing. The lake, however, with its fringe of cypress and its projecting roots and stumps, is just as dismal as ever.

PASTE for labels is made by soaking glue in strong vinegar, then heating it to boiling and adding flour.