SCIENTIFIC AMERICAN

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A REMARKABLE MARINE DISASTER.

We give an engraving taken from a photograph showing the condition of the bow of the steamship Thingvalla, when the vessel had been hauled up on the dry dock at Halifax, N. S., after her remarkable collision with the steamer Geiser. The accident took place on the morning of Aug. 14 last, at sea off Sable Island. Both vessels belonged to the same line and were going in opposite directions on their respective routes between New York and Copenhagen.

The story of this collision is one of the most remarkable in ocean records. Both vessels were under full headway. The night had been dark and stormy, and it was raining occasionally, but there does not appear to have been any fog or an exceptionally heavy sea. Both steamers were in charge of their first officers, who were old and experienced seamen. On whom the blame rests, neither the officers nor the passengers on either vessel were able to state. Few passengers were on the decks of the steamers at the time of the collision.

When the steamers came in view of each other in the gray of the dawn, they were only a few ship's lengths apart, and the crash came in a few minutes. The iron prow of the Thingvalla struck the Geiser amidships on the starboard side, tearing its way half through the side of the unfortunate steamer. Passengers and crew of the ill-fated vessel who were roused by the shock and who escaped injury had not time to realize what had happened. Many who were sleeping on the side of the vessel which was struck were crushed in their berths as they slept, and carried dead and mangled to the bottom of the sea.

For a short time it seemed doubtful whether the Thingvalla had not been so badly injured that she would sink also. Captain Laub, of the Thingvalla, had an immediate examination made, and the boats were made ready to lower, while the passengers were kept in control. It was soon found that the forward bulkhead of the Thingvalla, though badly crushed and leaking, was not destroyed, and the others were all intact. While the forward bulkhead was being repaired, boats had already been lowered for the assistance of the few people who had escaped from the Geiser.

The ship's carpenters succeeded in bracing up the walls of the bulkhead, but the pressure against them was so great when the ship was moving as to make it exceedingly doubtful whether she could continue her voyage to New York, and in event of a severe storm her condition would be too critical to take any risk. Captain Laub decided to put in at once to Halifax, which was about 180 miles distant, when the Wieland, of the Hamburg line, was sighted, and signals of distress were given. The Wieland bore down upon them, and Captain Albers, her commander, offered to take off all the passengers of the Geiser and the Thingvalla.

They were transferred with difficulty, the sea being rough, and the Thingvalla then steamed stern first on to Halifax, while the Wieland proceeded to New York.

Second Officer Jorgensen, of the lost steamer Geiser, had a narrow and thrilling escape. In describing his experiences he said: "When the collision occurred, I was sound asleep. I was awakened by the frightful crash, and rolled out of my bunk just as the bow of the Thingvalla crashed its way through the walls of my stateroom, making an enormous hole and blocking the door so I couldn't get out. I grasped the Thingvalla's anchor chain, which was hanging over her bow just in front of me, and climbed up to her deck just as the Geiser gave one last lurch and went down out of sight, with her decks covered with shrieking, despairing people. I believe there were many others who failed to get out of the cabins at all, for less than seven minutes elapsed from the time the Geiser was struck until she sank. As near as I could judge from a hasty glance, the entire starboard side of the Geiser, from the stern to forward of the mizzenmast, was crushed in, while the Thingvalla's nose was ripped completely off, clear back to the first bulkhead."

The Geiser was a three-masted iron screw steamer, schooner rigged, with square sails on her foremast. She was built at Copenhagen in 1881, and was 1,993 net and 2,831 gross tons register. Her engines were 300 horse power, and she was constructed with six water-tight compartments. The vessel was owned by the Thingvalla Steamship Company, of Copenhagen. She carried a crew of sixty-seven all told. The vessel was fitted up to accommodate fifty saloon, forty-five second cabin, and 600 steerage passengers, and had recently had new saloon and second cabin fittings put into her, which were of the most handsome and newest description. On leaving this port she had a cargo of flour, beef, leather, lard, 42,066 bushels of corn, forty seven hogsheads of tobacco, and miscellaneous merchandise, valued in round figures at about $150,000. The steamer was valued at about $250,000, and was partially insured.

The Thingvalla is an iron three-masted screw steamer and measures 301 feet over all. She is 1,745 net and 2,524 gross tonnage and her engines are 300 horse power. She was built in Copenhagen in 1874, and is owned by the same company as the Geiser. She is commanded by Captain S. Laub. Both vessels are classed 100 A 1 in Lloyd's Registry in England.

The Thingvalla was repaired at Halifax at a cost of about $60,000, and arrived a few days ago at New York to take her place again on the line.

THE STEAMSHIP THINGVALLA, AFTER COLLISION AT SEA WITH THE STEAMER GEISER.

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(Illustrated articles are marked with an asterisk.)

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For the Week Ending November 24, 1888.

Price 10 cents. For sale by all newsdealers.

ANOTHER COLLISION BETWEEN OCEAN STEAMERS.

On the 10th inst., at noon, a collision took place near Sandy Hook, the entrance to New York harbor, between the large Cunard steamer Umbria, outward bound, and the Iberia, a smaller trading steamer, inward bound. The accident took place at noon, during a fog. The Umbria struck and completely cut off the stern part of the Iberia; but the latter continued to float for nearly thirty hours, and then sank. No effort appears to have been made to tow the wreck into port, although there was ample time to do so. No lives were lost. The blame is charged upon the Umbria, owing to her dangerous speed at the time—17 knots per hour.

Accidents of this kind are of frequent occurrence. They seem to emphasize the importance of adopting proper means for their prevention. These means exist, and their employment should be made compulsory by law, if owners will not voluntarily put them into use.

In our paper for Sept. 14, 1886, we gave illustrations of the steamer Florence, then as now engaged in navigation in this harbor. The boat is provided with the marine brake, a device consisting of a couple of extra rudders hinged so as to fold under the stern, but capable of instantaneous action, and opening by the mere pull of a trigger in the pilot house. These brakes have a most powerful effect. In the trials made by the government engineers, they certified that the boat when running at full speed was stopped in 22 seconds, and in a space of less than her length. When the engine was backed at the same time the brakes were sprung, the vessel was stopped within a distance of 35 feet, and made to move back, all within the time of 12 seconds.

In view of remarkable facts like this, it would seem to be manifestly to the public interest that thorough trials of these devices should be made on some of our war vessels. We hope the matter will receive attention when Congress meets, and that a suitable appropriation will be made. The subject is one of great importance. Hardly a collision can be named but might have been prevented had the apparatus been in use. A glance at the engraving on our present first page shows what every steamer is liable to, by collision, which ordinarily sends them to the bottom.

TORPEDO AND OTHER FAST SHIPS.

In the SCIENTIFIC AMERICAN of November 3 last we gave illustrations of the new American torpedo boat Vesuvius, which carries the novel pneumatic guns and discharges torpedoes loaded with nitro-glycerine. We learn that on a recent trial trip the Vesuvius attained a speed of 27 miles per hour. If this is so, our navy department is at last to be congratulated in soon possessing one vessel, small though it is, capable of steaming about as fast as any other in the world. A new torpedo boat, called the Empong, built in England, has lately been delivered to the Dutch government. 1,200 h. p. Speed on trial trip, 27½ miles per hour. Built by Yarrow & Co., and provided with Yarrow's water-tight ash pan arrangement, which may be briefly described as follows:

In torpedo boats, owing to their narrowness of beam in order to secure speed, it is essential that all the weights be kept as low as possible to insure stability, and for this reason the grate must of necessity be very close to the bottom of the hull; consequently a very small amount of water entering the stokehole, from damage through shot or accident, is enough to extinguish the fire, thus leaving the boat helpless. By the above system the entire fire box and furnace is inclosed, as it were, in a complete envelope or casing, the upper part of which extends well above the water line, and all the air required for combustion has to pass over the top edges of this casing before finding access to the furnace. It will be evident that, if the water gain access to the boiler compartment, and if the pumping arrangements fail, or are not sufficiently powerful to keep it under, it will rise inside the boat to the same level as the surrounding water, but in spite of this the air supply to the furnace will be free, and the fire can be maintained burning. It has been found by actual experiment that in such a contingency, and after the firemen have been driven out of the stokehole, the boat will maintain its steaming powers for a run of four hours, at an eleven knot speed, which might enable it either to reach a port or elude capture by the enemy.

Our new ships of war now in process of construction are being built, for the most part, after English plans and drawings, not of the most recent date. Their speed will be considerably less than some of the latest German and French vessels. This is to be regretted, as it is now generally admitted in naval circles that high speed, the highest attainable, is the first requisite for the modern man-of-war. The ship must be equal in speed to anything that can be brought against her, otherwise the adversary has a striking advantage.

As an example, take the armored turret cruiser Maine, the construction of which has been commenced at the Navy Yard in Brooklyn. This ship is to be of 6,650 tons, 310 ft. long, 57 ft. beam, 8,750 horse power, calculated speed 19½ miles per hour. How slow and old-fashioned this boat is likely to be will be understood in view of the fact that the Germans already have afloat such vessels as the armored cruiser Greif, 2,000 tons, 5,400 horse power, speed 23 knots, or almost 27 miles per hour.

Domestic Animals as Vehicles of Infection.

It is reported from Chicago that a by no means inconsiderable local outbreak of scarlatina has been brought about by a cat, which acted as the means of conveying the infection. It has long been known that almost anything which can serve as a vehicle for carrying the desquamating epithelium of scarlatina patients may act as an intermediary between sick and healthy; and although recent study of the specific fevers tends to show that the period in which these diseases are most likely to be communicated is the acute stage rather than that of convalescence, it must be admitted that some of these diseases can be conveyed by such methods as the reception and subsequent discharge of infectious material from the coat of a cat nursed by patients. But that anything like an outbreak of scarlatina should be directly brought about by such a cause is contrary to experience, which goes to show that this disease is not often communicated from one person to another through the agency of a third party who is free from the disease; and it is far more probable that any extension of scarlatina in the case referred to was due to infection contracted directly from the first person to whom the disease was conveyed. But our main object in referring to the incident is to draw attention to the fact that the domestic animals do constitute a distinct danger to man, in so far as some of the specific infectious fevers are concerned. As yet we know nothing about any disease in the cat which can lead to scarlatina in the human subject. But it is probably highly different as regards diphtheria, for a number of instances have been placed on record in which, while diphtheria has been prevalent in the human subject, a similar if not the same disease has been ascertained to exist among cats, and it is certain that in some prevalences there has been close association between the human sick and the affected animals.

We are at present only just on the borderland of a wide subject—namely, that of the relationship of diseases of the lower animals to diseases in man; and we may possibly learn hereafter that, apart from the origin of infective diseases in the lower animals, the latter may serve as media for communicating infections to an extent as yet not understood. Certain it is that the manner in which dogs, cats, and other domestic animals are at times fondled by those to whom they belong, and to whom they become attached, is not free from risk.—*Lancet.*

The New War Ship Maine.

At the Navy Yard, Brooklyn, N. Y., work has been commenced on the construction of the twin-screw armored turret cruiser Maine, and immense amounts of material and plant have been delivered. This vessel, the largest ever built at the Brooklyn yard, will be of 6 650 tons, and in general appearance will resemble the Brazilian cruiser Riachuelo, but will be larger and more fully equipped. The ship was designed by Commodore T. D. Wilson, Chief of the Bureau of Construction and Repair, and his plans were accepted after considerable discussion and investigation. The Maine will be 310 ft. long between perpendiculars, 57 ft. beam, 21½ ft. draught, built of steel, with cast steel stem, stern, post and rudder frame. There will be 174 water-tight compartments, and even should the extremities above the under-water steel protective deck be shot through and through, the remaining buoyancy would be sufficient to insure floating and fighting capability. The armor belt will be 11 in. thick. The main battery will consist of four 10 in. guns, throwing 500 lb. projectiles, mounted in pairs, in turrets 10½ in. thick, also six 6 in. rifled guns. The guns can be fired directly ahead and astern, and the latest appliances for handling them will be fitted. The secondary battery consists of twenty-one Hotchkiss rapid-firing and revolving guns and four Gatling guns, grouped to secure a heavy concentrated fire. There are also to be four torpedo launching tubes above water and three below, but the type of torpedo is not yet determined upon. The engines will be of 8,750 horse power, capable of driving her at seventeen knots an hour, and she will have great coal-carrying capacity. She will be bark-rigged, with armored tops, and will carry a complement of 30 officers and 444 men.

Naval Volunteer Defense.

A public meeting was lately held at Brighton, presided over by the mayor, in support of the Naval Volunteer Defense Association. Earl Cowper, as president of the association, gave an address, in which he explained its objects in detail. He said it was started three years ago, when there were grave fears of the possibility of a war with Russia, and their object was to organize and encourage local volunteer efforts in the defense of the coasts. If in the time of war privateering were to be again introduced, the consequence would be most serious. The best means of defense was to have quick-firing guns on fast steamers.

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The United States vs. the American Bell Telephone Company.

AN IMPORTANT DECISION BY THE SUPREME COURT.

When the present administration came into office in 1885, among the eminent men whom President Cleveland selected for his cabinet was the Hon. Augustus H. Garland, of Arkansas, who was appointed Attorney-General, and he still exercises the high functions of presiding officer over the Department of Justice.

A few weeks after the new minister had taken his seat, it was announced that under the authority of the Department of Justice a suit had been instituted by the United States government against the American Bell Telephone Company, to recall, repeal, and annul Bell's telephone patent 174,465, granted March 7, 1876, on the ground, among other things, of fraud in the issue of the patent.

It was then also made public that the Hon. Mr. Garland, the Minister of Justice, was interested to the extent of one million dollars as proprietor in the stock of the Pan-Electric Telephone Company, the instruments used and belonging to the company being the patented inventions of J. Harris Rogers, granted in 1881. These instruments were claimed by the Bell people to be infringements on the Bell patent, and the Bell company had at this time brought suits and sought to obtain an injunction to prevent the further use of the instruments. In one of these suits one of the reasons alleged by the defendants why the injunction ought not to be granted was that the United States government had begun a suit to annul the Bell patent. Nevertheless, the circuit court granted the injunction.

The same lawyers that acted for the Pan-Electric Telephone Company, in which Attorney-General Garland was so heavily interested, were by his authority to act for and on behalf of the United States government in prosecuting the suit against the Bell Telephone Company, and since that time this fight against the Bell company has been carried on at the expense of the United States, the Pan-Electric lawyers being paid out of the treasury of the United States.

Such in brief is a sketch of the origin and pushing of the suit in which the United States government stands as the plaintiff and the American Bell Telephone Company is the defendant.

After sundry legal delaying dodges on the part of the Bell company the case was brought to a hearing in the United States Circuit Court in Massachusetts, before Judges Colt and Nelson. The main charge presented on the part of the government was that Bell's patent was procured by fraud and that Bell was not the first inventor of the telephone.

The Bell company, through its attorneys, waiving for the time any answer to the allegations made in the government's bill in equity, filed a demurrer, in which they asserted that the United States had no right, in the absence of a specific statute granting that power, to bring a suit to cancel a patent for an invention. They declared that such a suit could only be brought by a private party, and not by the government. The Circuit Court sustained the Bell company's demurrer, and refused to entertain the government's bill. From that decision the United States took an appeal to the Supreme Court, which, on November 12, 1888, through Justice Miller, reversed the decision of the lower court in a long and elaborate opinion, from which we make the following extracts:

After a review of the case, the opinion says that the defendant demurs generally to the whole bill, and in that demurrer objects to specific portions of the bill, and it may be very doubtful whether these are not so mixed up in the same pleading as to make the demurrer void so far as it relates to such parts of it. As the main questions in the demurrer, however, relate to matters which go to the merits of the whole bill, they are probably all that it is necessary to consider here. The court then takes up the three grounds of demurrer. The first ground, the question of multifariousness, the court does not think needs much consideration.

The court, then, skipping for the time being the second ground, takes up the third ground of demurrer, which is that the bill does not set forth any fraud in the procuring of said patents. On this point the court says that the bill alleges that Bell knew at the time of filing his application for the patent of March 7, 1876, that he was not the first inventor, as the law required he should be; that the statements made by Bell in his application constituted deception and fraud upon the government, and did deceive complainant and cause complainant to deliver the patent to Bell, which would not otherwise have been done; that in his application Bell misled the Patent Office by a statement that his invention was for "an improvement in telegraphy," and especially for a patent for a method of "multiple telegraphy," and that he carefully and intentionally refrained from any expression which would lead to the idea that his invention was to be used as a telephone or was capable of such use. The bill also described certain discoveries which anticipated Bell's patent, and which it is declared rendered it void, and further states that he practiced fraud upon various named persons.

The court is of opinion that if Bell was aware at the time he procured his patents that the same matter had been previously discovered and put into operation by other persons, he was guilty of such a fraud upon the public that the monopoly which these patents grant to him ought to be revoked and annulled. The fraud alleged, it says, is precisely the fraud which would be committed in a case of the kind set forth. It is the fraud of obtaining a patent for an invention of which the party knew he was not the original inventor. This priority of invention is absolutely necessary to the right to have such a patent granted, and can in no case be dispensed with.

There can be no question that if the bill be taken as true, there is enough in it to establish the fraud in the procurement of the patent and to justify its cancellation if the court has jurisdiction to do so.

The court then proceeds to take up the most important feature of the demurrer, the second ground, which alleges that the bill does not show any power or authority, and that no power or authority in law exists, in any person or party or any court, to bring or entertain the suit.

