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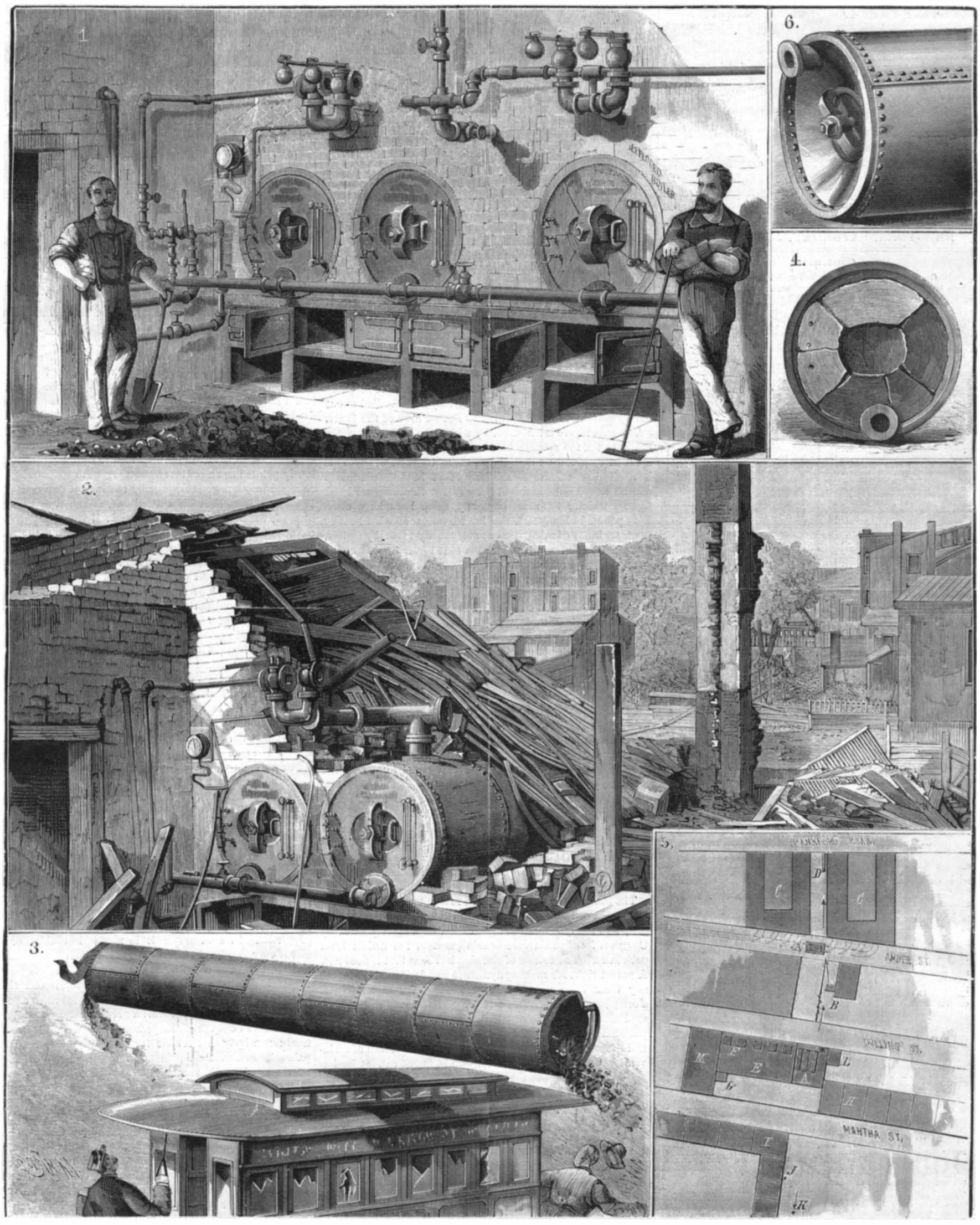

EXPLOSION OF A PLAIN CYLINDER BOILER IN PHILADELPHIA —(See page 20.)

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NEW YORK, SATURDAY, JULY 9, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 288,

For the Week ending July 9, 1881.

Price 10 cents. For sale by all newsdealers.

STATE LAWS AFFECTING PATENTS.

Can the State legislatures exercise any control over dealings under patent rights? This question is one of increasing importance, and presents many aspects: one of which—the power of a State to tax goods manufactured under a patent—is instructively discussed in a very recent Supreme Court decision. Other aspects of the question are not unfamiliar. Every reader knows that the general subject of granting and enforcing patent rights is under the exclusive control of Congress, and that the States cannot directly interfere with a privilege which Congress has granted. But how far does this prohibition extend? Very clearly, just as a State cannot issue a patent, so it has no authority to decide whether one is valid or to punish infringements. On the other hand, the great mass of ordinary contracts may come under State authority, notwithstanding they spring in some way from a patent right; thus State courts may decide the meaning of an assignment, or entertain a suit for damages for breach of a contract about a patent.

As the States need to be constantly on the watch for new subjects of taxation from which they may derive revenue for their increasing expenses, and the development of invention under the patent laws is steadily embracing more and more of the lucrative manufacturing business of the country, a claim to impose taxes on patent rights and dealings under them has been very natural. The general result of the discussion has been that the patent right itself, being a privilege directly granted by Congress, although a species of property, cannot be taxed by a State; for if these rights might be taxed at all, they might be taxed so heavily as practically to crush them. No authority can be conceded to the States which might result in enabling a legislature to destroy a privilege which Congress has been authorized to grant. Thus, also, a State cannot, by taxes, hinder the sale of a patent right or the exercise, under it, of the privilege of manufacturing. The combination of different materials to produce a new result or an old result better or more rapidly, which constitutes the invention, cannot be forbidden by the State; and if it cannot be forbidden, it cannot be taxed; for to tax is to forbid unless the tax shall be paid. But somewhere here the restriction upon the taxing power ceases. The right conferred by the patent laws upon an inventor to exercise or sell to another the invention he has made does not extend to the manufactured article; it does not take the tangible property in which the invention or discovery may be embodied out of the operation of the general tax or license laws of the State.

The case above mentioned, by which the authority of the States to tax the manufactured article has been established, arose in Virginia, under a law of the legislature, which made it a criminal offense to sell anywhere in Virginia things manufactured outside the State, without obtaining a license fee, for which a tax must be paid. Such laws have often been passed in late years, and have borne somewhat heavily upon all kinds of sales, such as are usually made by agents, drummers, and traveling salesmen sent throughout the comparatively new regions of the country to represent the large manufacturing establishments in the older parts. They have been enacted chiefly in the West and South, and are there, no doubt, considered a healthful encouragement of domestic manufactures and trade; while the view at the East and in the Federal courts has been that they involve an objectionable interference with the uniformity and freedom of commerce. In Virginia a traveling agent for the "Singer sewing machines," representing the Singer Manufacturing Company in New York, continued his sales without complying with the law. He was prosecuted and fined $50. He contested this fine in the State court; one of the arguments urged in his behalf being that the State could not impose any burden upon the sale of a machine patented under the laws of Congress. The Virginia court decided against him, and the Supreme Court has now pronounced the decision correct, saying that the grant of letters patent for the invention of the sewing machine does not prevent a law imposing a license fee for making sales of particular machines made under it. It is, however, noteworthy that the Supreme Court pronounced the Virginia law invalid for another reason, viz., for taxing the machines merely because made in another State.*

The States have sometimes seen reason to legislate for the protection of their people against noxious or dangerous articles, and the question has arisen whether a right granted by Congress for manufacture or sale exempts the article from such laws. The course of decision has been that it does not. A patent right for making dynamite powder does not prevent any State from prescribing regulations for manufacture, storage, and sale, such as will protect the community from explosions. So, a patent right for the manufacture of a poison does not impair the right of a State legislature to control the sale and use of the article. The ownership of an invention secured to the inventor by his patent cannot be impaired by local legislation; but he must be contented to enjoy it in subordination to the general authority of the State over all actual property within her limits. A similar question has arisen in States which forbid or seek to hinder the sale of intoxicating beverages, where liquor dealers have claimed that the internal revenue licenses granted under the laws of Congress gave them a right to sell which the local law could not gainsay. But such claims have been repudiated in the courts. Neither the patent laws nor internal revenue laws were intended to displace what is called the "police power" of any State; by which term is meant that general authority, necessarily vested in every government, of providing for the health, good order, peace, and general welfare of the community.