It will be observed, says the court, that this broad assertion admits that a party may practice an intentional fraud upon the officers of the government who are authorized and whose duty it is to decide upon his right to a patent, and that he may by means of that fraud perpetrate a grievous wrong upon the general public, upon the United States, and upon its representatives. It admits that by prostituting the forms of law to his service he may obtain an instrument bearing the authority of the government of the United States entitling him to a monopoly in the use of an invention which he never originated or a discover which was made by others, and which, however generally useful or even necessary it may become, is under his absolute and exclusive control, either as to the use it may be put to or as to the price he may charge for it during the life of the grant.

It assumes that the government, which has thus been imposed upon and deceived, is utterly helpless, and that it can take no steps to correct the evil or to redress the fraud. If such a fraud were practiced upon an individual, he would have a remedy in any court having jurisdiction to correct frauds and mistakes and to relieve against accident, but it is said that the government of the United States—the representative of sixty millions of people, acting for them, on their behalf, and under their authority—can have no remedy against a fraud which affects them all and whose influence may be unlimited.

It would be a strange anomaly in a government organized upon a system which rigidly separates the executive, legislative, and judicial branches to hold that in that department there should be no remedy for such a wrong. In the case of land patents this court has repeatedly held that the circuit courts of the United States have jurisdiction to set aside land patents for fraud. These cases establish the right of the United States to bring suits in its own courts to be relieved against fraud committed in cases of a class exactly similar to that charged in the present case. It is also to be observed that in those cases there is no express act of Congress authorizing such procedure. Furthermore, there is a striking similarity in the language of the Constitution relating to patents for invention and for land. The powers, therefore, though exercised by different officers, are of the same nature, character, and validity.

The court then proceeds to a consideration of the objection raised by the Bell company that such a proceeding as the present one must be brought in a common law court and not in a court of equity. The elaborate argument of the counsel for Bell to show that the English course of procedure, upon which our judicial system is based, required that the case should be brought in a common law court is reviewed, and issue is taken with the conclusion reached by the Bell company's lawyers. The course of English jurisprudence, however, the court says, can have little force in limiting or restricting the measures of the government of the United States. There is in this country no king. No man possesses a prerogative right, and patents do not proceed from the President, but from the United States. The seal by which patents are made valid is that of the Patent Office, as authorized by Congress, and is not that of the President. The granting of a patent is a quasi-judicial proceeding, not subject to be repealed by the President, the Secretary of the Interior, or the Commissioner of Patents when once issued. If an application for a patent is denied by the Commissioner of Patents, the case may be taken to the Supreme Court of the District of Columbia by authority of a statute of Congress, and the court has authority to compel the issuance of a patent. The United States, in the present case, is under an obligation to protect the public from the monopoly secured under a patent alleged to have been procured by fraud.

The United States by issuing the patents to the Bell company sought to be annulled has taken from the public rights of immense value and bestowed them upon the patentee. The government and its officers, acting as the agents of the people, have taken from them valuable privileges and conferred them upon the patentee. These privileges constitute a property so large that nobody has been able to estimate its value. In argument it has been stated at $25,000,000. This property has been taken from the public and conferred upon the patentees by one of the departments of the government under the forms of law, but it is charged to have been done because the officers of the government were deceived and misled by the patentee. That the government, authorized both by the Constitution and the statutes to bring suits at law and in equity, should find it its duty to correct this evil, to recall these patents, and to give a remedy for this fraud is so clear as to need no argument, and the proper remedy, it seems to the court, is the one adopted by the government in this case.

In conclusion, the court says: We think the doctrine that the United States is not entitled to obtain the cancellation of an instrument obtained from it by fraud—an instrument which affects the whole public, whose protection from such a fraud is eminently the duty of the United States—is not sound. The decree of the circuit court of Massachusetts dismissing the government's bill is, therefore, reversed and the cause remanded to that court with directions to overrule the demurrer, with leave to the defendants to plead or answer, or both, within a reasonable time to be fixed by that court. Opinion by Justice Miller.

There was a large crowd present in the court room in anticipation of the decision in this case. A great deal of interest has attached to the case, and both sides have been represented by an able array of counsel, Judge Thurman, Solicitor-General Jenks, and Jeff Chandler being among the attorneys representing the government, while Messrs. Storrow and Dickerson, who have represented the Bell company in all its litigation for years, appeared in behalf of the telephone company.

The stock of the American Bell Telephone Co. fell several points on the market as soon as the result of the decision was made known. It is claimed by the Bell people that all the evidence which it is possible for the government to produce against the Bell patents has been already heard by the Supreme Court and decided to be of no value; such, for example, as the prior invention of the telephone by Reis, Gray, Holcom, Meucci, Drawbaugh, and others. This may be true, and yet it by no means follows that the court may not reach a different conclusion if a new, more clear, and better presentation of the evidence can be had. The Bell folks were sure of a favorable decision in the present case; but instead thereof met with an ignominious defeat.

There is, moreover, one item of new evidence which is likely to be brought forward as bearing on the subject. We allude to the patent granted to Royal E. House, May 12, 1868, for a phonetic telegraph nearly eight years prior to Bell's patent. These devices are constructed upon the same principle; in both of them the famous "undulatory current" is found, and even the form of apparatus employed by the respective inventors is very nearly the same. If we throw aside the earlier Reis telephone, then House was the prior inventor of the device shown by Bell, and was entitled to the broad claim granted March 7, 1876, to Bell, namely:

"The method of, and apparatus for, transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations, similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth."

House's prior instrument is capable of vocal transmission just as described in Bell's above claim; and if this is so, it necessarily follows, the issue of said claim to Bell was illegal, and therefore must be held to be void.

Patent Law in America.

At a recent meeting of the Inventors' Institute, London, the chairman, Admiral Selwyn, stated that the American government prosecuted and punished men who infringed patents, and the inventor was put to no expense in the matter. The admiral is sadly mistaken, as our inventors know by sad experience. In this country the inventor is obliged to prosecute infringers at his own expense, and the way the prominent patent lawyers pile their charges upon him is frightful. Patent law business in this country is a most profitable branch of the legal profession. Every patent lawyer of any note is rich and enjoys a large income.

IN Philadelphia the Bell Telephone Company is building a conduit three feet wide through the main streets and avenues of the city, which will contain fifty 3 inch iron pipes and fifty wooden tubes laid in cement, with a capacity of 100 wires each, a total of 10,000 wires. Connection will be made with each block by a branch running from a main conduit to the middle of the block, and in nearly all the blocks there are small streets and alleys in which the distributing poles can be conveniently erected, leaving the main streets entirely free from wires.

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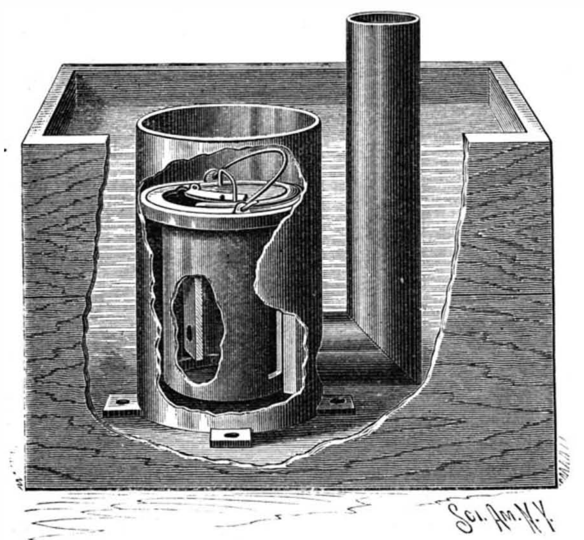
AN IMPROVED WATER HEATER.

A heater to be set in a trough or tank holding water, to heat the water to any desired degree, as drink for stock, or for tempering milk, etc., as required about a farm or house, is illustrated herewith, and has been patented by Mr. Herbert E. Harrington, of

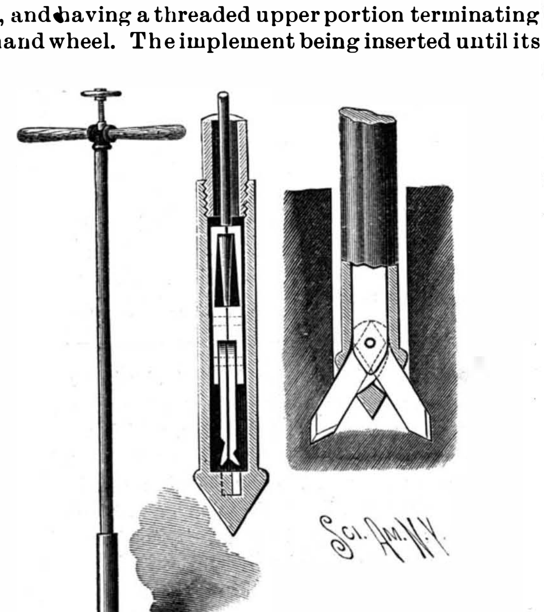


HARRINGTON'S WATER HEATER.

Walden, Vt. It is made with an outer shell or wall, from which leads a smoke flue, a readily removable covered fire box being placed within the outer shell, and its draught flue connected with the outer one, the whole to be placed in a trough or tank containing water. The outer shell is preferably fastened to the bottom of the trough, and the fire box is supported therein so as to leave a clear space between it and the sides and bottom of the shell. In one side of the fire box is a vertical partition forming an air flue, with an opening at the bottom and one higher up into the fuel chamber, with means for carefully regulating the draught, the cover of the fire box being made in two parts, a main part fitting the top of the fuel chamber, and a smaller segmental portion forming the lid of the air flue. The shell has on its inside a radial, or nearly radial, vertically ranging narrow plate, and a vertically ranging plate is fixed to the outside of the fire box, the arrangement being such that by turning the box the draught circuit may be regulated through the heater to the outer flue, the hot products of the fuel chamber being thus carried against the entire inner wall of the shell, to warm and heat the water in the trough. The fire box has a suitable bail by which it may be readily lifted from the outer shell, for regulating the temperature of the water or for recharging the fuel chamber at a place distant from the trough.

AN IMPROVED ROCK DRILL.

A drill especially designed for reaming out or enlarging drill holes at the base, so as to form a chamber or pocket for the charge, is illustrated herewith, and has been patented by Mr. Daniel Kilpatrick, of Morning Sun, Iowa. The point of the implement consists of a cylinder with a central square recess having a circular screw-threaded portion at its upper end, while from its base are outward and downwardly curving grooves. In this recess is a piston or drill holder, square in cross section, made of two spring steel plates, between the lower ends of which are pivoted the drills proper, as shown in the two sectional views, while the upper ends of the plates are offset, or bent inward, and formed with a round aperture and recess adapted to receive the enlarged pointed head of the lower end of the feed rod. The shank of the implement may be made of gas pipe, with a T-shaped steel top piece, to which is fitted wooden handles, the feed rod extending through a central threaded aperture of the top piece, and having a threaded upper portion terminating in a hand wheel. The implement being inserted until its point rests at the base of a drill hole, the hand wheel of the feed rod is turned to advance the drills downwardly and outwardly, while the implement is revolved by means of the handles fixed in the top piece, to enlarge the base of the hole.



KILPATRICK'S ROCK DRILLING IMPLEMENT.

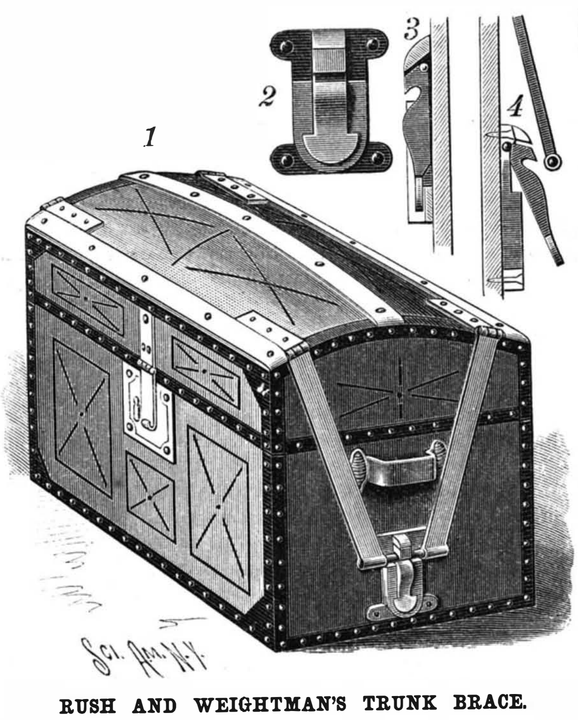
The London Hydraulic Power Company.

Water power for driving lathes, sewing machines, printing presses, elevators, electric light machines, etc., is supplied by the above company with much success.

The demand upon the mains of this company is continually increasing. The company has only been established five years, and already it has been found necessary to build a second pumping station at Millbank Street, Westminster, in addition to the central one at Falcon Wharf, Blackfriars. The number of consumers is 780, and the weekly consumption of water over 3,000,000 gallons. Nearly thirty miles of hydraulic mains are at present laid in London, embracing nearly the whole of the City and Southwark, and extending westward to Victoria Station, Westminster, Pall Mall, and Piccadilly. The power is available day and night and on Sunday, all the year round, at a pressure of 700 lb. per square inch.

AN IMPROVED TRUNK BRACE.

A simple and effective device for strengthening traveling trunks, that they may better withstand rough handling, has been patented by Messrs. George W. Rush and Joseph J. Weightman, and is illustrated herewith. A metal loop, consisting of two flat members, is hinged on top at each end, the members extending diagonally downward toward each other on either side of the trunk handle. These members are united at their lower ends by a transverse bar adapted to be engaged with a fastening device, shown in the small figures, having a locking lever which may be swung upward for disengagement of the loop, as shown in Fig. 4, while by engaging the loop with the notch



RUSH AND WEIGHTMAN'S TRUNK BRACE.

in the lever, and pressing the latter down into a central opening and depression in the body of the device, the loop is firmly held in tension against the end of the trunk. This brace may also be applied at the front as well as the ends of the trunk, and may also be made of wire, in the shape of a parallelogram or other form.

For further information relative to this invention address Messrs. G. W. Rush & Co., Bridgeton, N. J.

Rules for Fat People and for Lean.

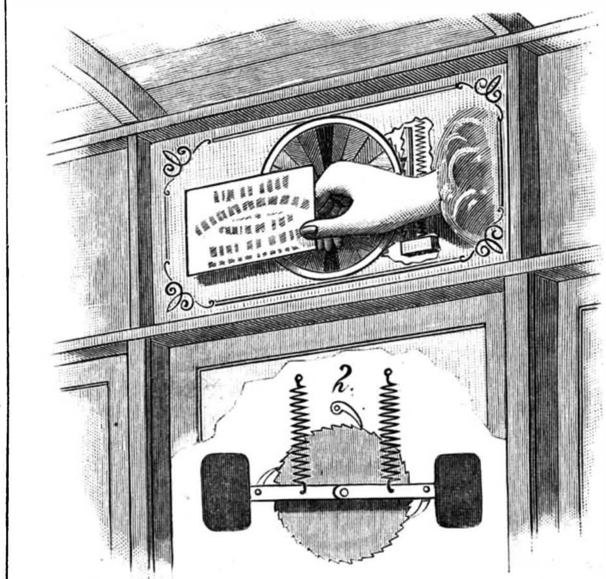
To increase the weight: Eat, to the extent of satisfying a natural appetite, of fat meats, butter, cream, milk, cocoa, chocolate, bread, potatoes, peas, parsnips, carrots, beets, farinaceous foods, as Indian corn, rice, tapioca, sago, corn starch, pastry, custards, oatmeal, sugar, sweet wines, and ale. Avoid acids. Exercise as little as possible; sleep all you can, and don't worry or fret.

To reduce the weight: Eat, to the extent of satisfying a natural appetite, of lean meat, poultry, game, eggs, milk moderately, green vegetables, turnips, succulent fruits, tea or coffee. Drink lime juice, lemonade, and acid drinks. Avoid fat, butter, cream, sugar, pastry, rice, sago, tapioca, corn starch, potatoes, carrots, beets, parsnips, and sweet wines. Exercise freely.—*Kansas City Medical Index.*

THE large stones at the base of the Gate City National Bank building are smooth and soft, and make excellent whetstones. This fact has become known to a great many citizens and small boys, and it is no uncommon sight to see a half dozen persons standing near the building sharpening their knives. Whenever two men stop at the bank corner to hold a conversation, out come their knives, and the sharpening goes on as long as the talk lasts.—*Atlanta Journal.*

AN IMPROVED ADVERTISING DEVICE.

A novelty in the advertising line has been patented by Ed. C. Magnus, 244 and 246 East Randolph Street, Chicago, Ill., and is illustrated herewith. It provides for utilizing the jolting or trembling of public conveyances, such as cars, stages, etc., for giving motion to



MAGNUS' AUTOMATIC ADVERTISING DEVICE.

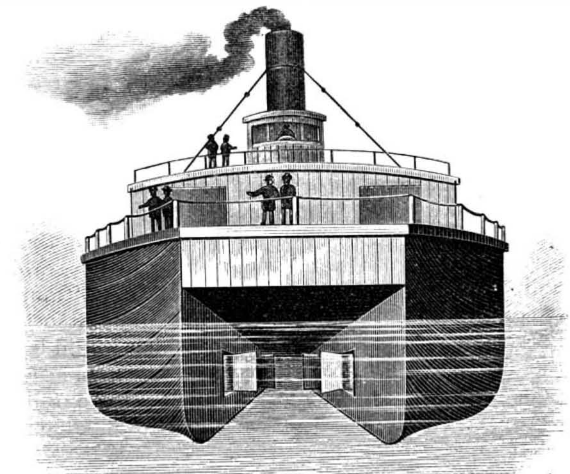
advertisements. The motion is obtained from spring-supported weights, the vibrations of which are utilized in such a way as to produce a great variety of effects. The motor consists of one or more weights attached to arms or levers, the latter being suspended from very elastic springs. A disk or ratchet wheel is actuated upon by pawls attached to the arms, but prevented from retrograding by a fixed pawl. The arms vibrating, the disk will consequently revolve. The illustration shows one way of employing the motive power thus obtained, the hand holding a card being made to alternately appear and recede through a slit, for example, which is effected by a crank pin engaging in one of two parallel swinging arms from which the hand is suspended. A great variety of other arrangements is possible; for instance, colored disks or geometrical figures can be made to rotate, or endless bands of fabric made to move along openings, displaying more advertising matter than would, under ordinary circumstances, occupy the allotted space, and pictures of any description can be thus exhibited.

Discriminating State Legislation.

The Supreme Court of New Hampshire lately held, in the case of the State vs. Wiggin, that a statute fixing the price of licenses for the sale of lightning rods at $100 to citizens of the State and $500 to citizens of other States created a discrimination prohibited by article 4, section 2, of the Constitution of the United States, which provides that the citizens of each State shall be entitled to all privileges and immunities of citizens in the several States.

AN IMPROVED PADDLE WHEEL.

Horizontal paddle wheels, adapted to vessels of shallow draught, or with variable load lines, have been patented by Mr. Richard Kirsch, of No. 7 Wall Street, New York, and are herewith illustrated as applied to a double-hulled vessel. The wheels have fixed blades radiating from a central drum and power shaft, and are submerged. Recesses in the hulls isolate the major portion of the wheels, while a minor portion of the drums with a corresponding number of blades project into the open water. The two straight sides of the hulls inclose a waterway undisturbed by the wave of progression which follows the curved outsides of the hulls, and the wheels operate in undisturbed water. The drums of the wheels are made to project sufficiently to compensate for the slip of the wheels, so that, by narrowing the channel where the slip occurs, the normal water level may be maintained throughout the channel.



KIRSCH'S HORIZONTAL PADDLE WHEEL.

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SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

As a means of illustration, nothing can excel projection by means of a good optical lantern. Not only can pictures and diagrams be shown clearly to a large assemblage, but apparatus of various kinds may be projected on a mammoth scale, many chemical actions may be exhibited, the phenomena of light, heat, electricity, and magnetism may be shown in various ways. In fact, there is scarcely a branch of physics that may not be illustrated in this way. The lantern is becoming deservedly popular in colleges and schools and for private use. Besides being of great use for general instruction, it affords a means of rational amusement and entertainment.

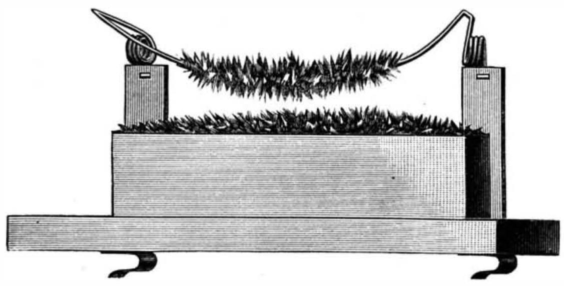

Fig. 1.—ARAGO EXPERIMENT.

A poor lantern, like any other inferior piece of apparatus, is undesirable. An instrument for scientific work should have a triple condenser, a rectilinear objective, a swinging front for the vertical attachment, a calcium or electric light, polariscopic and microscopic attachments, an erecting prism, and an alum or water tank. Such an instrument may now be purchased for a reasonable price, so that there is no economy in making one's own instrument. It will, however, be found advantageous to make the attachments.

A simple way of illustrating Arago's experiment showing the magnetizing effect of an electric current on soft iron, is represented in Fig. 1. The lantern to which this and other pieces of apparatus are adapted is provided with two rods projecting from the front of the instrument and connected with binding posts, which in turn are connected with a battery or dynamo. The base of this apparatus is furnished with spring clips for engaging the conducting rods of the lantern. To the upper ends of two posts rising from the base are attached the extremities of a copper wire, which is bent into spirals at its fixed ends. The wire is bent twice at right angles, and is curved downwardly between the arms extending from the spirals. The ends of this wire are connected with the clips. On the base below the curved part of the wire is placed a box well filled with iron filings. The box and the wire are projected on the screen, an erecting prism being used. The wire is pressed downward into the filings and withdrawn before the current passes, to show that the wire, uninfluenced by the current, is not able to lift the filings. The current is sent through the wire, when it is again dipped into the filings. This time it will take up a quantity of the filings, as shown in the engraving, each fragment of iron becoming a magnet, which tends to place itself at right angles to the current. When the current is interrupted, the filings fall.

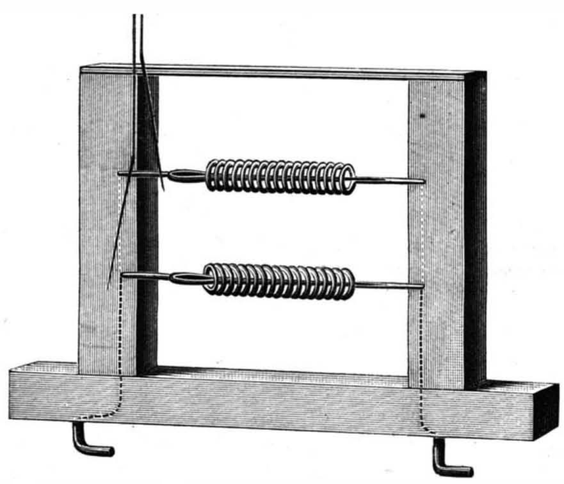

Fig. 2.—MAGNETIZATION BY MEANS OF SPIRALS.

In Fig. 2 is represented a device for showing the magnetizing effect of a helix, also the different results secured by helices wound in opposite directions. The frame is provided with metal clips for attachment to the rods of the lantern, and two helices, which are oppositely wound with respect to each other, are stretched across the frame.

The ends of the helices are connected with the clips, so that the current passes from one clip through both helices, as indicated by dotted lines, to the other clip. The helices are provided with a coating of insulating varnish. A darning needle is placed in each helix, and when no current is passing, a magnetized cambric needle, suspended by a fine thread, is held near the ends of the needles in alternation. It is drawn toward both alike.

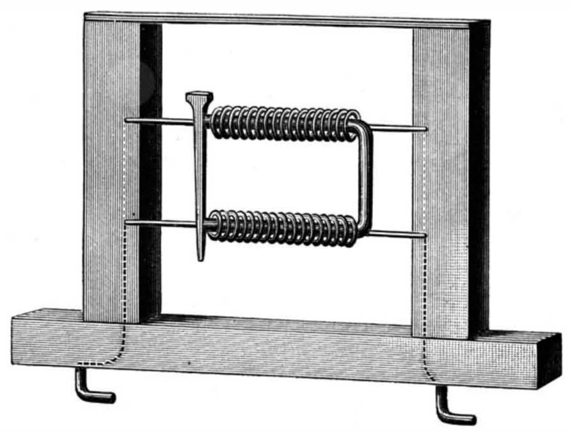

Fig. 3.—STURGEON'S MAGNET.

After a current has been sent through the helices it will be found that the darning needles are magnetic, but, owing to the opposite winding of the helices, corresponding ends will have opposite polarity, as will be shown by again presenting the suspended cambric needle to the ends of the darning needles. It will be attracted by one and repelled by the other. By placing a U-shaped piece of soft iron wire in the helices, as shown in Fig. 3, the construction of the first electro-magnet (Sturgeon's) is clearly illustrated. In Fig. 4 is shown a device for projecting the incandescent lamp. It is suspended from two conductors, and its image is thrown upon the screen with a dull light which is just sufficient to clearly show the outline of the lamp and the black carbon filament. A current is then sent through the lamp, when the filament becomes incandescent and shows as a brilliant arch on the screen, while all of the parts of the lamp are distinctly visible.

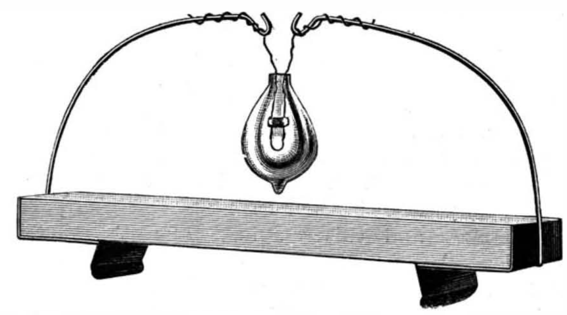

Fig. 4.—INCANDESCENT LAMP ARRANGED FOR PROJECTION.

In Fig. 5 is shown a method of projecting the electric arc which has the advantage of showing the carbons before the arc is formed, and also of rendering them visible during the experiment. The lamp consists of two wire carbon holders attached to a wooden standard and connected with the rods of the lantern, as in the cases before described. The carbons are projected with a dim light, showing the crater of the positive carbon and the point of the negative carbon. Then the current is turned on, the carbons are brought into contact and separated, forming the arc, the points soon become incandescent, and the arc light, in full operation, is seen on a large scale on the screen.

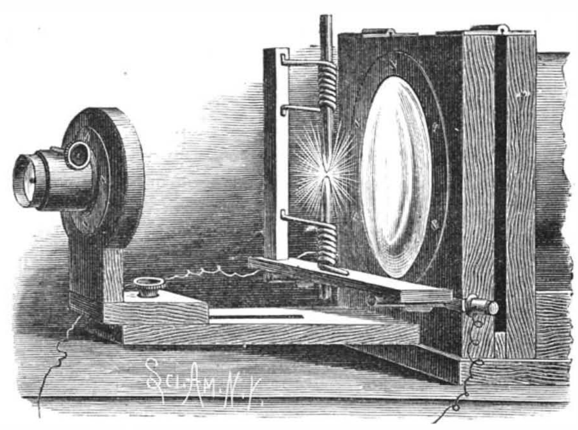

Fig. 5.—PROJECTION OF THE ARC.

These experiments are very striking when seen upon a large screen, the projection of the arc and incandescent lights being particularly interesting.

Our First Imported Locomotive.

In our sketch, in September last, of the venerable octogenarian, Eli Cooper, engineer on the first railway train from Boston to Lowell, it was inadvertently stated that the locomotive, the Stephenson, brought from England in 1834, was the first locomotive imported. The Stourbridge Lion, which is reported as having made but one trip, had, however, the precedence of the Stephenson by some five years. It was built at Stourbridge, England, and imported by the Delaware & Hudson Canal Company. Horatio Allen, of Orange, N. J., then chief engineer of that company, thus speaks of the trial trip, in a note under date of January 18 last, addressed to Mr. J. E. Watkins, Curator of the National Museum, Smithsonian Institution:

"The locomotive known as the Stourbridge Lion was the first locomotive run on this continent. The occurrence took place at Honesdale, Pa., August 9, 1829, on the mine railroad of the Delaware & Hudson Canal Company. The locomotive was one of three built for that company in England, in 1828, under my direction as to plans, which were received in the city of New York early in the year 1829. Through circumstances not necessary to state, I ran the locomotive myself—a responsibility I had never undertaken before and have never repeated since. Thus on this first movement by steam on railroads on this continent I was engineer, fireman, brakeman, conductor, and passenger."

EXPLOSION OF A PETROLEUM STEAMER AT CALAIS, FRANCE.

On October 16, a few minutes after nine o'clock in the evening, the usually quiet seaport of Calais was startled by a tremendous explosion. The inhabitants were terribly startled, the shock to the houses being terrific, and many people took to the streets, believing that an earthquake had occurred, windows being broken in all directions, and the gas being suddenly extinguished. It was soon ascertained that the explosion had taken place on board the Ville de Calais, a new vessel of some thousand tons register, which had been built for carrying petroleum between Calais

EXPLOSION OF A PETROLEUM STEAMER AT CALAIS, FRANCE.

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and New York, from which place she had lately arrived. For this purpose she had been fitted with various tanks and tubes. She had completed the discharge of her cargo the previous day, and at the time of the explosion water was being pumped into her ballast tanks. It is supposed that the disaster was caused by one of the engineers taking a naked light into the hold in order to examine these tanks, thus igniting the gas which had generated from the petroleum. The wreck of the vessel, the *Times* correspondent states, presented a remarkable appearance. The crew numbered twenty-six hands, but at the time only ten persons were on board. The captain, with his wife and another lady, were in their cabin in the after part of the steamer, and this remained almost intact, as though nothing had happened—the captain never imagining that the accident was so serious until he came on deck. The rest of the ship, with the exception of a small part of the forecastle, was blown into the air, and scattered in all directions, while the sides of the vessel were blown clean away. Some heavy pieces of machinery were hurled three-quarters of a mile or more. Almost simultaneously with the explosion, a huge cloud of black smoke and debris rose into the air, and burst into a column of flame of great height—the hull becoming a mass of flame, which was not extinguished until the next morning. Three persons lost their lives, one of the engineers, one of the ship's officers, and a seaman. Considering that the dock was full of timber-laden shipping, and that the quays were laden with logs, it is marvelous that the disaster was not far greater. Our illustration is from a sketch forwarded by Mr. Frank Merridew, of the British and Foreign Library, Boulogne.—*The Graphic.*

Type Writer Ribbons.

BY ISIDOR FURST.

The ever recurring query as to reinking type writer ribbons has been kindly referred to me by the editors of this journal.

In treating of this question the second time, I shall endeavor to put whatever knowledge I possess regarding it into such form as will enable any person of average skill to make an ink suitable for any particular style of ribbon and apply it. I mean to illustrate the principles involved and how to meet the various requirements. My reason for doing this, rather than to give a specific formula to be followed in every instance, is that often an experimenter has already produced an ink which lacks only some correction to make it entirely suitable; for "there are many ways leading to Rome." Besides, an ink which may have been suitable at one time may fail at another, because used under different conditions, and once a person knows how to correct a defect, the ink may be made to answer all purposes.

The constituents of an ink for type writer ribbons may be broadly divided into four elements: 1, the pigment; 2, the vehicle; 3, the corrigent; 4, the solvent. The elements will differ with the kind of ink desired, whether permanent or copying.

Permanent (*Record*) *Ink.*—Any finely divided, non-fading color may be used as the pigment, vaseline is the best vehicle, and wax the corrigent. In order to make the ribbon last a long time with one inking, as much pigment as feasible should be used. Suppose we wish to make black record ink. Take some vaseline, melt it on a slow fire or water bath, and incorporate by constant stirring as much lampblack as it will take up without becoming granular. Take from the fire and allow it to cool. The ink is now practically finished, except, if not entirely suitable on trial, it may be improved by adding the corrigent wax in small quantity. The ribbon should be charged with a very thin, evenly divided amount of ink. Hence the necessity of a solvent, in this instance a mixture of equal parts of petroleum benzine and rectified spirit of turpentine. In this mixture dissolve a sufficient amount of the solid ink by vigorous agitation to make a thin paint. Try your ink on one extremity of the ribbon; if too soft, add a little wax to make it harder; if too pale, add more coloring matter; if too hard, add more vaseline. If carefully applied to the ribbon, and the excess brushed off, the result will be satisfactory.

On the same principle, other colors may be made into ink; but for delicate colors, albolene and bleached wax should be the vehicle and corrigent, respectively.

The various printing inks may be used if properly corrected. They require the addition of vaseline to make them non-drying on the ribbon, and of some wax if found too soft. Where printing inks are available, they will be found to give excellent results if thus modified, as the pigment is well milled and finely divided. Even black cosmetic may be made to answer, by the addition of some lampblack to the solution in the mixture of benzine and turpentine.

After thus having explained the principles underlying the manufacture of permanent inks, I can pass more rapidly over the subject of copying inks, which is governed by the same general rules. Personally I am not in favor of the use of copying ink: first, because the print is liable to fade, smear, and become invisible; second, because it is unsuitable for legal and other documents of value; third, because it is easier to write two or more copies at one operation with manifold (carbon) paper than to make a second press copy after the writing is done.

For copying inks, aniline colors form the pigment; a mixture of about three parts of water and one part of glycerine, the vehicle; transparent soap (about one-fourth part), the corrigent; stronger alcohol (U. S. P.) (about six parts), the solvent. The desired aniline color will easily dissolve in the hot vehicle, soap will give the ink the necessary body and counteract the hygroscopic tendency of the glycerine, and in the stronger alcohol the ink will readily dissolve so that it can be applied in a finely divided state to the ribbon, where the evaporation of the alcohol will leave it in a thin film. There is little more to add. After your ink is made and tried —if too soft, add a little more soap; if too hard, a little more glycerine; if too pale, a little more pigment. Probably printer's *copying* ink can be utilized here likewise, because every one now has the means to modify and correct it to make it answer the purpose. I have not tried it, because I am opposed to copying inks.

Users of the type writer should so set a fresh ribbon as to start at the edge nearest the operator, allowing it to run back and forth with the same adjustment until exhausted along that strip; then shift the ribbon forward the width of one letter, running until exhausted, and so on. Finally, when the whole ribbon is exhausted, the color will have been equably used up, and on reinking, the work will appear even in color, while it will look patchy if some of the old ink has been left here and there, and fresh ink applied over it.