A distinct decision upon this branch of the subject was rendered about two years ago relative to the "Aurora oil." This oil was manufactured under a patent right. There was, however, a law of the State (Kentucky) which required all coal oils and like burning fluids to be inspected before sale; and punished the offering for sale of any which the inspector condemned as below the standard for safety. A dealer who sold a parcel of the Aurora oil which had been condemned, claimed that he had a right under his patent to sell the oil in any part of the United States, and that no State could forbid him. But the Supreme Court pronounced this claim inadmissible, saying that the patentee's right in the manufactured article must be enjoyed subject to the complete and salutary power, with which the States have never parted, of so defining and regulating the sale and use of property as to afford protection to the common people. The ownership of the manufactured article is altogether distinct from the right to the invention or discovery; the invention is protected by national authority against all interference; but the use of the tangible property which is manufactured by means of the invention is not taken out of State control by the patent right.

In so far as the decisions treat a patent right as superior to State laws, they evidently throw upon Congress the duty and responsibility of passing all laws which the interests of the general public demand. And it is scarcely to be denied that the subject has not received proper attention. There is one class of frauds from which farmers and dwellers in rural districts, especially foreigners not well acquainted with our language and business customs, have suffered extensively. It has been common for agents to travel through small towns and villages, offering to sell county rights, or to appoint local agents, for some new and patented invention. There are various forms in which such business is done; sometimes the traveling salesman offers to furnish the manufactured article in quantities for sale; sometimes he offers a license to manufacture within a limited territory; sometimes an agency to sell rights. But his negotiation always tends toward obtaining a negotiable note, or something which he can turn into a note, from one of the "solid men" of the place. Indeed there are several instances on record in which a person who could not read has been led to sign a note by assurances that it was only a paper appointing him agent; or in which one who could read has been enticed to sign a paper ingeniously printed as an ordinary contract, but capable of being changed into a negotiable note by cutting off one end of it. If the note were held when it fell due, and sued by the agent himself, the honest villager who made it would have some chance of obtaining justice; for if he could prove the fraud he would be released. But the agent never keeps the note. When it falls due, the maker finds that the agent almost immediately got the note discounted and went on his way to parts unknown. The note is owned by "an indorser for value and without notice." Now a familiar rule of law forbids the maker of a note to make defenses which would be perfectly good against the payee, when the note is presented by one who bought it innocently before it was due. Thus the swindle is completed.

Congress has taken no pains to suppress these fraudulent dealings; yet when some of the States have endeavored to protect their citizens against these traveling patent salesmen, the objection has been made that their laws are unconstitutional; that the manner of selling a patent right is wholly within the care of Congress. This is probably true; but forms a reason why Congress should pass a proper law.

* The decision of the Virginia Court of Appeals is published as Webber's case, 33 *Gratt.* 898; and that of the Supreme Court as Webber *vs.* Virginia, 12 *Cent., L. J.*, 488.

WATER GLASS.

In 1640 Von Helmont discovered that when in the preparation of glass from sand and alkali an excess of alkali was used the glass dissolved in boiling water, but it was not until 1828 that water glass as now known was prepared and practically utilized by Von Fuchs, in *stereochromy* or *solid color* painting, in mural and monumental decoration, and for the preparation of various cements and artificial stones. Water glass, soluble glass, or silicate of soda, as it is variously called, possesses, when properly prepared, many unique and valuable properties. In cold water it is nearly insoluble, or dissolves very slowly. In boiling water it dissolves with facility and remains in solution when the latter has cooled. Water containing 30 per cent of the glass in solution is of a sirupy consistence, and may be used as a transparent varnish on many substances; on drying it forms a glassy coating that resists moisture and change of temperature very well. It has been used extensively as a vehicle for certain pigments to form paints known as silica paints. These have the advantage over all paints or varnishes of being incombustible, and when used on woodwork serve in a measure to prevent sudden ignition of the wood by contact with flame. They are also serviceable in painting theatrical scenery, cloth saturated with a dilute water glass varnish becoming uninflammable. The pigments used in these paints are: zinc white, barytes, chrome green, chrome oxide, chrome red or orange, cobalt ultramarine, zinc yellow, ultramarine, cadmium sulphide, ocher, etc. Chalk mixed with water glass forms on drying a very compact stone as hard as marble; bone ash, zinc white, and magnesia with water glass form similar stones. Ransom's artificial stone is prepared by mixing sand with water glass solution to form a plastic mass which is pressed

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into the required shapes, then placed in solution of calcium chloride; silicate of calcium is formed and cements the grains together, the chloride of sodium formed at the same time being removed by washing with water.

In connection with clay, lime, sand, cement, etc, soluble glass enters largely into the composition of many of the patented artificial stones, plastic tiles, slates, etc.

The detergent properties of water glass make it an excellent scouring material, and it enters largely into the composition of most of our common soaps.

Water glass is best prepared by melting together in a crucible powdered quartz or quartz sand and carbonate of soda. Usually a small quantity of charcoal is introduced, but if the materials used are free from metallic oxides and compounds this in unnecessary.

Fine infusorial earth is nearly pure silica and makes excellent water glass. Where quartz or sand is employed it is reduced by grinding together with the calcined soda to a powder, the whole of which will pass through an eighty-mesh wire-gauze sieve.

The following are the usual proportions in which the materials are mixed:

1.	Clear quartz	45 pounds.
	Carbonate of soda, calcined	23 "
	Charcoal	3 "
2.	Quartz sand	100 pounds.
	Calcined soda	48 "
	Charcoal	5 "
3.	Quartz sand, purified	65 pounds.
	Anhydrous carbonate of soda	34 "
	Powdered charcoal	4 "

The ingredients, thoroughly mixed, are put into clay pots and gradually heated to bright redness; carbonic acid and oxide escape and the mass gradually becomes liquefied. When effervescence ceases and fusion is complete, the contents of the pots are poured out on clean stone slabs to cool. When made of good materials and properly fused the glass closely resembles ordinary flint glass.

Cold water scarcely dissolves it at all, but if broken into small pieces and boiled in soft water it gradually dissolves. If the boiling is continued some time and a sufficient quantity of glass is added, a clear sirupy liquid or a nearly colorless jelly, according to circumstances, is obtained. These solutions may be diluted with hot water.

The solution containing about 30 per cent of the glass is in greatest demand. It is quoted at fifty cents per gallon, put up in barrels or kegs.

THE STEPHENSON CENTENARY.

One of the notable features of the celebration of the hundredth anniversary of the birth of George Stephenson, at Newcastle, England, June 9, was a parade of locomotive engines. To this the leading railway companies contributed typical examples of the best modern locomotives for passenger and freight traffic, besides a considerable number of early locomotives, or so much of them as remained after the numerous alterations and repairs they were subjected to while in use. In the latter class was the engine called "Locomotive No. 1," built at Newcastle in 1825 by Stephenson for the Stockton and Darlington Railway Company. Another was the "Billy," fourth of its class, built by Stephenson & Co. in 1830. This was a four-wheel coupled engine, as was a similar specimen engine from the Old Hetton Colliery, which contained only the cast iron dome on top of the boiler, the steam pipes, and the feed pump of the original, the rest having been removed when the engine was rebuilt in 1874.

The propriety of ascribing so much honor to Stephenson has been seriously questioned, and his right to the complimentary title, "Father of Modern Railroads," has been disputed. It is true that Stephenson invented neither the railway nor the locomotive engine; the distinctive features even of his successful engine may be ascribed to others; nevertheless Stephenson had so much to do with the genesis of the modern railway system, and his work was of such a vital character at the critical moment when the promise of the locomotive was being put in the way of fulfillment—at the moment when steam transit on rails was first made a practical and profitable certainty—that he is fairly entitled to have his name placed at the head of those to whom we owe the railway as it is.

Railways of a sort were in practical use before Stephenson was born, and for more than a century the steam wagon had been the dream of inventors. As early as 1698 Papin had constructed a small model locomotive engine. Fifty years later Cugnot was at work upon a steam carriage employing two open-topped high pressure steam cylinders, the piston rods working upon the same axis. In his patent of April 28, 1784, Watt describes an improvement on "steam engines which are applied to give motion to wheel carriages for removing persons, goods, or other matters from place to place, in which cases the engines themselves must be portable." In the same year (1784), when Stephenson was but three years old, William Murdock made a working model of a high pressure locomotive, which is said to have performed well; but he abandoned his experiments in that direction through the remonstrance of Watt. On the expiration of Watt's patent in 1801, Richard Trevithick made a steam carriage which ran very promisingly on a common road until, through bad steering, it was overturned in a ditch. In the meantime our own ill-appreciated inventor, Oliver Evans, had worked upon the same problem with such success that he confidently predicted that the child was then born who would travel from Philadelphia to Boston in a steam wagon. He also went so far as to design sleeping cars and other railway conveniences so far beyond the comprehension of his fellows that his reputation for sanity was grievously endangered.