According to the directions here given, I have done nearly all the reinking of my ribbons for more than seven years, and I am sure, if the reader should fail, it will be due to inattention on his part to some of the principles laid down.—*American Druggist.*

The White Ant of the Bahamas.

Charles J. Maynard, Newtonville, Mass., in the last number of *Psyche*, a publication issued under the auspices of the Cambridge (Mass.) Entomological Club, says that among the many objects of interest that engage the attention of the naturalist on the Bahamas, perhaps the most striking are the nests of the white ants. The first that I saw was in the vicinity of Nassau in a cultivated field. It is the custom among the natives upon clearing away any portion of the low growth of trees that occupy the land before it is tilled, to leave certain ones, which serve for bean poles, or as a support for the stem of the yam, which climbs to a considerable height. The tree usually selected is the gumbo limbo, that has long naked branches, the twigs of which are only scantily supplied with leaves. These trees are so very often chosen by the ants as a support that it is not infrequent to see two or three nests in one field placed on them. The color of these domiciles is nearly black, and as they are often of a large size, they form conspicuous objects, even when seen from a distance.

The nest of which I have spoken was placed upon a limb some three feet from the ground, was about four feet high by some two feet in diameter, and was very nearly of the form of an old-fashioned beehive. This object in the midst of the field presented such a singular appearance that it was only upon close observation that I convinced myself that it was not something made by the owner of the field, and placed there by him for some purpose.

Subsequent observation showed that the ants prefer to build in openings, and that the gumbo limbo is a favorite tree on which to place their nests. This may be explained by the fact that the trunks of these trees are covered with a smooth bark, thus rendering the covered passages that the insects build between the ground and nests more easy of construction than on rougher material. There are two reasons that appear plausible why the ants prefer open fields to less exposed and more shady locations, the first of which is that they like the hot sunshine and free circulation to dry the moist material which is used in the construction of the nests, second the materials from which they gather their building supplies, and which consist of dead wood, palm leaves, boards, shingles, etc., are much more abundant in the fields than elsewhere. In fact, so universally are these situations chosen that I do not now remember ever having seen a nest in any other place.

The nests, as related, are most often placed in trees, generally low and near the trunk, but I have occasionally seen them among the branches. I have also seen them on stumps and even on rocks, although this support is rarely used.

In form, the nests are, as remarked, hive-shaped whenever the basal support is large, but if it be small the ants will then build around it, producing another hive-shaped structure with its base upward, which, resting against the base above, results in an oval-shaped nest. Sometimes, owing to the situation, irregularly formed nests are seen, but there is always a tendency to assume the hive shape. The nests are composed of various galleries, about 0·20 of an inch high and about the same width, of varying length, opening into others in many directions. Thus the whole system forms an exceedingly complicated labyrinth, the clew of which is difficult to find, but which appears to be perfectly understood by the insects. From the nests to the ground, and wherever the passages cross rocks the surfaces of which are exposed (and this frequently occurs even at a considerable distance from the nests), the roadways by which the ants travel are always covered. These thoroughfares are of sufficient width to allow the insects to pass freely at all points, and upon breaking down any portion of a gallery they may be seen hurrying in both directions.

Whenever their passageways are broken open, some of the ants at once begin to repair it, and this brings me to the material used in building, and the method of depositing it. Fibers, gathered from dead wood, leaves, etc., and mixed with enough earth to give it a dark color, form the principal portion of their building material. How this is applied was for a long time a mystery to me, for, although I had seen many hundred nests, it was not until December 19 of last year that I chanced upon one of them upon which visible labor was being performed. I was passing a nest that stood on the margin of a field on Andros, when, attracted by its size, it being the largest that I had ever seen, measuring six feet in height by four and a half in diameter, I turned aside to examine it, and perceived that a circular piece some six inches in diameter was being built on one side. Something over two inches of the outer margin of this portion had been completed, leaving a circular hole in the center. On this portion the ants were at work, standing around the unfinished margin as close together as possible without interfering with one another's movements. The workers are constantly changing. As one disappeared another took its place. Upon appearing, each ant had its jaws filled with building material, and as it reached the wall it turned and exuded a drop of mucilaginous fluid from the abdomen, then whirled instantly about and deposited its fibers upon it as it lay on the wall, mixing and moulding the mass with its jaws. This pulp had about the consistency of papier mache, and was readily manipulated, forming a wall of about the thickness of heavy writing paper. This hardens rapidly, but remains pliable for some time; thus the walls on the extreme outer edge of the newly erected portion could be bent without breaking, whereas the older portions are quite brittle.

As the orifice on which the ants were employed grew smaller, fewer and fewer could find room, yet there was no crowding, each keeping his accustomed distance from his fellows. So one after another they disappeared, as I watched, until but one was left to complete the minute hole remaining.

These ants are very destructive to buildings, especially to the small houses of the negroes, and when they have once obtained a foothold the house is doomed. I knew of a small house in the neighborhood of Nassau that had not been occupied for a year or two, that was two-thirds devoured by them. There was a nest on the roof, supported by the rafters, around which all the shingles had disappeared, while others were much eaten, and all the posts were thickly perforated with their galleries. Such was the speed with which the ants worked, through industry and numbers, that the eroded surfaces appeared quite fresh, being of nearly the color of newly cut wood. The owner of this house informed me that he had destroyed every trace of the nest many times, only to see it rebuilt as fast as the ants could construct it.

How to Thaw Frozen Gas Pipes.

Mr. F. H. Shelton says: I took off from over the pipe some 4 inches or 5 inches, just a crust of earth, and then put a couple of bushels of lime in the space, poured water over it, and slaked it, and then put canvas over that, and rocks on the canvas, so as to keep the wind from getting underneath. Next morning, on returning there, I found that the frost had been drawn out from the ground for nearly 3 feet. You can appreciate what an advantage that was, for picking through frozen ground, with the thermometer below zero, is no joke. Since then we have tried it several times. It is an excellent plan if you have time enough to let the lime work. In the daytime you cannot afford to waste the time, but if you have a spare night in which to work, it is worth while to try it.

A Great Irrigation Project in Texas.

The director of the geological survey is of the opinion that the recently conceived plan of constructing an immense dam across the Rio Grande at or near El Paso is perfectly practicable, but he thinks the question of conflicting water rights must first be settled by the enactment of a general law by Congress. The purpose of the dam would be to irrigate the valley for fifty miles and furnish motive power, to prevent destructive floods below here, and to settle the Mexican boundary question by keeping the river in its proper channel. It is proposed to make the dam an international affair.

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Correspondence.

Alcohol vs. Snake Poison.

To the Editor of the Scientific American:

The extract quoted in your issue of November 10, from the paper of Dr. Hudson on this subject, is liable to mislead those who may be called on to treat snake bite; and as the SCIENTIFIC AMERICAN falls into the hands of thousands of people, any statement in it is apt to be of more interest to them than if it were noted in a medical journal, whose readers are mainly professional, and who are not so easily misled as the general public by erroneous reasoning. An experience with twenty-three cases of snake bite in rattlesnake (*Crotalus horridus*) and eight of water moccasin (*Toxicophis piscivorous*), with the study of many instances reported to me by capable physicians, leads me to believe that alcohol *is* the antidote to snake venom, *and the only reliable one.* Laboratory experiments upon the lower animals are of no real value in therapeutics as applicable to man, and those referred to by Dr. Hudson were fallacious in themselves. The admixture of a few drops of alcohol or any other supposed antidote with snake virus is misleading, for the quantity of the antidote is infinitesimal as compared with the concentrated and deadly animal poison. To illustrate, a private in the Second U. S. infantry was bitten by a cotton mouth (moccasin), and within less than four hours he swallowed under my direction three quarts and a little over of good apple jack without any symptoms of intoxication until after the last three ounces, and then only slightly. His pulse and respiration failed promptly unless he was thus stimulated for nearly the whole time. Now, knowing that the snake venom is a powerful cardiac and nervous depressant, is it not reasonable to say that the enormous stimulation was borne only because of the persistent reduction of vitality by the virus injected by the reptile? Where would a few drops of alcohol be in such a case? I have seen and examined the body of a child killed in fifteen minutes by a rattlesnake where the temporal vein received the poison. She had no treatment. Ammonia is too fugacious, bromine and permanganate are useless locally or internally, so also is the reputed cure-all wild violet (*V. sagitatta*). The majority of presumed deadly bites are given by non-venomous reptiles, and the escape of the snake or the loss of presence of mind on the part of the person bitten leads to mistakes; but in *bona-fide* venomous bites, alcohol in some form is an absolute antidote when promptly and freely used. The failure of the pulse is the guide, and as the poison is rapidly absorbed, all ligatures, excisions, and cauterizations are simply useless and aggravating. Intoxication is not desirable, but stimulation should be evident to avert sudden heart failure, and I may say in this connection that in two instances the subcutaneous injection of atropia was markedly serviceable in maintaining respiration.

My cases occurred during my army life, between 1861 and 1872, and in the States of Alabama, Georgia, Tennessee, and Virginia, two during the war and the rest after that eventful period.

W. R. D. BLACKWOOD, M.D.

Philadelphia, Pa.

Capacity of Cylindrical Cisterns.

The *Sanitary News* gives the following table showing the capacity in gallons for each foot in depth of cylindrical cisterns of any diameter:

Diameter.	Gallons.	Diameter.	Gallons.
25 feet.	3,059	7 feet.	239
20 "	1,958	6½ "	206
15 "	1,101	6 "	176
14 "	959	5 "	122
13 "	827	4½ "	99
12 "	705	4 "	78
11 "	592	3 "	44
10 "	489	2½ "	30
9 "	396	2 "	19
8 "	313		

A Test for Saccharine.

In a recent number of the *Chemical News*, Mr. D. Lindo described the following test for saccharine. After placing the saccharine with concentrated nitric acid in a small porcelain dish, evaporate to dryness on the water bath, or by moving the flame of a spirit lamp to and fro under the dish; blowing on the surface occasionally to facilitate evaporation, and taking care that the heat does not rise too high. If the dish is not allowed to cool, and a few drops of strong solution of potash in 50 per cent alcohol are added to the residue, a faint yellow color only will be developed. Spread the liquor over the surface of the dish; and before it has settled to the bottom apply heat with the lamp, as above, quickly all over the under surface of the dish. If the vapor of alcohol happens to ignite, it must be at once extinguished. A great variety of colors will be developed in this way. As the dish cools and moisture is absorbed, the colors fade. By heating they can be reproduced, though not in the same perfection as at first.

PHOTOGRAPHIC NOTES.

Mounting and Finishing Silver Prints.—Probably the best means of insuring the minimum of cockling with a prevention of the expansion (more in one direction than in another) of the print which occurs when it is mounted wet, is to give the backs of the prints a good coating of starch while wet; then allow them to become dry, and, after a final trimming, lay them down upon the mounts, which have been previously moistened by passing a wet sponge over them, and then running each in succession through a rolling press, by which the adhesion is made perfect.

The burnishing of prints seems a *bete noir* to some, but it is a very simple operation. The print, after being quite dry, is rubbed over with a lubricant composed of three grains of Castile soap dissolved in an ounce of alcohol. This is applied by a pad of cotton wool or by flannel. The best results are obtained by allowing an interval of some hours to intervene between the lubricating and the burnishing. A high polish will not be obtained unless the burnisher has been well heated, for it is the heat and friction combined that cause the polish. The photograph must be passed quite through without any stoppage, even of the most temporary nature, which would insure a mark. To secure the best effect, the print must be passed over the burnisher several times.

Since the introduction of burnishing, the application of encaustic paste to prints, especially those of small dimensions, has fallen much into disuse. But there is no doubt that such paste confers greater brilliance upon prints, more especially on such as are made on somewhat lightly albumenized paper, rendering visible some details which otherwise would not be seen. The practice of waxing the surface of prints is one of a respectable antiquity; we know, at any rate, that for several years anterior to a quarter of a century ago it was adopted regularly in some establishments, *e. g.*, in that of Thurston Thompson, the photographer to South Kensington Museum, not one print in which collection but what underwent the treatment with encaustic paste. The mode of proceeding was as follows: Equal parts, say one ounce each, of white wax and spirits of turpentine were mixed by heat in an earthenware vessel. A portion of this was applied by a clean rag to the surface of the print, which was then subjected to friction by a brush similar to that employed for brushing clothes, until the surface was quite uniform. In the practice of others subsequently the turpentine was displaced in favor of other solvents, such as oil of lavender. The fine surface finish of the portraits of the late Adam Salomon, of Paris, was due to the application of encaustic paste.

A surface finish of a different nature is imparted by the adoption of enameling, so called. By this means the very highest degree of finish capable of being attained is placed within easy access of every photographer. The operation is easy in the extreme. The first thing to do is to select one or more smooth plates of glass without surface defects. No pains must be spared in making one surface of this quite clean. It is then to be dusted over with powdered French chalk, which must be well rubbed over every portion and all superfluous particles wiped or brushed off. It is now coated with plain collodion containing a modicum of castor oil to impart toughness. Enameling collodion, as it is designated, is an article of commerce, and can be purchased cheaper than it can be made. Plates thus prepared may be stored away until wanted for use.

An ounce of gelatine having been dissolved in eight ounces of water, the prints are immersed in this for about a minute and then transferred to the collodionized glass, which has previously been made slightly warm. Examine the print by looking through the glass, and ascertain that there are no air bubbles Allow the whole to become dry, which takes about a day, then run the point of a small knife around the margin, raise up one corner, and strip the print from the glass.

Almost every operator has his own special way of carrying out details. For example, some apply a layer of gelatine to the collodionized glass, and, allowing it to set until it becomes tacky, they then immerse the prints in plain water, and while wet lay them down upon the gelatined glass. Others coat both glass and print with gelatine, and superpose one on the other just before the surface is set. If air bubbles are observed, they are rubbed out by pressure with the finger; but if the print is removed from the water in a dripping state, and placed upon the glass first at one end and gently laid down in a curve, none will be produced.

The mounting of *glace* or enameled prints is, in our estimation, most conveniently effected in this way: After the print has been on the glass for half an hour, take two thin Bristol boards, and having previously soaked them in the gelatine, place them, one at a time, down upon the print, and allow to dry for twenty-four hours before stripping. If the ordinary card mounts are to be employed, they must be well sponged with the gelatine before application to the print, and pressure applied to the back to insure contact until the adhesion is perfect. It is, of course, well understood that the prints must in this latter case have been properly trimmed previous to the application of the mounts.

These remarks would scarcely be complete were we to omit mention of the mounting of prints in optical contact with glass, notwithstanding that we have so often written about it.

The glass ought to be of as colorless a sample as possible, and made scrupulously clean. The print is first soaked in plain cold water and then blotted off. In a flat dish have a solution in the proportion of two ounces of Nelson's No. 2 soluble, or any other good soluble gelatine, to the pint of water, and soak the print in this. Then, having first placed the glass in warm water—say 115° Fahr.—lift up the print by both ends and lay it down with a slight curl upon the glass. Some place the glass in the bottom of the tray containing the gelatine, and thus insure contact without the possibility of any air bubbles forming. We have seen quite successful results obtained even more simply —a pool of gelatine being poured on the center of the plate and a wet print laid down upon it, so as to force the superfluous gelatine to flow to the margins.

Photography on Wood.—The *Revue Photographique* gives the following directions for photographing upon wood. Measure out:

Gelatine	8 grammes.
White soap	8 "
Water	500 c. c.

The gelatine is allowed to swell, is dissolved in the water bath, and the soap is added to it gradually, stirring all the time. The mixture is then filtered through muslin. A little zinc white is added to it, and it is then rubbed well into the wood to be used, and then left to dry. The film should be as thin and equal as possible. A coating of the following solution is then applied to the wood by means of a broad brush:

Albumen	30 grammes.
Chloride of ammonia	1·2 "
Citric acid	0·2 "
Water	24 c. c.

Whip the albumen to a froth, let it settle, and then add (in order) the water, the chloride of ammonia, and the citric acid. When dry, this film is sensitized by pouring on it a little of the following solution, and spreading it with a glass rod:

Nitrate of silver	3·2 grammes.
Water	31 c c.

Pour off any excess of the sensitizer and allow it to dry again. Print as usual. It is not necessary to overprint. When sufficiently exposed, hold the printed surface of the wooden block for three minutes in a weak solution of salt; in this the print will become slightly paler. Wash under the water tap, and fix for four or five minutes in a concentrated solution of hyposulphite of soda. Wash again for ten minutes under the water tap and dry.—*Br. Jour. of Photo.*

A Novel Scheme for Harbor Defense.

According to a recent report in some of the Philadelphia newspapers, a large company, backed by millions of dollars, has proposed to the Secretary of the Navy a striking and possibly effective scheme for the defense of that harbor and the harbors of other cities from the attacks of an enemy's fleet by shooting ignited petroleum at the unfriendly ships from the bottom of the river and burning them up. The Rear-Admiral has been directed to study closely the harbor of Philadelphia and its approaches. The petroleum defense scheme, the originators of which have induced the government to make this preliminary examination of the Philadelphia harbor, is a brilliant one in more respects than one. A company has been organized at Washington to develop the plan and to show its practicability.