In 1802 Trevithick and Vivian obtained a patent for improvements in steam engines and their application to the propelling of carriages, and two or three "puffing devils" were made by them that year and the year after for use in London. They were able to make five or six miles an hour on common roads, but the enterprise was, after all, a failure. The next attempt of Trevithick was a high pressure locomotive engine for railroads, built at Pen-y-darran, in South Wales, in 1804. It ran well and did good service, but its weight finally broke the cast iron plates of the tramway, and it came to grief with broken axles. In 1805 a similar engine was constructed at Newcastle. It ran backward and forward quite well on a temporary track, but for some reason it was never put upon the road. After many years' service as a stationary engine it was set aside, and finally found an honored resting place in the Patent Museum at South Kensington. In 1808 Trevithick was running another locomotive—the "Catch-me-who-can"—around a circular track in London, for exhibition purposes. In 1811 John Blenkensop patented a rack rail for a steam railway, and had constructed an engine in which, for the first time, there were employed two double-acting steam cylinders. It was built by the engine firm of Fenton, Murray & Wood, of Leeds, Trevithick's patent being still alive. This engine (with others) began running on the railway from Middleton Collieries to Leeds, August 12, 1812, and continued in use for many years.

Here was the real beginning of practical steam railroading. Within a year after the introduction of Blenkensop's engines, three different methods of effecting steam locomotion were patented in England. The smooth-wheeled engine "Puffing Billy," now in the Patent Museum at South Kensington, was put to work in 1813. Stephenson made his first engine in 1814, departing from Blenkensop's plan mainly in using smooth wheels. Springs were introduced in 1815. But little progress was made during the next ten or twelve years, though quite a number of engines were built by Stephenson and others. In 1827 Timothy Hackworth built the "Royal George," the first of a new type, the nearest approach to the modern locomotive that had been designed. In 1829 Robert Stephenson (not his father, as is commonly reported) built the "Rocket," in which the multitubular boiler appeared for the first time. It also had an improvement in the blast pipe arrangement of Hackworth. The "Rocket," came out ahead in the celebrated competitive trial of locomotives on the Liverpool and Manchester Railway, in October, 1829; and it was the successful application of steam locomotion on this road that insured the final victory of steam transport and inaugurated the modern railway system of Great Britain.

THE GREAT COMET NOW IN SIGHT.

The comet which made its appearance to the naked eye in the northeastern sky on the morning of June 23, and was seen from many points between Hartford, Conn., and San Francisco, Cal., is perhaps the comet lately reported by Dr. Gould, of Cordova Observatory in South America. It appeared, after its perhelion passage, in the constellation Auriga, about eight degrees from Capella, with a bright center and a tail fifteen degrees long. It promises to be a conspicuous object in the heavens this summer.

The new comer was almost simultaneously discovered in this country by P. H. Thompson, Blufton, Ga.; by T. L. Edwards, Haverford College, Pa.; E. L. Larkin, New Windsor, and several others. We are indebted to Mr. Thompson for a special telegram announcing his interesting observation.

A correspondent of the New York *Sun* reports the discovery of the comet at a little before 2 o'clock A.M., June 23, at Washington. This we believe is the very earliest sight of the stranger, and may entitle the observer to the Warren prize of $200. The first appearance of the comet is thus described by the *Sun* correspondent:

"Just before 2 o'clock this morning the writer was summoned to an upper story window by a night watcher in the hotel. Pointing to the horizon just east of the Georgetown Heights, the watcher said: 'Don't you see that distant fire?'

"Shooting up from the horizon was a bright, silvery, perfectly defined, and steady stream of light, fan shaped. It was wholly unlike the light of a distant conflagration. The stream seemed to reach further and further up, pointing to the pole star. The boundary lines were well defined, and converged. It was no fire. There were none of the waves of light suggesting an auroral display. The distant glitter of a moving electric light was the only explanation that could be given of the singular phenomenon. Suddenly there arose from the horizon a brilliant disk of light, bright as Venus at her brightest, and fully as large as that planet appears. Into this disk or nucleus the fan-shaped stream of light converged. There was no longer any doubt; it was the bursting into view of a comet, the like of which has not been seen since Donati's comet of twenty-three years ago.

"The comet rose rapidly and became a splendid object. At 3 o'clock it was about fifteen degrees above the horizon and forty-five degrees north of the moon. At this altitude the tail was about ten degrees long. It moved apparently rapidly in an easterly direction, and was visible until after sunrise."

At half past four it was seen at Bodie, Cal., where the nucleus was well defined and the tail brilliant. It was observed at Tombstone, Arizona, at four A.M., with the nucleus apparently half the size of a full moon, and the tail fan shape and very brilliant.

A dispatch from London says the new comet in the northern heavens can be seen by the unaided eye even in the morning twilight. It is predicted by astronomers that before the first of July it will be visible all night.

The identity of this remarkable body will doubtless be soon determined. Professor Lewis Swift thinks it may possibly prove to be the great comet of 1812, which has been expected to reappear in this quarter about this time.

Dr. Gould, of the National Observatory of the Argentine Republic at Cordoba, S. A., announced, June 1, the appearance there of a large comet which he suspects to be the great comet of 1807, though that comet was not expected to return for some fifteen centuries.

Concentrating or Storing up Electricity.

We give, on another page, extracts from an able review and criticism by Mr. Geraldy, of the performances and claims of the new Faure battery. We also present an illustration of the use of the battery in propelling a boat on the river Seine, at Paris. The battery has also been applied to drive a passenger omnibus in Paris, with promising results, so the newspapers state.

Mr. Geraldy points out very clearly that the battery is not capable of delivering such a large percentage of energy as has been claimed for it; and his conclusions seem to be well sustained. We also have a letter from a correspondent in Paris who tells us that the invention is classed there like the Keely motor, and that the most extraordinary efforts are being made to force the sale of stock shares in the patents, which no doubt accounts for the published inaccuracies which Mr. Geraldy mentions.

In London Professor Osborne Reynolds has deemed it necessary to publish a note, cautionary to the public not to be misled by the enthusiasm with which Sir William Thomson views the new battery. Professor Reynolds makes the point that in a pound of coal there are stored up eleven million foot pounds of energy, while in a seventy pound Faure battery there is only one half that amount of energy. He also reminds the public of other modes of transmitting energy, such as wires, ropes, compressed air, etc., which he thinks have been found wanting.

All this is very well. Let all possible deductions be made, and still we think it will appear that the new battery contains qualities and powers that promise to render it a most useful appliance in the arts. While it is true that coal is far superior in the quantity of stored-up energy, it is equally true that the coal must have the weight of a steam boiler added to render it available to drive a small boat or a carriage, for example. We are inclined to think that Sir William Thomson is doing the public a better service in practically experimenting with and trying to find out how the new battery may be best applied to the wants of man, than is Prof. Reynolds in discouraging these efforts of his colleague.

Exhibition in Orizaba, Mexico.

It is announced that a scientific, agricultural, and industrial exhibition will be held at the city of Orizaba, Mexico, in November next, under the auspices of the Government of the State of Vera Cruz. Arrangements have been made for all necessary space in the exhibition building for exhibits from the United States, and all goods intended for exhibition are exempted by law from import duties. Reduced rates for passage and freight have been secured from points in the United States to Vera Cruz, and a cordial invitation has been extended to citizens of this country to participate in the exhibition, either as visitors or exhibitors.

A Large Belt.

What is described as one of the largest belts in the world was lately finished at Bingley, England. It is 132 feet long and 6 feet wide. It is two layers, the outer layer having three sections, of which the middle section is 36 inches wide and the two side sections 18 inches each. The inner layer is in five strips, in the following order, beginning at one edge: First, 14 inches wide; second, 8 inches wide; third and middle, 28 inches wide; fourth, 8 inches wide; fifth, 14 inches wide. The belt is both wire-stitched and hand-sewn, and the arrangement of the strips, it will be seen, breaks the joints very effectively. It is to work considerably under its power, being intended to transmit only 600 indicated horse power over a flywheel and drums of 71 feet and 7 feet respectively.

The Source of Much Noise.

At Granville Corners, Mass., a couple of men began the work of drum making in 1853. Now they have a five-story factory, 110x40 feet, from which they have turned out 79,000 drums. They were mostly toy drums, and were made of wood, tin, brass, and nickel. The drumheads have used up 30,000 sheep skins.

WE are informed that the bending machine made by Messrs. Williams, White & Co., of Moline, Ill., and illustrated in our issue of June 11, is being extensively adopted in shops having considerable iron bending to do. It finds its principal application in the manufacture of plows, cars, wagons, and wherever a number of wrought iron pieces of the same form are required.

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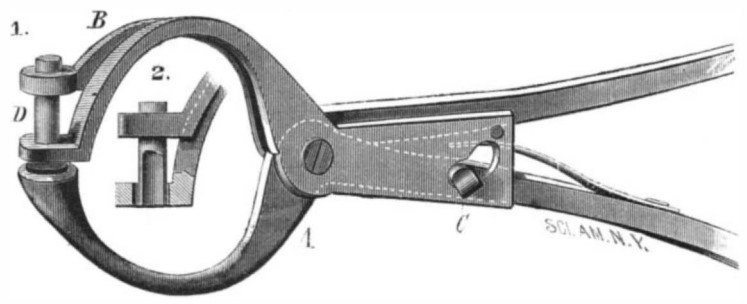
NOVEL CATTLE RINGER.

The engraving represents a new cattle ringer recently patented by Mr. Horace E. Barnes, of Lee's Summit, Mo.

A is the fixed jaw, which may be similar to the corresponding jaw in an ordinary punching tool. It is provided at the point where the punch engages it with a cushion of rubber or leather. The movable jaw is made in two parts, B, arranged to work side by side, and both pivoted to the jaw, A, as if made in one piece. The part, B, is extended into a handle, corresponding with the handle of the fixed jaw, A, and its tip carries the punch, D, which is similar to that of an ordinary punching tool. The movable part of the jaw, B, corresponds in shape with the fixed part for a portion of its length. The front portion or tip is extended beyond the tip of the fixed part and formed into a ring, through which the punch, D, works, and its rear portion is provided with a slot, of ellipsoidal form, in which works a thumb screw, C, the threaded portion of which screws into the part, B. The handles are thrown apart by a flat spring attached to one handle and bearing against the other.



BARNES' CATTLE RINGER.

In using the instrument the handles are pressed toward each other just sufficiently to prevent the punch from protruding beyond the surface of the ring. The screw, C, is then turned so as to place the thumb piece transversely across the widest portion of the slot, which holds the parts in such position that the distance between the ring and cushion on the opposite jaw corresponds with the thickness of the gristle between the nostrils of the animal. The instrument is then applied to the nose, and when the punch and ring are at the point where the hole is to be made the thumb screw is given a quarter turn, so that it can work in the slot. This allows the punch to protrude beyond the surface of the ring so as to punch the hole as desired when the handles are pressed toward each other. When the handles are released the spring forces them outward, so as to withdraw the punch, D, within the surface of the ring, and the thumb-screw, C, is again turned so as to hold the parts in the former position. The tool is then partly withdrawn from the nose with one hand, and the nose ring placed in position with the other hand. By this construction provision is made for punching a neat hole and for inserting and withdrawing the instrument without unnecessarily cutting the animal or marring the extremities of the hole as punched, and also for clearing the punch from the hole by means of the ring.

IMPROVED FEED-WATER REGULATOR.

We give an engraving of an improved feed-water regulator, lately patented by Mr. Charles H. Kuhne, and is being manufactured and introduced by the Kuhne Regulator Company, Limited, of Corry, Pa. Fig. 1 is a perspective view of the regulator with a portion broken away to show internal parts; Fig. 2 is a vertical section of the steam and water cylinders; and Fig. 3 is a detail view of the steam valve which is operated by the float. The larger cylindrical vessel or float chamber is connected with the boiler above and below the water line by two horizontal pipes, each provided with a valve by which communication with the boiler may be stopped.

The float in this vessel is connected with a lever connected with a valve for opening communication between the float chambers and the larger of two cylinders, placed axially in line with each other and above and at one side of the float chamber. These two cylinders are accurately bored, and are each provided with a piston attached to opposite ends of a common piston rod. The upper cylinder is provided with a water-supply pipe at the top, and two lateral pipes placed one above the other. The upper of these two pipes leads to the water space of the boiler, the lower one is the over-flow. A guide rod extends from the float downward into a pipe terminating in a small cock, which may be opened from time to time to keep the pipe clear.

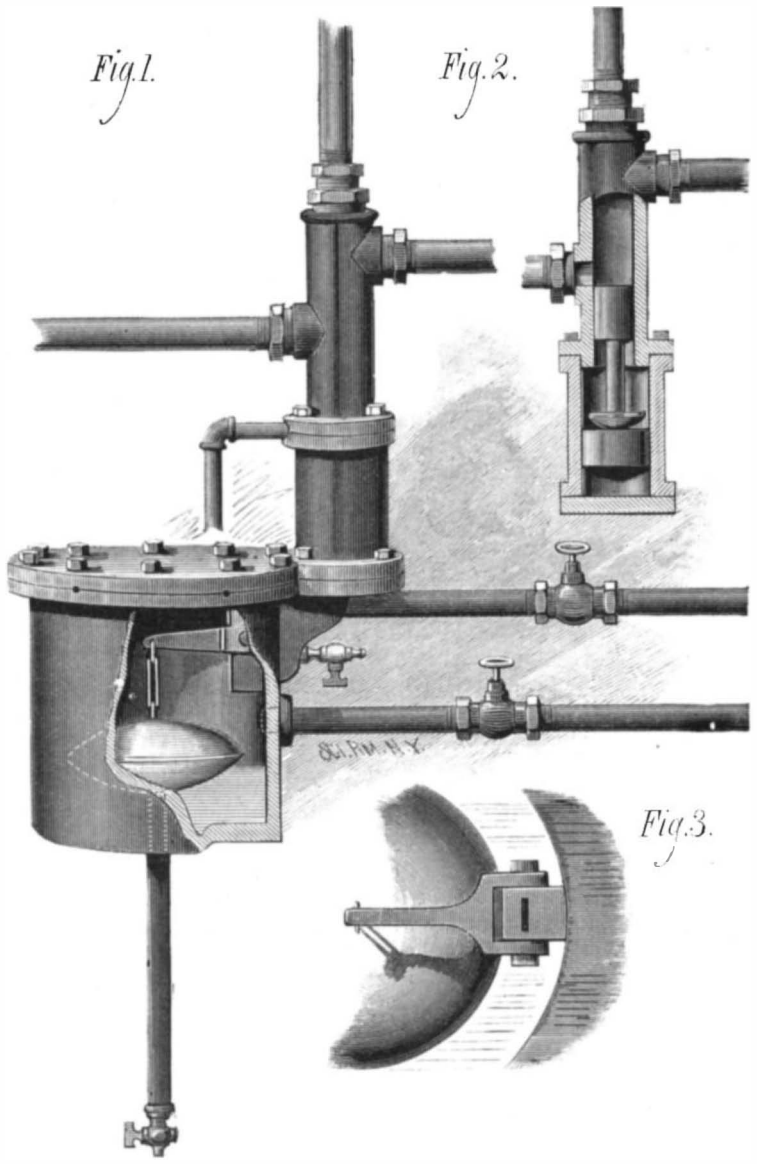
The apparatus is attached to the boiler, so that the float is on the water line. When the water in the boiler falls a small distance below the usual working level, the float drops, and opening communication between the steam space of the float chamber and the space below the piston in the larger cylinder above, the piston is forced upward and carries the smaller piston with it, closing the overflow pipe, when the water forced in by the pump passes through the upper or feed pipe into the boiler, and is retained by a check valve. When the float is raised by the increase of water in the boiler, so as to shut the steam from the lower side of the piston, the pressure of water on the smaller piston pushes it down so that the water passes out of the overflow instead of going into the boiler.

Should it be desirable to use water from the street mains the upper lateral pipe will be dispensed with, and the opening into which it is screwed will be plugged. The pipe which was used as the overflow will now be taken to the boiler, and the feed water will be taken in at the top of the regulator. When the pistons rise the pipe leading to the boiler will be closed, and when the pressure is removed from the lower piston, the water pressure forces both pistons down, and opens communication between the supply pipe and the boiler feed pipe.

Every engineer knows the advantages of having an equable supply of water. It obviates danger from low water, insures dry steam in a properly constructed boiler, and saves fuel and labor.

The inventor informs us that this device has been in successful use for some time past, and is considered more reliable than any attendant can be. It is compact and simple, requires no packing, and needs little attention. It will be seen that the water supply is controlled entirely by steam, and that the duty of the float is simply to turn the steam on and off from the actuating mechanism.

Further information may be obtained by addressing the Kuhne Regulator Company, P. O. box 606, Corry, Pa.



KUHNE'S FEED-WATER REGULATOR.

MECHANICAL INVENTIONS.