It is proposed to sink perforated iron pipes in the river bed and the approaches to the harbor, through which petroleum can be forced to the surface of the river by machinery and at a high pressure. In this way a fierce stream of blazing oil can be sent down on the enemy's fleet to destroy it or drive it away. It is claimed by the projectors that a flame can be produced in this way as high as a ship's mast, and sent with terrific force on the attacking vessels many miles from the point where the oil is supplied to the system of submerged pipes. Iron vessels could not pass through this lake of fire, because it could be made to extend many miles along the river. A experiment in connection with the scheme will be made at Fort Mifflin in a few weeks. The necessary apparatus is almost ready at the present moment, and great things are expected from this test.

THE first of a fleet of electrical power boats, destined for public use on the River Thames, London, was launched from a yard at Chiswick a few days since. The boat is intended to carry eighty passengers; her length is 65½ feet, beam 10 feet, displacement 12½ tons, and speed, with the conservancy regulation, six miles an hour. The machinery and storage cells are placed below deck. The boat carries 200 E. P. S. accumulators, and two 7½ horse power motors drive twin three-bladed propellers.

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Port Arthur.

Mr. H. E. M. James says: Hunchun and the northern garrisons of China are all of small importance when compared with the great military and naval station of Port Arthur, situated at the extreme south of the province of Manchuria. This place has been established to oppose, not one European nation in particular, but all, and it may be said to represent the net outcome of the recent efforts the Chinese have made to adopt European methods and appliances of war and to imitate their system of defense. It is here that the Chinese government consider they have created a first line of defense against the powers of the West, and it must be admitted that a naturally favored position has been rendered the most formidable military station in the empire by the efforts they and their European advisers have bestowed upon it. Mr. James writes:

The hills to seaward are crowned with a series of forts, thirteen in number, armed with very powerful Krupp guns, and manned by artillerymen, who are drilled and instructed by . . . . a German officer. The garrison consists of 7,000 foreign drilled troops, armed with the Mauser rifle, and there are field batteries besides. During the war with the French 25,000 men are said to have been massed at this place, which is in communication by telegraph with Newchwang and Pekin. The hills on the landward side, which have not yet been fortified, are covered with barracks, magazines, and other offices, all connected by telephones, and on the far side of all lies the native bazar. A graving dock and a refuge dock are now under construction, at an estimated cost of £250,000 sterling. On the eminence overlooking the entrance of the port an electrical search apparatus is mounted to illuminate the sea and prevent an enemy approaching under cover of darkness. There are factories for submarine mines and torpedoes, with a supply of torpedoes in stock; in fact, Port Arthur is like a good suburban villa—fitted with the latest modern improvements.

Gas Works in a Cold Climate.

In the discussion of a paper read before the recent meeting of the American Gas Light Association, Mr. J. F. Scriver said: I happen to be one of the unfortunate fellows who live in a cold country—Montreal. I do not know that we get down to 36° below zero there, but we very often have it at zero, which is quite cold enough to be comfortable. We have a great deal of trouble, as you have heard, from the extremely cold weather of our northern climate.

The greatest trouble which we experience is the trouble with capital. We require at least double the capital to construct gas works in Montreal, Quebec, or Halifax that you need in New York, Brooklyn, Washington, or any point about there. We have to put our pipes down to a very great depth in the ground. We lay our pipes with a covering of at least 5 feet. We find that it is not safe to have them any nearer the surface than that. We have to construct over all our machinery very expensive buildings. I wish that we could run our gas holders in the open air, as they are represented in the pictures which are exhibited here. But we cannot do that, and we have to put up very expensive buildings, with costly iron roofs over them. We have to cover in our purifiers and condensers, and all the machinery that we have has to be thoroughly housed. We have not only to keep them covered with buildings, but we have also the additional expense of keeping them warm and keeping everything from freezing. It would not do for us to allow the gas holder to freeze, and, therefore, we have to keep an immense space heated. With regard to the freezing of pipes, I may state that in Montreal we have on more than one occasion found our pipes frozen solid for at least 100 feet. Then with the temperature below zero, we have to open the ground, expose the pipes, and thaw them out, and the only way to get the frost out of the pipes under such circumstances is to build coke fires upon them, and it is rather a strange sight in the middle of winter to see about 100 feet of ground open, filled with hot coke, burning away night and day for three or four days, until the frost is removed.

Another difficulty with which we have to contend is that bugbear naphthaline. The cold weather makes naphthaline very readily. Our greatest difficulty, however, is not in the extremely cold weather, but when the winter sets in. We are not troubled with it very much about our works, but outside of the works for a distance of half a mile is where we get the most. We do manage to keep the naphthaline out of our works, but when it travels from cold pipes to pipes that perhaps lie in low damp ground, the naphthaline accumulates to a large extent, although I am happy to say it has not troubled us to the extent that it seems to trouble people in Hamilton at the present time.

Another additional expense (and I refer to it because it requires additional capital) is the furnishing of buildings for the storage of our coals. Our American brethren get their supplies of coals in daily, I presume, as they want them, but in Montreal we have to store 35,000 or 40,000 tons of coals for our winter's supply. Therefore we have to purchase a great deal of ground on which to erect our shed. We do not pile our coals high in Montreal. We find that we cannot pile our coals more than 6 feet or 7 feet high. We build our sheds with open sides and with the roof sustained by iron columns, so as to allow a free circulation of air, and you can readily understand that it requires a great deal of ground to pile up to a height of 6 feet or 7 feet 40,000 tons of coals. This is absolutely necessary with us, because we have not railroad communication with the mines, and have to lay in a sufficient supply in the summer season.

IMPROVED FLOATING SCOURING DAM.

This apparatus was devised by Mr. John Kingston, for clearing away silt deposits from rivers by the action of the current intensified and directed upon the bottom by the obstruction of the dam.

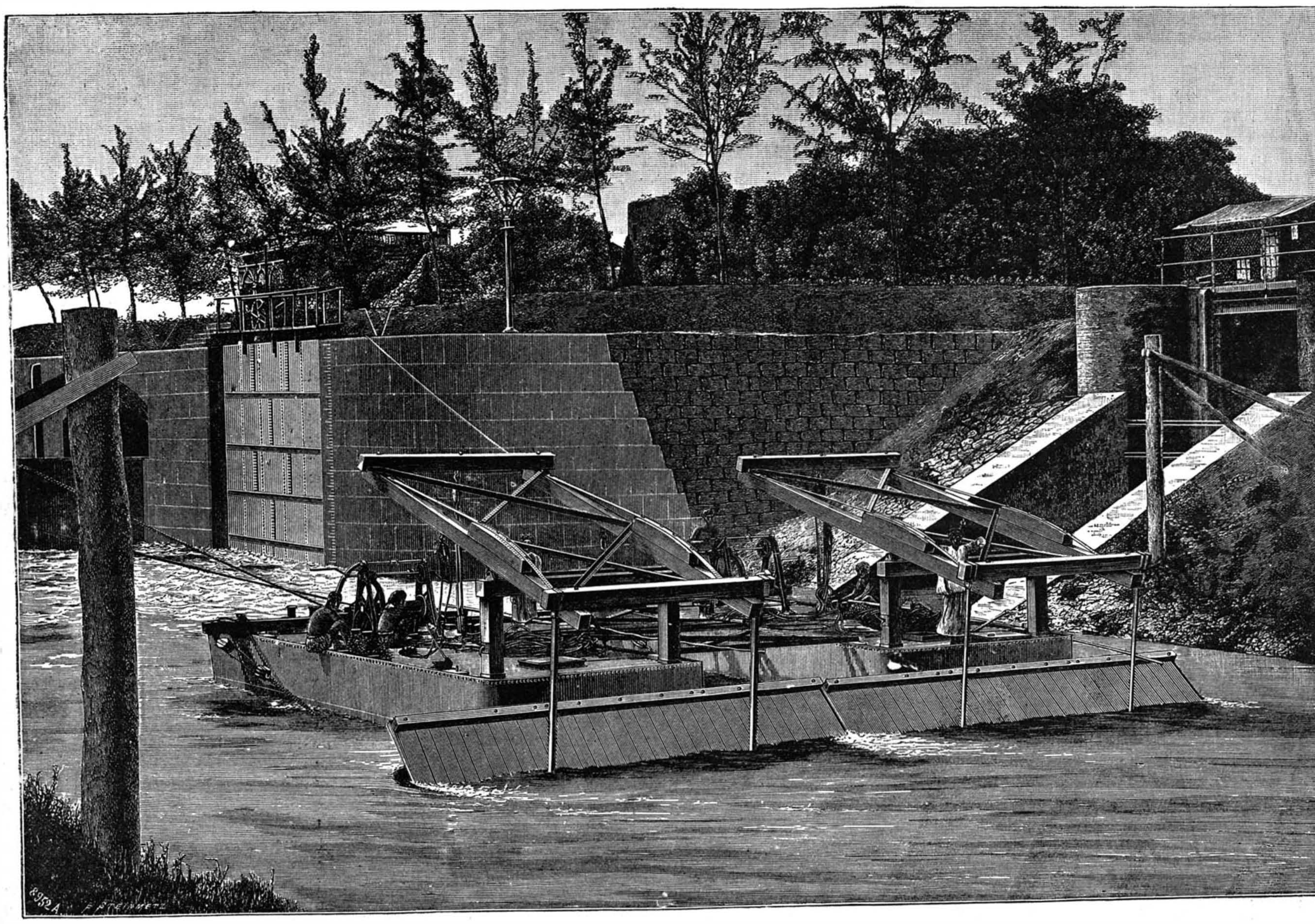
Mr. James Henry Apjohn, a canal engineer in India, has applied the apparatus for keeping clear of silt the channels 200 feet to 300 feet in length between the canal locks and the tidal rivers with which they connect.

The water of these rivers is for the most part very full of silt, which rapidly deposits in the back water of the lock channel, and to such an extent does this silting up in many instances take place, that the bed of the channel is often as much as 8 feet to 10 feet above the lower sill of the lock, which consequently can only be entered by boats at or about high water. There is generally plenty of water for scouring purposes available from the canals, but merely letting it run out through the silted-up channel during the time of low water was found to have but little effect until Mr. Kingston's scouring dam was brought into use.

These dams are now in operation on the Orissa coast canals and the Calcutta circular canal. We give illustrations and the following particulars from *Engineering:*

The apparatus consists of an iron boat carrying a dam or shutter (19 feet wide and 8 feet high) over the stern, capable of being raised and lowered by a rocking beam to which it is suspended. When it is desired to scour out the channel, this shutter is let down in the water, until the lower edge is close to the bottom, and it is held there by chains in a position inclined to the current. The boat being secured by warps, the water is let out through the lock valves, and being obstructed by the shutter, it heads up and escapes with increased velocity underneath and on either side of it, and it is practically found that the silt is rapidly cut away and carried into the river. As the bottom is scoured away the warps are slackened out until the whole channel has been swept clean through to the river.

An improved shutter was provided with tines or teeth on its lower edge, which in case of an exceptionally hard bottom are forced into it by letting down the shutter vertically when the lock valves are closed,



IMPROVED FLOATING SCOURING DAM.

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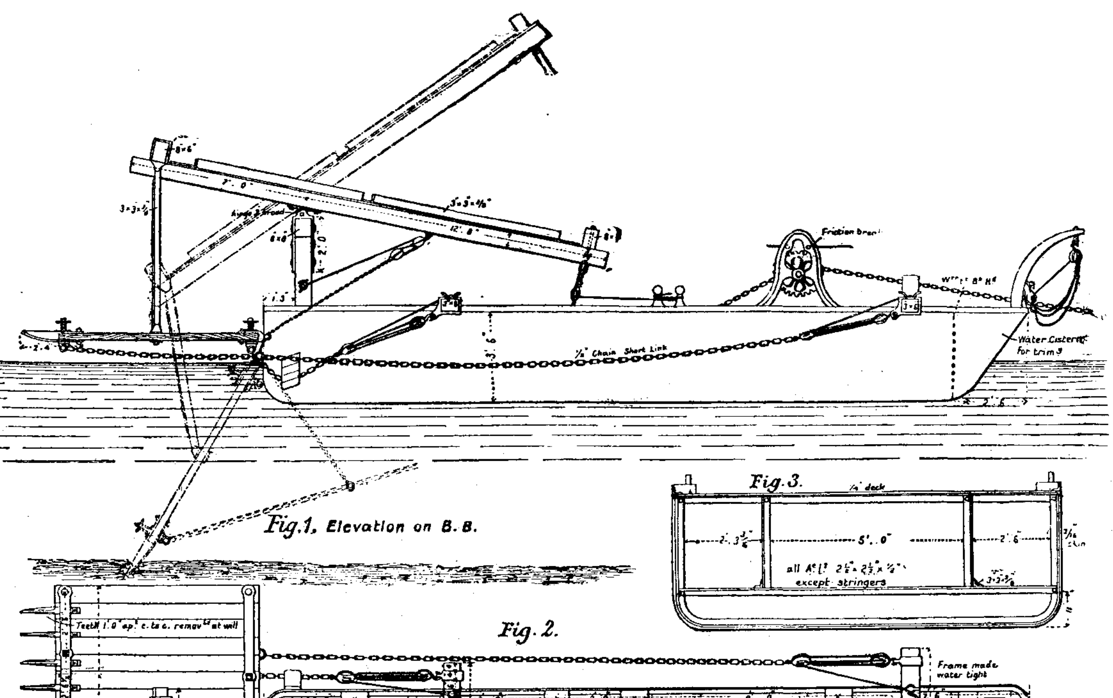
and the water in the channel is consequently at rest. The water is then turned on and the shutter forces the teeth through the ground, which, being thus plowed up, readily yields to the action of the current.

The Orissa coast canal lock being 20 feet wide, the dams are made 19 feet wide, so as to pass through them; but by diagonal bracing between the boats, two or more can be joined together so as to fit a channel of any width. The perspective illustration (from a photograph) shows a pair of dams working in the channel between the 40 feet wide Chitpore lock and the River Hooghly.

It is found that the dam will, according as the silt is hard or soft, cut away, each time that it is passed through the channel, from 6 inches to 2 feet in depth, and that it is usually passed through a channel 300 feet long in about two hours at low-water time.



IMPROVED FLOATING SCOURING DAM.

Grapes in Chautauqua County, New York.

A writer in the New York *Times* sends the following letter from Jamestown, October 20:

There has sprung into prominence in the past few years an industry which is very sure to give Chautauqua County a more extended reputation than has been earned by the products of her dairies, and that is the raising of grapes and the making of wine. The towns of Hanover, Sheridan, Portland, Westfield, Ripley, and Pomfret for the most part occupy the territory extending back from Lake Erie from one and a half to three miles to the hills, which geologists say are composed of the debris deposited during the glacial period by the incalculable mass of ice which scooped out the Lake Erie basin. For a good while this level strip of land, usually denominated the "Lake Shore," has been noted for the fruits it raised, but not until a very few years has the grape culture overshadowed all others, while the two seasons preceding the present one were the first when the growers organized and made heavy shipments. This year the grape crop will sell for fully $750,000, and the profit is large. The soil does not have as much to do with the quality of the grapes as the fact that Lake Erie on the north and the high hills on the south serve to keep off the frosts until late, allowing the fruit to mature slowly, but very perfectly. Since the craze of planting for grapes began, it has been found that land which for general agricultural purposes was not worth over $10 or $15 per acre is now a good investment at $100 or more, while whole farms are held at three times that price per acre.

A score of years ago, when a man named Harris came from England and founded a "community" at Brocton, in the township of Portland, about midway on the Lake Shore railroad from Buffalo to Erie, he saw the adaptability of the region to the culture of the grape, and began a vineyard, which has since become famous, and the reputation of which would have become still more extended but for the disruption of the settlement. But the start made at that time has given Brocton the lead in grape growing, and it is now the recognized center of the industry, with the only wine cellars and the largest shipping station. In the township of Portland there are now 3,000 acres devoted to grapes, and the yield under careful management is from three to eight tons per acre. The Concord is the standard grape, and probably seven-tenths of all the grapes grown on the lake shore are of this variety, as it is hardy, a large producer, stands transportation well, and can be preserved for months. But the Niagara is a favorite variety, white, not unlike the Malaga grape in appearance, and of very delicate flavor. While all the grapes require much care, especially in the early part of the season, more than the usual time and labor are spent on the Niagaras, some of the growers even going to the extreme of tying paper bags over the bunches when partly grown to prevent bruising and mildew. To a stranger the sight of a 10 acre lot of grapevines bearing brown paper bags is enough to excite the risibilities. In one vineyard this season 20,000 of these bags were thus used.

The harvesting of the grape crop is the period of anxiety for the viniculturist, and, like the hop grower, he brings all the force possible into service—literally "his sisters and his cousins and his aunts." When the harvest is about to begin, the housewife cooks many times the usual quantity of food, and until the vines have been robbed of their bunches of fruit little attention is paid to the creature comforts. From early in the morning until dusk, the vineyards swarm with pickers, and the bunches are carefully clipped from the stalks and packed in baskets or trays, some of them being wrapped in tissue paper to insure their reaching market in the best possible condition. Only the small and imperfect bunches are sent to the wine cellars. The markets for the grapes are principally in the West, Chicago taking the bulk of the product, and car after car at the principal stations is packed full of the delicious fruit, the shipping being done mainly by associations which employ their own shippers and salesmen. The price paid this season on an average has been $45 per ton. The yield this year is the largest in the history of the county.