An improved milling cutter has been patented by Mr. Alfred Muir, of Manchester, County of Lancaster, England. This invention is applicable to cylindrical milling-cutters and globe-shaped cutters, and to cylindrical cutters having curved, rounded, taper, or flat ends, also to face cutters and to reamers. The teeth are formed on the cutter or reamer in the usual way, and then spiral grooves are made around it, thus dividing the faces of the cutting edges. In making the spiral groove the edge is undercut to make clearance at one side, and afterward the other side of the groove is cut out, thus giving clearance at both sides of the cutting edges.

Mr. John Grein, of Maine Prairie, Minn., has patented an improved wrench for use in oiling carriages and for other purposes, which is so constructed as to hold the nut when removed in such manner that it can be replaced without soiling the hands.

Mr. John Hyslop, Jr., of Abington, Mass., has patented a machine for cutting, shaping, or finishing the heads of tacks, nails, and rivets, which is so constructed as to make all the heads uniform in shape and size.

Summer Conventions.

Among the important conventions recently in session are several at such a distance that only the briefest accounts have been telegraphed.

The American Society of Civil Engineers began its thirteenth annual meeting in Montreal on the 15th. The members were welcomed by Mayor Beaudry and Principal Dawson, of McGill University.

The Associated Maltsters of the United States met at Niagara Falls the same day.

The American Railway Master Mechanics met for their fourteenth annual convention in Providence, R. I., June 14, nineteen States being represented at the opening session. The secretary's report showed a membership of 197. A paper was red from Reuben Wells, of Louisville, Ky., upon the manner of riveting boilers, favoring button-set riveting above hand riveting. The paper was generally approved. A report from Jacob Johann, of Springfield, Ill., favored a straight style of boiler rather than the wagon top. A committee was appointed to consider the propriety of adopting a standard gauge. A committee was appointed to report on the most economical plan for running locomotives. The next day Mr. James M. Boon, of Fort Wayne, Ind., reported for the committee on the best means of producing combustion of bituminous coal in locomotives. Mr. W. Woodcock, of New Jersey, for the committee on the best form of locomotives, reported in favor of the American eight-wheel as best for express passenger service.

The fourteenth annual convention of the Master Car Builders of the United States and Canada began in this city on the 14th. A large number of delegates were present. The first session was devoted chiefly to the discussion of proposed amendments to the constitution relative to membership. The chief interest centered on a proposition to make eligible for representative membership any person having a practical knowledge of car construction, and to give to such a member all the privileges of active members, and in addition thereto in all measures pertaining to the adoption of stand ards for car construction, or the expenditure of money, one more vote for each thousand cars owned by the company he represents. It was contended by those favoring the provision that it would gain for the association the active interest of the heads of the various railroad companies, and by those who opposed it that too much power would thereby be given to the wealthier corporations. The matter was finally referred to a committee of five, to be reported on at the next annual meeting. The remainder of the morning session was occupied by the discussion of the report of the committee on brake-shoes. The afternoon session was devoted altogether to discussion of the rules governing the interchange of freight cars between roads. The rules relate to the condition of cars, inspection at the time of interchange, and payment for repairs and for cars destroyed while in the custody of other roads. Among the important subjects to be reported on by committees appointed last year at Detroit, are, "How to Prevent Accidents and Injury to Train-men," "The Best System of Train Brakes for Freight Cars," "Standard System of Screw-threads for Nuts and Bolts." An interesting feature of the convention is an exhibition of recent inventions relative to improvements in rolling stock.

The American Pædological Society convened in this city on the 13th. President T. C. Duncan, M.D., of Chicago, read an important paper on "Pædology as a Specialty," in which he urged a larger attention to those diseases which occasion the terrible mortality of children under five years of age. Dr. S. Lilienthal, of New York, read a paper on infantile eczema. Other infantile diseases were discussed, such as tonsillitis, gastro-enteritis, capillary bronchitis, etc. The officers for the ensuing year are: President, Dr. S. Lilienthal; Vice-President, Dr. W. B. Chamberlain; Secretary, Dr. W. P. Armstrong; Board of Censors, Dr. George F. Foote, Dr. T. C. Duncan, Dr. M. Deschere, of New York; Dr. E. M. Jones, of Taunton, Mass.; and Dr. D. Foss, of Newburyport, Mass. The president then appointed the following gentlemen to prepare papers to be read at the next convention of the society: Prof. Dr. W. Owen, of Cincinnati, on chronic eczema; Prof. Dr. M. Deschere, on capillary bronchitis; Prof. Dr. W. C. Earle, of Chicago, on diphtheritic croup; and Prof. Dr. J. P. Mills, of Chicago, on elementary infantile foods.

The American Institute of Homeopathy began its thirty-eighth annual session at Brighton Beach, Coney Island, June 14, with a large attendance. In the usual address the president, Dr. J. W. Dowling, of Brooklyn, said that there were 6,000 physicians in the United States whose practice was according to the homeopathic law; there were 11 homeopathic medical colleges, no less than 38 homeopathic hospitals, 29 dispensaries, 23 State societies, 92 local societies, and 16 medical journals. In a paper on personal hygiene as to fluids drunk, Dr. George M. Ockford, of Burlington, Vermont, spoke of the need of caution with regard to the use

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of ice water, as gastric troubles and insanity sometimes resulted from its careless use as well as from water polluted with sewage matter. The effects of alcohol on highly sensitive nervous organizations were considered at length, and an increase of insanity, epilepsy, and kindred nervous disturbances was traced to its use as a beverage. Dr. Ockford also lamented the increasing use of absinthe among the intellectual classes, and regarded it as rapidly ruinous to the constitution, productive of serious disturbance of the function of the brain and nervous system, and very dangerous as a habit. He considered tea as a better beverage than coffee in cold climates, and contradicted the current notion that tea tasters became broken down in nervous function by the pursuit of their business. Coffee could be used without disadvantage as a beverage in southern climates, but in the north once a day should generally be the limit, as dyspepsia and nervous derangement frequently followed the coffee habit when inveterately indulged. He recommended caution in the use of milk—one of the most valuable of beverages and foods when pure and clean, but exceedingly liable to pollution and a frequent agent in the propagation of diseases, having in a high degree the property of absorbing putrescent matter without its presence being detectable by the senses.

Advantages of Electric Railways.

In an extended account of the construction and working of the Siemens electric railway at Berlin the London *Times* mentions as first among the advantages which the electric motor has over steam or compressed air for passenger transport, the circumstance that no heavy machinery has to be carried about to set the train in motion. The carriages can, therefore, be built in a lighter manner, thus reducing the power necessary to move them, and permitting all bridges and other superstructures to be built more cheaply than usual. Several carriages, each with a dynamo machine, can be joined to one train, and by this distribution of motive power much steeper inclines can be overcome than when the same train is drawn by a single locomotive. In addition to the ordinary brakes, means can be provided to short-circuit the machines on the carriages, and to cause them to act as very powerful brakes. The use of large stationary engines reduces the amount of fuel necessary to develop a certain power on the traveling carriage, and if waterfalls can be utilized the cost of working these railways can be further diminished. It seems probable that such railways can be usefully and economically constructed to facilitate the traffic in crowded streets, or in situations where local circumstances favor their application. From all that has been done during the last few years it is evident that the art of transmitting power by electricity has advanced rapidly, and that its practical application is continually gaining ground.

A Vessel Wrecked by a Water Spout.

The brig Bogota recently arrived at New Bedford, Mass., having on board a party of shipwrecked mariners composed of the officers and crew of the wrecked British brigantine Florence May, who were picked up in the ocean, about 600 miles from this coast, their vessel having been almost torn to pieces by a water spout. Captain Cochran, of the May, says that he sailed from New York May 13, with a crew of eight men and one passenger; weather was good, and May 23 the vessel had reached latitude 35:42, longitude 65:26, and was lying becalmed; at 2 o'clock A.M., she was struck in the bow by a waterspout, which hit her so forcibly that she was opened forward, her jibboom and head gear were twisted off, and the vessel severely strained and her seams opened, causing her to leak badly. The pumps were at once started, and for three days she drifted about in an unmanageable condition. Fortunately the weather was good, and but little difficulty was experienced in keeping her free from water, but on the third day one of the pumps gave out, the water began to gain in the hold, and the boats were prepared for leaving the brig; but at this juncture the Bogota appeared and rescued the crew, with their personal baggage. The Florence May was 213 tons burden, and was loaded with a miscellaneous cargo, consisting mainly of flour and grain.

Quick Telegraphy.

The Direct Cable Company and the *Evening Telegram* of this city seem to be justly proud of a recent feat in rapid telegraphy, by which the result of the Derby race in England was announced here in advance of all other mediums of communication. The *Telegram*, with its usual enterprise, had an operator and instrument on the grand stand at Epsom. The remainder of the story is thus recorded: "Horses got away at 10:21:5, New York time. Iroquois passed winning post 10:23:55, New York time. Result reached New York 10.24. Time occupied in transmission, 5 seconds."