The wine cellars at Brocton have a storage capacity of about 90,000 gallons, and are not large enough to meet the demands of the trade, as several of the Western railways are using the wines in their buffet cars and station refreshment rooms. Lawrence Oliphant was at one time connected with the Harris community in Portland, and on his visit to this county last spring he pronounced the Brocton wines of the highest quality, and took to his English home a large supply of them, from which excellent reports have been received. The wines sell from one to several dollars per gallon. Some of the grape growers whose temperance proclivities prevent their selling refuse bunches to the cellars scald the juice and preserve it, and the beverage would not offend a connoisseur, while the natives esteem it.

Picking begins about the middle of September and continues through October. Probably between 200 and 300 cars will be filled with grapes from the vineyards of the lake shore towns this season, and the profits are so liberal that every farmer who has a thrifty vineyard will be able to give his daughter a piano or its equivalent next Christmas. For profit, grape growing casts far in the shade everything which Chautauqua County farmers have yet tried to take from Mother Earth.

Cultivation of Annatto.

Annatto thrives in Guadeloupe at an altitude of 500 to 600 meters, but yields less and less as the distance increases above 400 meters. Consul Bartlett says that in cultivating it, it is not necessary to plow the land, but holes are generally dug to plant annatto. These holes have a diameter of fifty or sixty centimeters and thirty or forty centimeters in depth. According to the state of the soil, they are set at a distance of about three meters, and of four meters if the soil is a rich one. The seeds are laid in the ground at once, a few seeds in each hole, and later on, one of the strongest shoots is left to grow, and all the others are pulled up. The young plants require a careful hoeing around them for nearly a year on the whole extent of the plantation. In nurseries the seeds are sown in well-prepared beds, at a distance of about thirty centimeters between each row. These beds are carefully attended to for several months, and when the young plants have attained a height of about forty to sixty centimeters they are placed singly in each hole. The soil around the young seedling is carefully attended to, in order that weeds should not take possession of the holes and destroy the young plants. The plant grows very fast, requiring little care after the plantation has attained a certain size. It blossoms one year after being transplanted, and bears a few pods, but is far from having reached its full size, which may be four to five meters. In a rich soil the trees will meet each other at a distance of four meters, and will shade the whole ground in four or five years. The ground is hoed at least two or three times a year, until the trees have attained their full size. Annatto bears twice a year, the spring blossoms always yielding the largest crop. As soon as the pods in the bunches commence drying and opening, the bunches are cut by means of a pair of shears or a crooked knife. These bunches are packed in baskets and transported to the shed prepared for the purpose. Consul Bartlett says that this is the most tedious part of the cultivation, every pod requiring to be picked with the hands, as much as possible the seeds attached to the white film inside being left untouched. The pods when empty are used as manure. This work of picking, in Guadeloupe, is generally performed by women and children, who are paid at the rate of about five centimes per kilogramme. The crop is gathered from July 15 until the end of August, and it is estimated that one hectare of annatto (the hectare being equivalent to 2·47 acres) should yield on an average 1,500 kilogrammes of green seeds for the two crops, or about seven casks of pulp, weighing from three hundred and fifty to four hundred pounds each.

THE five heaviest hammers in the world were built in the following order: Krupp, at Essen, 1867, 40 tons; Terni works, Italy, 1873, 50 tons; Creusot, France, 1877, 80 tons; Cockerill, Belgium, 1885, 100 tons; and Krupp, Essen, 1886, 150 tons. Thor can take a vacation now.

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A Substantial Dam.*

The construction of dams in localities where the stream is small and variable is an important feature. If by a suitable dam all the water which accumulates during the night can be stored for use during the following day, the capacity of the mill is thereby nearly or quite doubled.

Defective and leaky dams are a constant source of annoyance and expense. It is not only the loss of power in dry times by the constant waste of water, but such dams are liable at any time to be carried away by the first freshet that may occur. Thousands of dollars are lost every year in this manner. It is not only the expense of building a new dam with which the mill owner has to contend, but the loss of the earnings of the mill for a month or two while a new dam is being built is also quite an important item in the bill. In nine cases out of every ten, the fault may be traced to a defective foundation.

There are but few localities where a dam cannot be built strong enough to withstand any freshet that may occur. Where the bottom is rock, the mud sills, which form the most important part, should be well secured with bolts driven into it. Where it is earth or sand, it may be necessary to resort to other means in order to secure it. The height and length of the dam, the nature of the bed of the stream, with the probable pressure that may be brought to bear upon it, should all be carefully taken into consideration before the work is commenced.

Suppose a dam fifty feet long and twelve feet high, to be built of timber, is required, and the bed of the stream is rock. The first step should be to calculate the greatest amount of pressure which it may be required to sustain. The pressure upon an inclined surface is equal to the product of one-half the perpendicular height and the length multiplied by 62½. By this means the whole pressure upon the dam in pounds may be obtained when it is just full. But in times of high water the depth of the sheet which may be liable to flow over it must be taken into consideration, for the pressure will be increased as the depth, and in this case two feet at least should be allowed. Now, one-half of twelve feet is six, and two feet allowed for high water is eight, then $50\times8=400\times62\frac{1}{2}=25{,}000$ pounds.

Excavations should be made in the banks on each side of the stream, to admit of suitable abutments being built, which should be of stone laid up with water lime, and carried far enough above the proposed height of the dam to prevent the water at any time flowing over them. The bed of the stream, where the foundation will rest, should be leveled off as nearly as possible, so as to give a good bearing for the mud sills. These, to resist the action of the elements and withstand the pressure of a dam of this height, should be of oak twelve inches square, if that kind of timber can be conveniently obtained, and laid the whole length across the stream, from one abutment to the other, and secured to the rock by rock bolts 1½ inches in diameter and about thirty inches long, and not over six feet apart.

A rock bolt is a piece of round iron, with a head upset upon one end and the other split about two inches or more from the end. Into this split the end of a thin, tapered iron wedge is inserted just far enough to hold it while it is being put down into the rock through the timber. The hole which is drilled to receive it should be just deep enough to correspond with the length of the bolt, and allow the end of the wedge to rest upon the bottom of the hole before it is driven. With the end of the wedge resting upon the rock at the bottom of the hole, if the bolt is driven down with a sledge, the wedge is forced into the end of the bolt, where it is split, and spreads it apart so as to force it against the sides of the hole.

Bolts well fitted and driven down in this manner will never give way, no matter what the strain may be upon them.

Mortises should then be made in the sill between each bolt, and uprights of the same size framed into it of a length corresponding with the height of the dam, allowing, of course, for the thickness of the stringer, which should also be framed upon the top of them and run the whole length of the dam, and should be the same size as the sills. This completes the first part of the structure.

Another mud sill corresponding in size with the first should now be put down twelve feet above it, and fastened to the rock in the same manner. Timbers or joists, 3×8 or 4×12 inches square, should now be laid about two feet apart, one end resting upon the upper mud sill, while the other rests upon the top of the former part of the structure, thus making an angle of forty-five degrees with the bed of the stream. Each end of the joist should be secured to its respective timbers by bolts, when the whole surface may be covered with planks well spiked to the joists. This completes the structure as far as the millwright is concerned.

The arrangement for the head gates and flume to be attached to it will vary according to circumstances, and their location, etc., and will readily suggest itself to the practical millwright.

To avoid small leaks, and to secure the planking from injury, it is well to cover them to a considerable depth, especially toward the bottom, with earth or gravel.

When the bed of the stream is hard earth or clay, posts should take the place of the rock bolts, and be sunk at least six feet below the bed of it, and the mud sills bolted to them, otherwise the structure may be the same. The bottom below the dam, however, for a considerable distance, should be either covered with planks or filled in with stones, to prevent the overflow washing out the earth which sustains the posts.

Where quicksand forms the bed of the stream, which fortunately is not often the case, it is almost impossible to build a permanent and reliable structure of this kind without first driving piling and then planking it over for the foundation. In such cases two rows of piles should be driven across the stream, twelve feet apart, for a dam twelve feet high, to secure the upper and lower mud sills, and as close together as may be convenient, but not in any case more than three or four feet apart. The mud sills should be securely bolted to each pile, and the whole space between them should be either well grouted with stone and water lime or covered with planks, which should extend at least ten feet below the overflow.

The grouting, if put in to a proper thickness, is no doubt the best, but as it is quite expensive, planks, if well put down, will answer the purpose.

When the structure is completed, to secure the upper side and prevent the water working under the mud sill located there, the bottom for some distance above it should be puddled with clay before the earth and gravel filling is put on.

If sufficient care is manifested in all these details, there is no locality where a good and permanent dam cannot be erected. But it is frequently neglect in some of the small details which leads to disaster.

It is well for the practical millwright to remind those who are about to put up structures of this kind that it is better for them to spend a few extra dollars in making everything perfectly secure than to be obliged in a short time to spend several hundred for a new dam, which is liable to be carried away by the first freshet which may occur.

* C. R. Tompkins, in the *American Miller.*

Hints for Builders.

The *Builder and Woodworker* gives the following advice to builders and to those who have not had much experience in working up old materials. The suggestions will be found valuable:

Never compete with a "botch," if you know he is favored by the person about to build. He will undercut and beat you every time.

In tearing down old work be as careful as in putting up new.

It costs about 15 per cent extra to work up old material, and this fact should be borne in mind, as I have known several contractors who paid dearly for their "whistle" in estimating on working up second-hand material.

These remarks apply to woodwork only. In using old bricks, stone, slate, and other miscellaneous materials, it is as well to add double price for working up.

Workmen do not care to handle old material, and justly so. It is ruinous to tools, painful to handle, and very destructive to clothing.

In my experience I always found it pay to advance the wages of workmen—skilled mechanics—while working up old material. This encouraged the men and spurred them to better efforts.

Sash frames, with sash weights, locks, and trim complete, may be taken out of old buildings that are being taken down and preserved just as good as new by screwing slats and braces on them, which not only keeps the frame square, but prevents the glass from being broken. Doors, frames, and trims may also be kept in good order until used by taking the same precautions as in window frames.

Old scantlings and joists should have all nails drawn or hammered in before piling away.

Counters, shelving, drawers, and other store fittings should be kindly dealt with. They will be wanted sooner or later.

Take care of the locks, hinges, bolts, keys, and other hardware. Each individual piece represents money in a greater or lesser sum.

Sinks, wash basins, bath tubs, traps, heating appliances, grates, mantels, and hearth stones should be moved with care. They are always worth money, and may be used in many places as substitutes for more inferior fixings.

Marble mantels require the most careful handling.

Rails, balusters, and newels may be utilized much readier than stairs, as the rail may be lengthened or shortened to suit variable conditions.

Gas fixtures should be cared for and stowed away in some dry place. They can often be made available, and are not easily renovated if soiled or tarnished.

It is not wise to employ men who have nothing but their strength to recommend them. As a rule they are like bears—have more strength than knowledge; and lack of the latter is often an expensive desideratum. Employ for taking down the work good, careful mechanics, and do not have the work "rushed through." Rushers of this sort are expensive.

Have some mercy for the workman's tools. If it can be avoided, do not work up old stuff into fine work. If not avoidable, pay the workman something extra because of injury to tools.

Don't grumble if you don't get as good results from the use of old material as from new. The workman has much to contend with while working up old nail-speckled, sand-covered material.

Clarifying.

Clarification is a process by which any solid particles suspended in a liquid are either caused to coalesce together or to adhere to the medium used for clarifying, that they may be removed by filtration (which would previously have been impossible), so as to render the liquid clear.

One of the best agents for this purpose is albumen. When clarifying vegetable extracts, the albumen which is naturally present in most plants accomplishes the purpose easily, provided the vegetable matter is extracted in the cold, so as to get as much albumen as possible in solution.

Egg albumen may also be used. The effect of albumen may be increased by the addition of cellulose, in form of a fine magma of filtering paper. This has the further advantage that the subsequent filtration is much facilitated.

Suspended particles of gum or pectin may be removed by cautious precipitation with tannin, of which only an exceedingly small amount is usually necessary. It combines with the gelatinous substances better with the aid of heat than in the cold. There must be no excess of tannin used.

Another method of clarifying liquids, turbid from particles of gum, albumen, pectin, etc., is to add to them a definite quantity of alcohol. This causes the former substances to separate in more or less large flakes. The quantity of alcohol required varies greatly, according to the nature of the liquid. It should be determined in each case by an experiment on a small scale.

Resinous or waxy substances, such as are occasionally met with in honey, etc., may be removed by the addition of bole, pulped filtering paper, and heating to boiling.

In each case, the clarifying process may be hastened by making the separating particles specifically heavier, that is, by incorporating some heavier substance, such as talcum, etc., which may cause the flocculi to sink more rapidly, and to form a compact sediment.

CLARIFYING POWDER FOR ALCOHOLIC LIQUIDS.

Egg albumen, dry	40 parts.
Sugar of milk	40 "
Starch	20 "

Reduce them to a very fine powder, and mix thoroughly.

For clarifying liquors, wines, essences, etc., take for every quart of liquid seventy-five grains of the above mixture, shake repeatedly in the course of a few days, the mixture being kept in a warm room. Then filter.

Powdered talcum renders the same service, and has the additional advantage of being entirely insoluble. However, the above mixture acts more energetically.—*Eugene Dieterich, in Neues Pharm. Manuale (Ed. II.); Amer. Druggist.*

The Compressibility of Gases.

M. Amagat has communicated to the *Comptes Rendus* some observations upon the compression of gases—comprising oxygen, hydrogen, nitrogen, and air—to pressures reaching 3,000 atmospheres. The author remarks that his results differ considerably from those published by Natterer, since, for the same reduction of volume of the gases observed, he has generally found the pressures to be very much greater than those given upon Natterer's authority—a result which he ascribes to the probable and even inevitable errors of the processes adopted by that experimenter. M. Amagat finds that at a pressure of 3,000 atmospheres, and at a constant temperature of 15° C., a volume of the following gases which is equal to unity at the ordinary temperature occupies the following spaces: Air, 0·001401; nitrogen, 0·001446; oxygen, 0·001235; hydrogen, 0·000964. Under extreme pressures, oxygen, nitrogen, and air have nearly the same compressibility, which is according to the room occupied by the liquids. At 3,000 atmospheres it is about equal to that of alcohol under the normal pressure. The compressibility of hydrogen is much greater—nearly double, in fact. At 3,000 atmospheres it is nearly equal to that of ether at about the normal pressure. The densities of these gases when compressed to 3,000 atmospheres are given as follows by M. Amagat, water being taken as unity: Oxygen, 1·1054; air, 0·8817; nitrogen, 0·8293; hydrogen, 0·0887. These values have been determined by assuming the number generally admitted for the compressibility of the glass envelopes of the liquids.

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A URUS SKELETON (*Bos primigenius*).

The zoological collection of the Imperial Agricultural High School at Berlin has recently been enriched by a very interesting object, viz., the skeleton of a wild cow (*Bos primigenius*). This was found May 12, 1887, when cutting peat in the bog at Guhlen, near Goyatz (Lower Lusatia), in the deepest stratum of the bog. Most of the bones lay in their natural relation to each other, and we may safely assume that the cow reached the spot where it was found in good condition, and that the disintegration took place there.

As it was found in the evening, when the workmen were preparing to go home, some of the parts were, unfortunately, overlooked. Among these were the lower bones of the right fore and left hind leg, most of the caudal vertebræ, a rib, the breast bone, and several small bones. Several of the teeth were also lost during transportation. All of the other parts were saved, and are in an excellent state of preservation.

Through the efforts of Pastor Overbeck, of Zaue, a village near by, the newly found treasure came into the possession of Architect Overbeck, of Berlin, and from him the Imperial Agricultural High School purchased it; but in the meantime Overbeck had had the skeleton mounted by J. Wickersheimer, the missing bones being replaced in alderwood by a skillful sculptor.

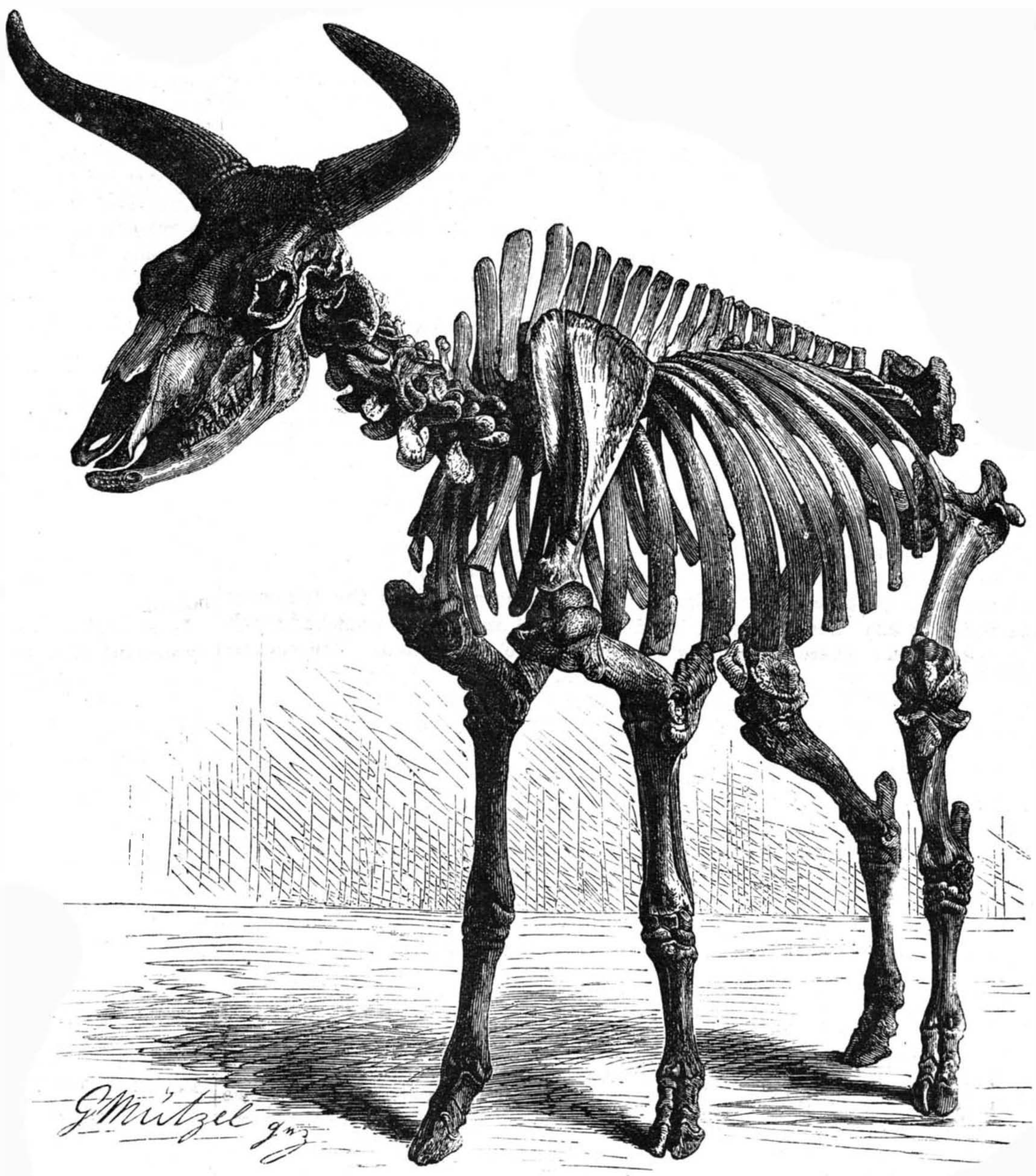
This skeleton is certainly an object of scientific interest. There are, to be sure, skeletons of the *Bos primigenius* in several museums—for instance, Jena, Braunschweig, Copenhagen, and Lund—but they have heretofore been very rare, although numerous skulls are known to exist.

The urus, or *Bos primigenius*, must not be confounded with the so-called aurochs, the real bison (*Bison europæus*). While a few of these latter—protected by strict laws—exist in the woods of Bialowicza (Russian Litauen), the other species is extinct. Several investigators are of the opinion that the last specimens of this class were killed in Poland about three hundred years ago; but others maintain that the urus was extinct in prehistoric times. We are inclined to the former opinion. Whether the so-called "wild cattle" which are kept in the parks of certain large landed proprietors in Scotland could be considered direct descendants of the *Bos primigenius* is doubtful; at any rate, these "wild cattle" are no longer of the same size and general appearance as the really wild urus, but have greatly degenerated in the course of time.

In many points the fossil skeleton from the Guhlen peat bog resembles the Podolion and Hungarian steppe cattle, but the urus is larger than these, as well as all kinds of domestic cattle. The height of the withers of the cow from Guhlen, as now mounted, is 5 feet 6 inches, while the skeleton of a domestic cow seldom measures 5 feet 1 inch. The skull of the former is 2 feet 1 inch long, that of a very large domestic cow is 1 foot 7 inches to 1 foot 9 inches in length. A specimen in the British Museum measures 2 feet 11 inches.

In regard to the horns, the part which was really horn has, naturally, perished in the course of the hundreds or thousands of years; but the well-preserved bone portions, called the horn cores, show that the horn sheaths were large and well formed. The length of one of the horn cores, exclusive of the bend, is 2 feet 3 inches, and its circumference at the base 1 foot 1 inch. The greatest distance between the horns at the curves is 2 feet 5 inches, and at their points they are 3 feet apart. The setting and curves of the horn cores can be seen in the accompanying cut.

As the *Bos primigenius* can rightly be considered the progenitor of our domestic cattle (*Bos taurus*, L.), or at least of certain breeds of them, and as many important investigations depend on a careful comparison of the wild species with their tame descendants, a urus skeleton may certainly be considered an important acquisition, specially for such a museum as that of the Agricultural High School of Berlin, which offers an opportunity for comparison of the skulls and skeletons of wild and tame bovines which is scarcely equaled by any other museum in the world.—*Illustrirte Zeitung.*



A URUS SKELETON (BOS PRIMIGENIUS.)

Autumn Work among the Trees.

All planting north of the latitude of this city is most safely done in the spring. Further south the long autumn enables trees, planted when the leaves are ripe, to push out new roots and establish themselves before the ground freezes. But where cold weather follows close after the early frosts, a tree planted in the autumn has no opportunity to develop new roots, and therefore loses not only the advantage it would have obtained in a more temperate climate in an early and vigorous spring growth, but it is forced to endure the severity of the winter without the aid of roots in active working condition. Trees planted in the autumn do not always die in the Northern States, but they are more apt to suffer than those planted in the spring, they are often blown over unless carefully supported, and they are frequently heaved by the frost or thrown out of the ground entirely. But for all the operations connected with the planting and the care of trees, except the mere setting them in the ground, the autumn is the right time. All planting plans should be completed, and all stock selected, at this season, and the ground to be planted should be prepared and ready to receive the trees.

Our springs are so short and the rush of spring work is always so pressing that it is impossible to properly prepare the ground for planting unless it is done during the summer and autumn. This is the time, therefore, when northern planters should decide what trees they want to plant next spring, and just where they will plant them. It is the time to select and order nursery stock, and if the planter has any facilities for protecting plants through the winter in a cold cellar or pit, this is the time to obtain them from the nursery, rather than in the spring, when nursery men are crowded with orders, and too busy to devote proper time and attention to digging and packing their trees. The ground being prepared, the exact position of each plant determined on, and the plants on hand, the mere setting them in the ground is the work of a short time. The man, moreover, who is thus prepared beforehand for spring planting can take advantage of the first suitable weather, and get his plants into the ground as soon as the frost is out and it is dry enough to work, while if he waits for material ordered in the spring, very often it will not be received until after the trees have started to grow, and warm, dry weather has set in. In a climate like that of our Northern States, where summer follows hard after winter, and where spring is almost unknown, there is no other operation of the farm or of the garden which demands more carefully planned preparation—more forehandedness—than tree planting

The autumn, too, after the leaves have begun to fall from the trees, is the best time to study plantations with the view of determining which trees should be removed and which of those which are to remain need pruning. The actual condition of a tree—its health and shape, and its relation to its neighbors—is best determined after the leaves, or many of them, have fallen; and if trees are to be marked for the ax, it should be done now, and before really cold weather or snow makes the critical examination of each individual practically impossible. The autumn, too, as has been explained in a recent issue of this journal, is the best time for all pruning operations intended to rejuvenate old trees or to bring unsightly ones into shape.

The man, therefore, who has trees should devote some portion of these autumn days to determining how he can improve them by thinning or by pruning, or, if he is a planter, in deciding where his next spring's plantations are to be made, and what they are to be made of.—*Garden and Forest.*

Ants and Butterflies.

In the last number of the *Journal* of the Bombay Natural History Society, Mr. Lionel de Niceville describes the manner in which the larvæ of a species of butterfly (*Tarucus theophrastus*, Fabricius) are cultivated and protected by the large common black ants of Indian gardens and houses. As a rule, ants are the most deadly and inveterate enemies of butterflies, and ruthlessly destroy and eat them whenever they get the chance, but in the present case the larvæ exude a sweet liquid of some sort, of which the ants are inordinately fond, and which they obtain by stroking the larvæ gently with their antennæ. Hence the great care which is taken of them. The larvæ feed on a small thorny bush of the jungle—the *Zizyphus jujuba*—and at the foot of this the ants construct a temporary nest.

About the middle of June, just before the rains set in, great activity is observable on the tree. The ants are busy all day running along the branches and leaves in search of the larvæ, and guiding and driving them down the stem of the tree toward the nest. Each prisoner is guarded until he is got safely into his place, when he falls off into a doze and undergoes his transformation into a pupa. If the loose earth at the foot of the tree is scraped away, hundreds of larvæ and pupæ in all stages of development, arranged in a broad, even band all round the trunk, will be seen. The ants object to uncovering them, and immediately set to work to put the earth back again; if this is taken away again, they will remove all the chrysalids and bury them lower down.

When the butterfly is ready to emerge in about a week it is tenderly assisted to disengage itself from its shell, and, should it be strong and healthy, is left undisturbed to spread its wings and fly away. For some time after they have gained strength they remain hovering over their old home. In one case a butterfly fell to the ground before its opening wings had dried, and a soldier ant tried to rescue it. He carried it back to the tree with the utmost care, and made several attempts to assist the butterfly to hold on again, but finding his efforts unavailing, he left the cripple to recover himself. On his return, seeing no improvement, he appeared to lose all patience, and, rushing in, bit off both wings and carried the body into the nest. But high-handed proceedings of this kind are very unusual. It is said to be a curious sight to watch the fragile and delicate butterflies wandering about, all feeble and helpless, among the busy crowd of coarse black ants, and rubbing shoulders in perfect safety with the ordinary fierce, big headed soldiers. A larva of another species thrown down among them as an experiment was immediately set upon and torn to pieces by the ants.

IT is said that in Leominster, England, there are growing together an oak and an ash which appear to have only one common trunk for four feet and then divide.

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ENGINEERING INVENTIONS.

A safety valve has been patented by Messrs. John W. Spolders and Francis X. Vien, of Brooklyn, N. Y. It is designed to act on the slightest excessive steam pressure, all the contacting points offering very little resistance, while the construction is simple and not liable to get out of order.

A railroad water tank has been patented by Messrs. John Skinner and Rolly W. Jackson, of Newman, Ill. This invention covers improvements to prevent the valve and its connections and the outlet pipe from becoming inoperative from the freezing of the water in the tank, and to do this effectually and cheaply.

A car coupling has been patented by Messrs. Henry L. and Charles W. Banta, of Canon City, Col. This invention covers a peculiar construction and arrangement of the coupling pin adjusting mechanism and of the link adjusting contrivance, the coupling being operated without the train man going between the cars to couple or uncouple them.

An exhaust nozzle extension for locomotives has been patented by Mr. Julius T. Lee, of Mattoon, Ill. Pipes of varying lengths are movably and adjustably supported within the smoke stack, above the stand pipe, whereby the exhaust steam may be discharged at different points in the stack, as desired, to increase or diminish the draught, the use of either discharge pipe being under the ready control of the engineer.

A balanced valve for steam engines has also been patented by the same inventor. The invention consists of an adjustable table or track held in the steam chest, and a roller frame with rollers traveling on the table and supporting the slide valve, being designed to save friction and wear of the valve, while keeping it true and even.

AGRICULTURAL INVENTIONS.

A center draught mowing machine has been patented by Mr. Warren Hill, of Towanda, Pa. This invention covers a novel construction and combination of parts in a machine designed to cut a very broad swath, and in which all the parts are easily adjustable, without rattling, and the minimum amount of friction.

A seeding machine has been patented by Mr. William H. Schenck, of Sterling, Col. This invention provides a drill designed to close without the aid of a drill or furrow closer after the passage of the drill-opening devices, making a narrow furrow and avoiding the necessity of employing a dragging furrow-closer.

MISCELLANEOUS INVENTIONS.

A chinch trap has been patented by Mr. Robert H. Wilson, of Timber Lake, Col. This invention provides a trap of novel construction designed to catch any kind of insects which secrete themselves in crevices and places from which it is difficult to dislodge them.

A bobbin winder for sewing machines has been patented by Annie Lewis, of Galveston, Texas. This invention covers a novel construction, combination, and arrangement of parts, constituting a new and improved attachment for sewing machines for winding bobbins.

A mandrel for bending lead pipes has been patented by Mr. John J. Carr, of Brooklyn, N. Y. It is made with a shank having a quarter bend and slightly tapering, with a shoulder formed on the shank for driving the latter wholly or partly into the pipe to be bent.

A combined burglar alarm and sash lock has been patented by Mr. Archie B. Caudle, of Monroe, N. C. This invention provides a device serving as a lock for the sash, and which operates an alarm, while the sash may be partly raised for ventilation, with no danger of its getting out of order, and the alarm may automatically reset itself.

A rubber compound or mixture has been patented by Mr. John A. Titzel, of Glenshaw, Pa. It is composed of gilsonite asphaltum, vulcanized rubber or scrap or waste, manganated linseed oil, spirits of turpentine, deodorized petroleum naphtha, and powdered sulphur, making a compound to be variously prepared and applied for different uses.

A twine oiler for self-binding reapers has been patented by Mr. Donald McCoig, of Mull, Ontario, Canada. It is a novel device, to be attached to the reaper in such a position that the twine may pass through it while passing from the twine box to the needle, to coat the twine with a substance to prevent insects and mice from eating it.

A whiffletree coupling has been patented by Mr. Ingalls Bragg, of South Andover, Me. This invention relates to an improvement in couplings in which the pivot bolt has a bearing above the whiffletree in a brace fixed to and rising from the cross bar or evener, the object being to make sure against accidental loosening and detachment of the bolt.

A bolt or bar having a coating of enamel or vitreous substance, combined with a protecting sleeve or jacket, has been patented by Mr. Oliver R. Butler, of Cooperstown, N. Y. Such vitreous covering of bolts is designed to absolutely resist the burglar's saw or file, making it impossible to sever a bolt or bar so made by any cutting instrument.

A skimmer has been patented by Mr. George W. Gulledge, of Briartown, Indian Ter. It consists of a pan secured to a handle fulcrumed on a pivot secured to an extension rod, with a slotted fork held on the pivot and pressed against the end of the handle by a spring coiled on a rod extending from the fork, being specially adapted for skimming sorghum while undergoing the usual boiling process.

A rest for packing hats has been patented by Mr. James W. Seymour, of Brooklyn, N. Y. Combined with a packing box having a series of spaced brackets on opposite inner sides is a rest consisting of a ring of the general shape of the hat crown, and having loop ends longer than the width of the hat crown, to facilitate the packing and unpacking of hats in boxes.

A method of musical notation has been patented by Mr. Diego Fallon, of Bogota, U. S. of Colombia. It consists essentially of designating the sounds by consonants and their value and duration by vowels, the music to be written without the use of notes, clefs, keys, staffs, flats, or sharps, to enable a beginner to learn quickly, and to transpose music readily from one key to another.

A churn has been patented by Mr. Lambert Snyder, of Midland Park, N. J. The dash stem has adversely arranged slotted conical frames, with horizontal rods in alignment with the slots of the frames, whereby the fluid is drawn from the top and bottom toward the center of the dasher, in a way designed to make fine butter in a short time, with little labor.

A portable safe has been patented by Mr. Joseph J. Schuknecht, of Bailey, Ohio. It is for the storage of important papers, jewelry, etc., and has a hollow box with a lid, a box enlarged to form a step near its top held in the body a fire-proof filling isolating the box from the body, and other novel features, being cheaply manufactured and designed to afford secure protection against fire.

A combined cane and stool has been patented by Mr. William Leisner, of Los Angeles, Cal. This invention covers a cane made with two separable sections, a tubular head section and a body section, with two series of essentially triangular hinged members, and other novel features, making a cane which can be conveniently converted into a stool, while the article can be simply and cheaply manufactured.

A screw driver has been patented by Mr. Michael Cashin, of New York City. It has a longitudinally slotted handle with reversible pawls, the bit having right and left threads, a ratchet having pins engaging grooves in the bit, the pawls being adapted to be thrown into and out of engagement with the ratchet by turning the cap, the device being designed to be used as a simple screw driver or a ratchet screw driver.

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THE METALLIC ALLOYS. A practical guide for the manufacture of all kinds of alloys, amalgams, and solders used by metal workers, together with their chemical and physical properties and their application in the arts and the industries, with an appendix on the coloring of alloys. Translated and edited, chiefly from the German of A. Krupp and Andreas Wildberger, with extensive additions, by William T. Brannt, one of the editors of "The Techno-Chemical Receipt Book," etc. Illustrated by sixteen engravings. 12mo. Pp. 428. Price $2.50. Philadelphia: Henry Carey Baird & Co., 810 Walnut Street.

The title as given above very well indicates the range of this admirable volume, which surpasses in completeness any book on alloys, amalgams, and the coloring of metals previously published in the English language. The treatise is arranged under forty-six chapters or sections and an appendix, each discussing with great amplitude a different subject, and it would be difficult for any worker in metals to fail to find precisely the alloy, amalgam, or solder which he needs, with a clear description of its properties and uses. A specially interesting feature of the book is the fullness with which phosphor bronze and aluminum alloys are treated. Like all of the publications of this house, so widely known by the industrial character of its books, this volume is provided with a full table of contents and an admirable index, these rendering any subject in it easy of access.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) C. W. D. asks: For the best way to get copper off the sides of a vat which has deposited there. The vat is lead lined. Also can you give me the process of coating electrotypes with steel? A. Connect your vat to the wire leading to the copper or carbon of your battery. Fill vat with sulphuric acid and water, and carry a wire from your zinc pole to a plate of copper immersed in the sulphuric acid. This will strip the copper.—For steeling process we refer you to SUPPLEMENT, No. 605, which we can send you for 10 cents.