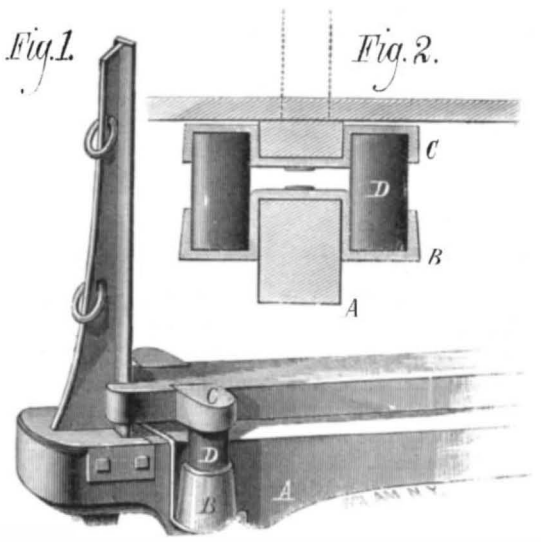
Electrical Light Patents.

About 175 patents have so far been granted for patents relating to electrical lighting, in this country, and about three hundred more applications for patents thereon are now pending.

When we consider the large number of patents now existing for telegraphing instruments, telephones, alarms, electrical batteries, switches, and the divisions of electrical devices, it will readily be understood that the Patent Office at Washington is rapidly becoming a great store house of novelties relating to electricity, and that this branch of invention is already one of extraordinary magnitude.

IMPROVED WAGON SPRING.

The engraving shows an improved wagon spring lately patented by Mr. Christopher Heinen, of Fort Laramie, Wyoming Territory, and designed to lessen the concussion between body and bolsters. The bolster, A, is supplied at the ends with removable standards, and with sockets, B, formed in one piece with a saddle plate fitted on the bolster. Inverted sockets, C, made like the sockets, B, but somewhat



HEINEN'S WAGON SPRING.

shallower, are secured to a bar extending parallel with the bolster, A, and guided by the standards. In the sockets, B, are placed springs, D, which may be either of rubber or steel. The upper ends of these springs are received by the sockets, C.

With this construction the body of the wagon has an elastic support, which relieves it from shocks and the running gear of the wagon, and at the same time relieved from the downward blows of the load.

This device can be readily applied to wagons already in use, and will not only break the concussion between the body and bolster, so as to avoid injury to the load by jarring, but it will increase the durability of the wagon.

Fig. 1 is a perspective view of one end of a bolster having the improvement applied, and Fig. 2 is a transverse section showing the relation of springs, sockets, and bolster.

IMPROVED AIR PUMP.

The illustration represents a powerful double-acting hand pump for air or gas lately brought out by Mr. H. Weindell, 405 N. Fourth street, Philadelphia. A smaller pump for air only

WEINDELL'S AIR AND GAS PUMP.

was illustrated in this paper on Oct. 15, 1876, in which the leading principle is the same as in the pump now illustrated. The present improvements made consist mainly in greater simplicity and different construction in the pumping cylinder to adapt the machine to more varied uses.

By moving the hand lever, consisting of the frame containing the slide rod, piston, and piston rod, the two flywheels are rotated, and the momentum acquired by these is sufficient to bring the cylinder to a point where the resistance of the compressed air is equal to that in the receiver. At this point the slide rod (on hand lever) and the crank (formed on the flywheels) stand at such an angle as to work like a toggle-joint and compress and expel the air with great force.

The particular pump shown is expressly designed as exhaust pump. It, therefore, has a long stroke (6 inches) and very large and light inlet valves of 2⅜ inches diameter, consisting of leather plates backed by sheet brass. The flywheels are 15 inches in diameter, and the entire machine is very strongly built, weighing almost 70 pounds. It will, when compressing air at its regular working speed of about 110 revolutions a minute, readily give in its $2\frac{5}{16}$ inch cylinder 32 pounds pressure to the inch. In exhausting it will also quickly raise mercury within three-quarters of an inch of the barometric pressure. This is with valves actuated by air pressure only. The same pump is also built for a better vacuum yet, having for this purpose valves operated by friction only, and a simple contrivance connecting automatically for a short time at each stroke both sides, thereby answering as a Babinet cock, making very complete exhaustion possible.

The Lady Franklin Bay Colony.

The members of the Arctic expedition under the command of Lieutenant Greeley, have assembled at St. Johns, Newfoundland, intending to start July 4, for Lady Franklin Bay. The whaling steamer Proteus has been chartered for the conveyance of the enlisted men and officers detailed by the Signal Service Bureau for the expedition. The personnel of the expedition is as follows:

Lieutenant A. W. Greeley, Fifth Cavalry (in charge); Lieutenant James B. Lockwood, Lieutenant Frederick T. Kislinburg, Sergeants Edward Israel, W. S. Fewell, George W. Rice, and D. C. Ralston, of the Signal Corps; Sergeants D. L. Brainard and D. Sinn, and Corporals D. C. Starr and N. Sailor, Second Cavalry; Corporal P. Grimm, Eleventh Infantry; Corporal J. E. Elison, Tenth Infantry; Privates Black and Gardiner, Signal Corps; J. Frederick, Second Cavalry; J. Ryan, Second Cavalry; W. Ellis and T. M. Connell, Third Cavalry; Charles B. Henry, Fifth Cavalry; J. Bender, Francis Long, and W. Whistler, Ninth Infantry; J. H. Bredbrick, Seventeenth Infantry; and W. H. Cross, general service.

The expedition is intended to establish a permanent scientific colony at the most suitable point north of the eighty-first parallel and contiguous to the coal seam near Lady Franklin Bay. The official instructions provide that after leaving St. Johns, N. F., except to obtain Esquimau hunters, dogs, clothing, etc., at Disco or Upernavik, only such stops will be made as the condition of the ice necessitates, or as are essential in order to determine the exact location and condition of the stores cached on the east coast of Grinnell Land by the English expedition of 1875.

The main purpose of the colony is meteorological observation, the station being one of eight or more to be established for such work by the United States, Russia, Norway, Sweden, Holland, Denmark, Austria, and probably also by Germany, France, Great Britain, and Canada. The American colony engage in the work of geographical exploration by sledge parties, and will give careful attention to the collection of specimens of vegetables, animals, and minerals. Incidentally they will keep a sharp lookout for the Jeannette expedition, which may drift into that quarter.

Drifting Half a Year.

The following report of the rescue of nine Japanese sailors by the Pacific steamship City of Pekin, is printed in the San Francisco *Chronicle* of June 13: The Japanese had been blown out to sea in a storm which occurred December 9, 1880. They lost their masts and rudder in the storm, and had been drifting at the mercy of the winds, they knew not where. After their own provisions were exhausted they subsisted on their cargo, mostly beans and dried fish, and such rain water as they could catch during the six months which had elapsed since the typhoon occurred. They had burned most of the small woodwork, doors, berths, windows, etc., of their vessel for fuel, and were on short food rations, 40 beans per day for each man being the allowance. Their fire, when put out from time to time, they had rekindled by rubbing two pieces of wood together. They had given up all hope of ever seeing land or anything human again, when, on Saturday, the 28th of May, in latitude 36° 37′ north, longitude 143° 54′ east, about 300 miles from the Bay of Yeddo and Yokohama, they sighted the Peking on the wide waste of water. Captain Berry, in answer to their signals of distress, bore down and sent one of the boats off with an officer and the doctor to examine into their sanitary condition, and the poor souls were soon landed on her deck. One of their number had died the day previous from exposure, hunger, and anxiety.

Discovery of an Aztec Calendar Stone.

The *World's* correspondent at Mexico reports the discovery of a new Aztec calendar stone. It was found, June 2, by Captain Eavans under a dilapidated Indian hut, which stood on the place that once formed the favorite garden of the Texcocan "Poet Prince" Netzahualcoyotl. It is a stone slab, eight feet by six, covered with hieroglyphs, and near the center of it is a clearly cut calendar—similar to the far-famed "Aztec Calendar stone" which is now attached to the cathedral in the city of Mexico. The stone goes to the Mexican National Museum. Further excavations are to be made on the same site, and since King Netzahualcoyotl "the Wise" built his palace on a hillock on which the residence of the sovereign lords of a more ancient nation had stood, it is probable that further researches in that locality may lead to interesting discoveries.

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EXPLOSION OF A PLAIN CYLINDER BOILER IN PHILADELPHIA.

BY S. N. HARTWELL.