(2) H. W. W. asks: 1. What is the process for reducing raw lump alum to burnt alum powder in large quantities? And what is loss in weight of alum by evaporation? A. Simply heat the alum in an open vessel to 401° Fah., such as an enameled frying pan. The following are the elaborate directions of the United States Pharmacopœia: Alum, in small pieces, one hundred and eighty-four parts. To make one hundred parts. Expose the alum for several days to a temperature of about 80° C. (176° Fah.) until it has thoroughly effloresced. Then place it in a porcelain capsule, and gradually heat it to a temperature of 200° C. (392° Fah.), being careful not to allow the heat to rise above 205° C. (401° Fah.) Continue heating at the before mentioned temperature until the mass becomes white and porous, and weighs one hundred parts. When cold, reduce it to a fine powder, and preserve it in well stopped vessels. 2. Please give receipt for a good blacking. A. For blacking we refer you to Phin's "Trade Secrets," which we can send you by mail for sixty cents.

(3) D. F. C. writes: A party recently passed through here selling a powder which, placed in a lamp containing oil, rendered it non-explosive; do you know of any compound of that description? A. We do not, and no such powder is known. The powder sold was valueless, and without effect of any kind.

(4) A. R. S. asks: 1. If hot and cold water are exposed to a temperature below freezing, will the hot water freeze first? Will it make any difference in this respect whether the water is in open vessels or in closed pipes? A. The cold water will freeze first, whether in open vessels or in pipes. 2. If water that has been heated and is become cold again and water that has not been heated are exposed to heat, will they both begin to boil at the same time? A. The unheated water will be apt to boil the first, owing to the presence of a certain amount of dissolved gases.

(5) R. G. D. asks: 1. If a solid glass ball be dropped into the ocean (at its greatest depth), will it sink to the bottom? A. It will. 2. Why should a diver be weighted according to the depth he desires to descend? A. This is a practical question. A weight that would cause a man to sink in one depth would insure his sinking to any depth. The diver finds by experience what weighting is best adapted to his needs.

(6) A. F. B. asks: 1. How near may one go to a dynamo for the electric light without danger of having one's watch balance wheel magnetized? A. It depends on the dynamo, its size, make, etc., and also on the size, quality of steel, etc., used in the watch movement. 2. What are the symptoms of such magnetizing? A. Your watch will fail to keep time, and the works will attract a fine needle suspended by a thin thread. 3. Supposing the watch balance to be magnetized, how may this be entirely demagnetized? A. For demagnetization of watches we refer you to SUPPLEMENT, Nos. 206, 207, and SCIENTIFIC AMERICAN, 14, vol. 55.

(7) G. B. asks whether or not bisulphide of carbon is too dangerous to handle as an ant and gopher destroyer; in fact, as general insect destroyer. If not too dangerous for a careful person to use, will you please state how best used for above purpose? A. Bisulphide of carbon as well as its vapor is highly inflammable. Inhalation of its vapor produces very serious effects, a species of intoxication following, with loss of memory, etc. A person might become its victim when applying it, however careful he might be. Inject into soil with a syringe or force pump. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 471, which we can send you for ten cents, for illustrations of improved appliances for application of bisulphide of carbon to the soil.

(8) E. F. F. writes: In a discussion with a friend, I made use of the phrase that in the telephone sound was converted into electricity on one end, and then on the other end of the line reconverted into sound. The correctness of this expression was doubted, it being held

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that sound could not be turned into electricity. Please decide whether I am right, and if not, please explain the principle of the process. A. Sound is not convertible into electricity, but sound waves are utilized as a motive power for operating apparatus for varying the current, or for generating it, according to the kind of instrument used. In the case of the carbon transmitter, the vibration of the diaphragm by the impact of sound waves varies the current in the local circuit by varying the pressure of the two electrodes of the transmitter. The Bell telephone, when used as a transmitter, is simply a magneto-electric generator in which the armature is vibratory instead of rotary. The diaphragm (which is the armature), when vibrated by sound waves, causes electrical impulses to be generated in the coils of the instrument. These electrical impulses produce in the diaphragm of the receiving instrument vibrations corresponding to those of the transmitting instrument, and the vibration of the diaphragm of the receiving instrument produces air vibrations similar to those which actuated the diaphragm of the transmitting instrument.

(9) S. S. asks: 1. Can I do satisfactory nickel plating without a battery? A. No. 2. If not, what kind of a battery would you recommend? A. Use a large bichromate Bunsen type battery.

(10) N. S. C. asks: 1. What are the proportions of air and common illuminating gas that constitute the most explosive mixture? A. One gas, seven to ten air. 2. How can I remove writing ink stains from a photograph? A. Use a dilute solution of oxalic acid.

(11) F. X. W.—For information as to construction of electrical apparatus in general we refer you to Bottone's "Electrical Instrument Making for Amateurs," which we can send you by mail for $1.20.

(12) H. M. B. asks how and of what material is superphosphate made. A. It is made by treating phosphate of lime with sulphuric acid in proper amount. As a source of phosphate of lime the natural phosphate rock of Charleston, S. C., is largely used.

(13) G. F. writes: In using tallow in my laundry I succeed in making it odorless. I wish to know the way to make it white and soft. A. Melt and heat with water, allow to cool, and remove the solid tallow. If it is bad to start with, you will probably be unable to purify it satisfactorily.

(14) R. H.—For information on balloons we refer you to May's "Ballooning," which we can send by mail for $1.00. For emery wheel address makers, stating your requirements. A 40 foot sloop yacht may run at from $300 up to $2,000 per annum; a 40 foot steam yacht will cost about twice as much.

(15) W. W. C. asks: 1. How can I treat cow horns so they may be bent into shapes? A. Steam will soften them so that they can be bent to a certain extent. 2. Is there any process for dyeing or coloring horns black? A. They may be dyed by an aniline dye, or by soaking in copperas solution, followed by soaking in logwood decoction.

(16) V. C. T. asks: What would be the best book to get for a young man of 18 to learn electricity? A. We recommend Thompson's "Elementary Electricity," price $1.25. "Practical Electricity," by Ayrton, $2.50. Thompson's "Dynamo-Electricity," $5. We can supply all of these works, free by mail.]

(17) A. P. asks for a paste or cement by which cotton cloth may be made to adhere to metal plates, the latter throwing out a heat of about as great as the hand can bear. A. Try silicate of soda, also try gum tragacanth mixed with water and a little glycerine to the thickness of soft butter.

(18) F. V. asks how to make a solution of tin for electroplating.

A. Distilled water	200	parts by weight.
Pyrophosphate of soda	2	" " "
Fused chloride of tin	200	" " "

Dissolve the soda salt first, and then gradually introduce the tin salt.

(19) W. I. K. asks: How many cells, and of what kind, would be required to run a one candle power Edison miniature lamp? How long will same be run by the battery, that is, in continuous use? A. One or two good bichromate cells, Grenet or Bunsen, would run it for a number of hours.

(20) W. W. C. asks: 1. Will a battery composed of a zinc and a copper plate suspended in a strong solution of NaCl be reliable when placed in the circuit of an electric door bell? A. It will be very weak and liable to polarization. 2. What is the best and simplest home-made battery for an electric door bell? A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 157. 3. Does a stop or diaphragm when placed in a lens have any more effect than to exclude the rays of light that fall on the outer edge of the lens? A. This is practically its function. 4. Would a Darlot R. H. (common angle lens), which with full opening covers a four-fifth plate, cover a larger one if stoppered down with a diaphragm three-sixteenths of an inch in diameter? If so, what size? A. Probably it would cover a 6½×8½ plate. To test it hold the lens in front of a window, then place a large white cardboard behind it, moving it nearer or further from the lens until the image is distinct. Then measure the circle it cuts, and you have the actual size of plate it will cover. 5. What is the best shape for a canvas canoe for speed on smooth water? Why? A. The one that will expose the minimum surface, because "skin friction" is the principal resistance to the motion of a vessel. 6. Of what wood would you recommend that the frame be built? A. Ash, hickory, or white oak, as strong, light, and easily bent. 7. Is there any better way for waterproofing canvas than applying one or two coats of linseed oil, letting it dry, and then varnishing? A. Melted paraffin is excellent. For full details of canoe construction we refer you to our SUPPLEMENT, Nos. 164, 181, 216, and 219, which we can send you for 10 cents each.

(21) O. S. asks: 1. Is there a locomotive or stationary engine in existence that can get up steam enough to run itself with a one-inch hole in the dome? A. It is a question of size of boiler, of size of engine, of relative sizes, and of steaming capacity. The question we answer affirmatively. 2. Is there any substance that can be mixed with liquid glass that will thin it, and what is liquid glass made of? A. Water. Liquid glass is a solution of silicate of soda or potash in water. 3. Which is the highest mountain in the world? A. Mt. Everest, in the Himalaya ranges in Asia—29,000 feet high. 4. What was the highest altitude ever reached by man, and by whom? A. 37,000 feet, attained by Glaisher and Coxwell in a balloon, September 5, 1862. 5. Are white maple and sugar tree the same? A. Yes.

(22) A. C. asks for a formula for collodio-bromide emulsion that is rapid. The following is recommended:

Ether s. g. 0·720	4	fluid ounces.
Alcohol s. g. 0·820	2½	" "
Pyroxyline	40	grains.
Castile soap dissolved in alcohol	30	"
Bromide of ammonium and cadmium	56	"

Dissolve 125 grains of nitrate of silver in one ounce of boiling alcohol, and sensitize the emulsion by adding one drachm of the silver solution at a time, thoroughly stirring with a glass rod until the silver is well incorporated. After the whole has stood for twelve hours add 30 grains more of the double bromide of ammonium and cadmium dissolved in half an ounce of alcohol. After standing for a few hours longer the emulsion is poured into a flat dish and allowed to evaporate and dry. It is then washed with distilled water by repeated soakings until all the soluble salts are removed. After drying it is again redissolved in equal parts of alcohol, at the rate of from twenty to twenty-four grains to the ounce of solvents. Then it is ready for use, and plates may be used wet or dry.

(23) J. McG. asks: 1. What is meant by the philosopher's stone? A. A substance which could turn base metals into gold. 2. How can I make ethereal solution of gold? A. To one part strong solution of terchloride of gold add three parts ether in a separatory funnel, mix by gentle agitation, allow it to stand until the supernatant ether is strongly colored, draw off the water from beneath, and the solution will remain. 3. Will hydrochloric acid etch soft steel? A. Yes. 4. Which is the cheapest for newspaper etching—copper or zinc plates? A. Zinc plates are used for relief work.

(24) E. H. F. asks for the best way of applying naphtha to furniture and carpets, to be effectual in destroying Buffalo moths, without injury to the articles. A. Naphtha will not injure carpets, but will injure varnish. It can be applied by sprinkling. It is very dangerous as regards conflagration, its vapor being liable to ignite from fires, lamps, etc.

(25) T. H. B. asks how to prepare a toilet cream, with snow white petrolatum as the base, and mixture tinted a faint or delicate pink. A. You can color the petrolatum pink by a little alkanine, or extract of alkanet root. It can be stiffened with a little white wax, and almond oil can be added. The subject is excellently treated in various books, such as Cooley's "Practical Treatise on Perfumery," which we can send you by mail for $1.50.

(26) G. R. C. asks how white metal is made. I mean the kind that is used in the manufacture of cheap table ware, such as table casters, spoons, butter knives, etc. The metal being naturally soft, will you also please state how same can be hardened and still retain its color? I want it for small castings, cog wheels, etc. A. The following are formulas for white metal. Melt together: (*a*) Tin 82, lead 18, antimony 5, zinc 1, copper 4 parts. (*b*) Brass 32, lead 2, tin 2, zinc 1 part. For a hard metal, not so white, melt together bismuth 6 parts, zinc 3 parts, lead 13 parts. Or use type metal—lead 3 to 7 parts, antimony 1 part.

(27) J. P. asks for a good recipe for stove polish. A. We can supply you with "The Techno-Chemical Receipt Book," price $2, which contains a very good receipt for stove polish.

(28) T. J. asks: Can a molecule exist apart from gravity? A. Gravity is supposed to be inherent in all molecules; none can exist without possessing it.

(29) A. G. asks for the best wire to use for heating purposes. A. Platinum, which may be coated with a thin wash of pipe clay and water.

(30) Carpenter asks: Would you please tell me how long a man could subsist without any special inconveniences in a barrel six feet in diameter, ten feet long, perfectly airtight? A. One or two hours.

(31) S. R. K. writes: Please straighten me out on the following problems: 1.

$$y=17\sqrt[1\cdot35]{\frac{45{,}000}{80{,}500}}=\ ?$$

A. Reduce the quantity under the sign to a decimal, find logarithm, divide the logarithm by 1·35, and find number corresponding thereto, multiply this by 17. 2.

$$P=\left(\frac{1}{1\cdot3308}\right)^{1\cdot4}=\ ?$$

A. Reduce quantity within parenthesis to decimal, find logarithm, multiply the logarithm by 1·4, and find number corresponding thereto.

(32) R. B.—The size of a wheel affects the sliding friction at the axle, and the resistance offered as its circumference in its rolling motion strikes obstacles on the road. The large wheel is normally the easiest running.

(33) J. B. S. writes: I wish to extract the fiber from a certain kind of grass. What is the simplest plan without machinery? A. Soak in water and beat with a mallet until the fiber separates; repeated washings and rubbings will gradually remove all soft matter and leave pure fiber.

(34) F. S. asks how the operation known as "boiling out" a meerschaum pipe is performed. A. The pipe is immersed in hot beeswax for ten or fifteen minutes.

(35) W. T. asks: 1. How many pounds of pressure will a mixture of O and H produce by their combination by electricity in a limited space of the same volume as the gas? A. Ten atmospheres under the most favorable circumstances. 2. What will be the temperature? A. About 7,000° Fah., under assumption of complete combustion; practically far less. 3. Will it take less O and H mixed in a proper proportion to run a gas engine than the gas generally used, and what will be the proportion in cubic feet? A. It will take about seven times as much coal gas and air.

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November 6, 1888,

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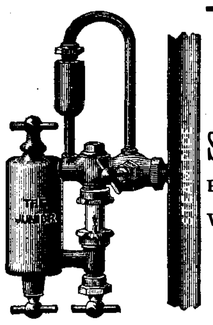
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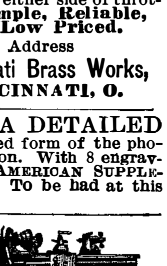

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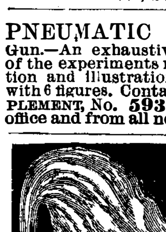
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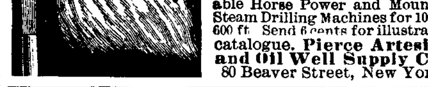
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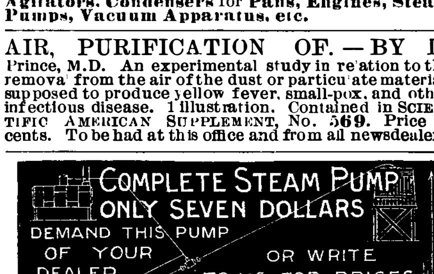

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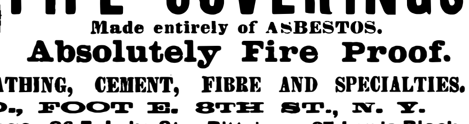

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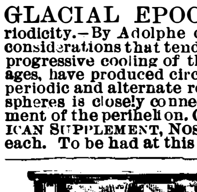

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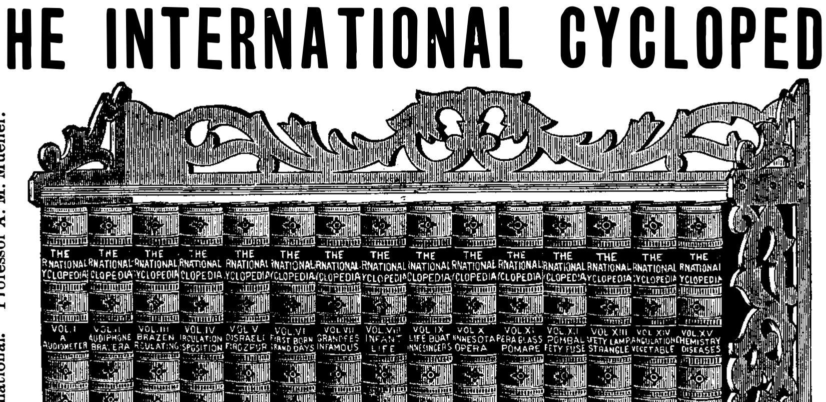

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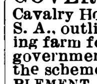

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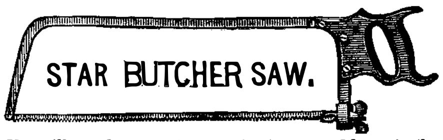

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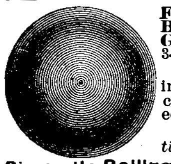

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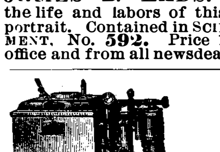

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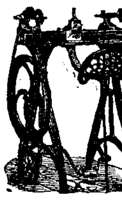

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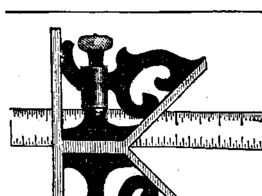

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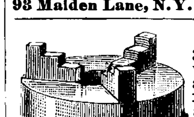

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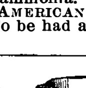

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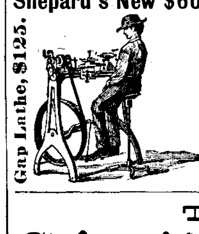

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