The front page cuts illustrate the explosion of boiler No. 3 in the dye works of Gafney & Co., in Kensington, Philadelphia, which occurred during the noon hour, on the 1st day of June, 1881, killing three persons and injuring a number of others. The coroner's sensible and pertinent inquiries into the cause of death brought out the usual variety of opinions of the cause of the primary rupture from which the explosion arose.

THE CONSTRUCTION OF THE BOILER

was not new or uncommon, nor was the material or work unusually bad. The shell plates, which did not break, were marked at a fair tensile strength, and the head that did break was of a fair quality of cast iron where the rupture began. The type and principal dimensions are as follows: A plain cylinder, 30 feet long by 36 inches diameter, composed of No. 3 iron plates in nine courses, single riveted; the least observed thickness at the edge of plate was 0·255". The end plates or heads were flat cast iron disks having suitable flanges turned inward, with cored radial holes for the rivets that secured them to the shell plates. Thickness of disks, 1⅞ inches; flanges, 1⅝ inches. The pitch or spacing of the rivets was according to accepted American practice. A man-hole was cut in the center of the front head, 12¾ by 15½ inches, the form of which appeared to be not an ellipse, but of somewhat larger area. The gasket seat had been planed, but the corresponding seat on the man-hole plate was not planed, though it appeared quite as true as such castings usually are.

The arrangement of the boilers is shown in the engravings, by which it will be seen that two, namely, Nos. 1 and 2, were set over the same furnace, and No. 3 by itself over an adjoining one. The former, called the old boilers, had been in use two years, and the latter, the new boiler, had been working but two months prior to the explosion. Two pair of safety valves, one pair to each system, were fitted as shown, their connecting pipes coming through the wall of the steam dry house under which the boilers were set. The pair of boilers had a pair of 2½ inch, and the single boiler, No. 3, had a pair of similar 2 inch safety valves. The main steam stop valves, by which communication between the boilers and with the heating and drying systems of pipes was regulated, were also in front of the wall, as shown. The steam and water pipes were so arranged that the single boiler could be used alone.

These boilers were insured by the Hartford Steam Boiler Inspection and Insurance Company, and allowed to carry 70 pounds of steam. The usual working pressure appears to have been from 60 to 65 pounds *by the gauge*, the pressure increasing when the demand for steam was less than the supply, indicating that the safety valves did not fully relieve the boiler. The increase of pressure that might have occurred with all the distributing valves closed is therefore unknown.

The new boiler was inspected on or about the 7th of March, and no doubt the hydrostatic test (about 100 pounds) was applied according to law. The builder swears before the coroner that he applied a cold water test of 115 pounds, and found it all tight, etc.

This boiler, No. 3, was fitted with the usual gauges and other attachments, and fed by an injector, either separately or in common with the other two boilers. The steam was used for boiling dye-stuff and for drying.

The observed phenomena indicate unmistakably that

THE EXPLOSION

was due to a pressure a little in excess of the strength of the weakest point of the boiler. The course of the initial ruptures is clearly indicated in the engravings, radiating from the man-hole. The cast-iron head was not compensated for the loss of continuity. There was simply a slight chipping spot just raised above the general inner surface, for convenience in finishing a gasket seat upon the planing machine. The removal of the firm and tenacious skin of the iron by the planer reduced its strength. The slight sustaining power of the pinch on the gasket is an indefinite and variable factor, and a great strain falls upon the margin of the man-hole.

So far as the writer knows, there is no well defined and simple rules for determining the strength of flat disks with man-holes in them. To make this front head equal in strength to the rear one, omitting now all comparison with the strength of the cylindrical portion of the boiler, it seems evident that a rib is necessary around the man-hole of sufficient depth to fully compensate for the removal of so important a part of the disk.

But without a full line of ultimate experiments on the strength of these forms it would be difficult to specify the depth of the rib.

It may be said, and is strongly maintained by some engineers, that the concave form, shown in figure 6, is stronger than the flat; but how these two forms compare in strength when they have equal inward projections, experiment only can determine.

No respectable guess, therefore, can be made at how much internal pressure was required to break this boiler. Either of its heads had less resisting power than the cylindrical portion, on which form plenty of experiments have been made.

The arguments used against the hydrostatic pressure as a test of the strength of unequally heated and complicated boilers, do not so well apply to this case, for this head was in a fairly uniform condition of temperature throughout, so that unequal tension, except such as might arise from a badly fitted man-hole plate, is hardly admissible. Its strength, if uniformly heated to 350° or 400° Fah., would not differ greatly from its strength when the cold test of 115 pounds was applied. And here are its neighbors, cast from the same pattern apparently, that have held out for two years, while no doubt many of the hundreds of cast iron boiler heads now in use in Philadelphia and elsewhere in America, are no better and have stood longer and heavier strains than those now under consideration.

A defect is noticeable in the circular fracture, as much as 3 or 4 inches long by width of 0 to ½ inch, in the middle of the plate and near the lower part, consisting of confluent blow holes; but it is difficult to conceive how the rupture could start at any point in the circle from which lines of fracture should converge toward the manhole so as to break the head as shown. The rupture, no doubt, began almost simultaneously at the inner end of the four radial lines, in which case a defect in the circular line would not affect the weakest point at the margin of the hole.

It is not pleasant to think that a boiler which ought to be able to stand five times the working load would be so capricious as to blow up upon slight provocation. Scully, the fireman, stoutly and persistently denies having wet this head with his hose, although it was sought to be proved that he did so, and it was assigned as a sufficient cause of the breaking of the head.

Many of the steam valves were found to be closed when dug out of the *débris;* in fact the writer has not seen one that was open when found, but has seen four that were closed, and under such conditions that no amount of swearing by interested witnesses to the contrary would stand as truth.

The diagram, Fig. 5, is a plan of the neighborhood of the explosion. The buildings occupied by Gafney & Co. are (were) located between Martha and Collins sts., the boilers in the lower story of the three story brick building, A, adjoining the one story dye house, E. To the left is the shed building, M, on the roof of which the dyed material was sundried in fine weather. The dye tubs, F, were square wooden vats, heated by direct steam, admitted by branch steam pipes, in each of which was a steam stop valve, controlled by each dyer, according to his requirements. G is the small detached office building of the proprietors. H is the location of the two story dwellings, one of which was badly smashed and took fire, but it was soon extinguished. Beds, cooking stoves, and household utensils in the ruins, were painfully suggestive of the horrors that attend a first-class boiler explosion. The stable, L, was also destroyed by the falling of adjacent walls. The boiler gave out by the bursting of the front cast-iron head, which broke into four quarters, the fracture running from the man-hole radially, as shown in drawing; thence the break continued along the circular base of each quarter of the head, leaving the entire rim or flange outside of its junction with the disk attached to the shell plates. This rim was smashed, as shown in the cuts (Fig. 3), by the fall upon the ground at D, or possibly by contact with some solid object in its flight. On leaving its bed the main portion of the boiler took a direct, nearly horizontal, course in the line of its projected axis, and striking the terrace at the corner of the grapery in front of the dwelling, B, it rose and turned to the left, some 15° or 20°, passing over or in front of a passenger street car, at N, which was about to enter the station house of the Second and Third street horse railroad, shown at C, whence the cars depart at the opposite end on Frankford road. In striking the terrace, the rear head, which was foremost in the flight, was demolished, and the adjoining shell sheet torn and turned inward, as seen at Fig. 3.

The four quarters of the front boiler head were found scattered at various points in the foreground, the lower piece, in which was the feed water opening, was found on removal of a large mass of *débris*, about twenty-five feet from, and directly in front of its former site. Here also were found a 2½ inch steam pipe (easily distinguishable from the feed water pipe of same size), in which was a stop valve *closed;* to this pipe was connected several 2 inch branches, and valves, also *closed* when examined by the writer, before they were touched by any person, after the explosion. Mr. Farran, of the Hartford Steam Boiler Inspection and Insurance Company, observed the same thing, and the attention of bystanders was called to this important fact. Mr. Williams, a member of the coroner's jury, was informed, and the valves shown to him before their removal. That gentleman remarked that other steam valves were also closed when found, notably the one in the pipe connecting this boiler with the others. In fact *all steam valves were found closed when taken from the ruins* so far as known.

The man-hole crossbar, a pretty heavy one, with its bolt, which engaged with the plate by means of a pocket in the plate, into which the head of the bolt fitted loosely, was detached when the boiler head was broken and its tension relaxed, and it flew to the front, crossing Martha street, to the second door on the cross street, where it struck the brick door jamb. A man was found dead or fatally injured at this point, marked J on the diagram, having been hit by this piece before it struck the brickwork. It made an indentation of a depth indicating that its force was far from being spent upon the body of the man. The man-hole plate itself flew a greater distance in the same direction, said to have been more than two squares, where it lodged on top of a building. This is the longest distance traversed by any of the pieces. A piece of the rear head bounded from D into Frankford road and landed in front of a boarding saloon where a number of people were taking dinner. This was warm, said to be hot, as well as the main piece of the boiler, which caused steam to arise from the damp manure heap on which it landed. A rumor gained circulation that the boiler flew through the air like a glowing meteor, red hot, but no evidence of an extraordinary temperature was found on any part of the fragments.

Some search was made for the steam gauge that was said to have been attached to this boiler, but its condition could have given no clew to the pressure at the time of the explosion, and it could not have contradicted other phenomena.

The fact that the plate and crossbar of the man-hole of the broken head were shot with violence as from a gun, indicates that the head, weak though it is acknowledged to be, resisted considerable pressure, and at last gave way with a snap. This wreck has been studied from a disinterested standpoint, and the

CONCLUSION IS

that the flow of steam from this boiler was stopped or obstructed by the defective condition of the safety valves, the distributing valves having been incidentally closed at the noon hour, by the several workmen who were in the habit of handling them according to their several demands for steam, and that the pressure gradually increased, the fire being active, till the boiler gave way at its weakest point, which was manifestly the front head.

RECENT DECISIONS RELATING TO PATENTS.

United States Circuit Court.—Eastern District of Wisconsin.

ROWELL *et al. vs.* LINDSAY *et al.*—PATENT CULTIVATOR.

Dyer, J.:

1. A patent for a combination of known parts is not infringed by the use of any number of the parts less than the whole.

2. Where some of the parts of a combination are new and others old, and where the new parts are distinctly claimed as inventions, the appropriation of a part which is new is an infringement.

3. Where a patentee claims as his invention only the combination which he describes, the separate constituent parts of such combination are to be regarded as old or common and public.

4. A combination must be maintained as an entirety. If one of the elements is given up the thing claimed disappears. The different parts may perform more or less important functions, but each and all are essential to make the thing which the patentee has claimed as his invention.

5. A combination is not infringed by the substitution of a new element or of one that performs a substantially different function, or by the substitution of an old element not known at the date of a patent as a proper substitute for the omitted ingredient, or by a new combination of the existing elements of the patented combination.

6. A patent for an improvement in cultivators claimed the combination of a slotted beam, shank, brace-bar, and bolt, when the parts were constructed and arranged to operate as and for the purposes specified: *Held*, that such patent was not infringed by a machine which contained such slotted beam, shank, and bolt, but did not include the brace-bar or any mechanical equivalent for the same.

United States Circuit Court.—District of Massachusetts.

PENNINGTON *et al. vs.* KING.—PATENT SPRINKLER.

Lowell, J.:

1. Letters patent No. 203,069, granted to Pennington and Beggs, April 30, 1878, for an inprovement in lawn sprinklers, which describes, *inter alia*, "the rose C, provided with a number of discharge holes, *d*, at the outer circumference, which holes are placed in a plane passing preferably through the hole, B, but bored at a certain angle of inclination through the rose, so as to produce the revolving motion of the same by the forcible discharge of the water through the holes," is not anticipated by sprinklers having radial arms which are caused to revolve by the force of the water passing out through one and the same side of each arm, nor by sprinklers wherein the chamber or rose is caused to revolve by forcing the water through perforations in the same side of ridges formed on its convex surface.

2. In the absence of other evidence, a patented invention will be held to date from the time of filing the application, and not from the time of the grant.

Polar Observation.

It will be remembered that the ill-fated Gulnare left at Lady Franklin Bay a number of men to form a permanent colony for arctic exploration and meteorological and magnetic observation.

The Government has just chartered the Newfoundland sealing steamer Proteus to convey thither the relieving party under Lieutenant Greeley. The Proteus is described as nearly new, stoutly built for encounters with ice, of about 800 tons capacity, and with engines of 300 effective horse power.

Proposed Statue to Robert Fulton.

A monument to Robert Fulton is talked off, to stand on a prominence on Polipel's Island, situated in the Hudson River at the southern end of Newburg Bay. A heroic figure of Fulton will surmount the monument.

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AN INTERESTING BOILER EXPERIMENT.

Numerous instances are on record of strong boilers, well made in all respects and handled with good care, having suddenly exploded with terrific violence, just at the instant when the valve was opened to admit steam to the cylinder; or at the moment when cold water was injected into the boiler. The usually received theory of this class of explosions is that by opening the valve or throwing in cold water, the pressure of steam on the surface of the water is suddenly reduced, whereupon the water, charged as it is with the tremendous energy of its heat, leaps from its place, divides, and strikes with the solidity and force of cannon balls against the interior walls of the boiler, tearing everything to pieces with its resistless momentum. Water may in fact be easily heated to such a degree that a pound of the liquid will equal a pound of gunpowder in energy. At sixty pounds pressure to the square inch every cubic foot of boiler water has the energy of a pound of gunpowder. Given the proper conditions for discharging that energy against the boiler, and it will be rent as if it were exploded with a corresponding weight of cannon powder.

In the SCIENTIFIC AMERICAN of July 3, 1880, we presented an engraving and description of an improved form of boiler, invented by Mr. Daniel T. Lawson, of Wellsville, Ohio, which was designed by him to promote safety in the use of steam by preventing all danger from explosions or injurious strains arising from the causes we have mentioned. In the article describing his invention Mr. Lawson's theory was fully set forth; it differs somewhat from that we have stated as ordinarily held. Mr. L. claims "that when water is superheated it becomes as explosive as gunpowder, exploding by bursting into steam from a reduction of pressure." This explosive formation of steam produces a concussion on every square inch in the boiler, much greater, Mr. L. thinks, than the regular steam pressure. "There is abundant reason to believe," he says, "that it is this concussive action which causes the numerous and mysterious boiler explosions, and which cause is wholly independent of the amount of water in the boiler; in fact the greater the amount of water in the boiler the more terrific the explosion."

We are not disposed at this time to question the correctness of Mr. Lawson's theory; but will only suggest that the other mentioned theory better explains the actual result, since steam has a yielding or gaseous action, whereas projected water acts like a solid.

Mr. Lawson has lately tried, at Pittsburg, Pa., a very interesting and important practical experiment, for the purpose of verifying his theory and demonstrating the advantage of his invention. His first step was to prove that boilers were liable to and did explode in the manner he asserted; and this he has apparently proved by actually getting up an explosion, which took place at the time and hour he named and in the way he said it would, namely, by simply opening the boiler valve and letting off some steam.

This experiment has been heretofore tried by various engineers, some of them very learned, but Mr. Lawson is the only one, so far as we know, who has succeeded. He has certainly taught us a good lesson in the boiler explosion art, which we think will result in great benefit. A letter in the *Tribune* gives the following particulars:

"The experiments were made in June, at Munhall Farm, on the Monongahela river, nine miles above Pittsburg, Pa., where the United States Government Commissioners made signal failures in their attempt to produce the same result a few years ago. The same foundations, furnaces, water supply, and bomb proofs were used on this occasion. The boiler was made of the very best iron, and showed a tensile strength of 624 pounds to the square inch, according to the United States standard. It was six feet in length by thirty inches in diameter. Before being taken to the ground it was tested by the boiler inspector of this county and pronounced one of the best and most perfect steam boilers he had ever examined.

"The cylinder of an old steamboat engine was connected with the boiler by means of a two-inch pipe, in which was fitted a quick-lifting valve. The steam was permitted by means of this valve to enter the cylinder in the same manner as it enters the cylinder of any ordinary engine, with the exception that it was not cut off suddenly, as in a working engine. Had it been, Mr. Lawson claims the explosion would have been still more certain. When the pressure reached a certain point the furnace was fed with petroleum by means of a small pipe connected with a tank located at a safe distance.

The majority of those who saw the boiler were of the opinion that it would safely stand 500 pounds pressure, and would not give way to less than 600. In order to save time no test was made until a pressure of 325 pounds to the square inch had been obtained. The valve was then lifted quickly, and the steam rushed into the cylinder rapidly, but with no other effect than to produce a shock distinctly noticeable by those in the bomb-proof.

The final test was made at a pressure of 380 pounds, a little over half the capacity of the boiler. At this time the water was eight inches above the fire line, the boiler being at least three-fourths full. No sooner was the cylinder filled with the rushing steam than a slight shock was felt, followed by a terrific report. Vast volumes of steam enveloped everything, but there were no signs of any hot water, it all having burst into steam when the pressure was removed. This accounts for the absence of water marks in the vicinity of boiler explosions, which has often led to the conclusion that they were caused by the extremely low water.

The report had scarcely died away before a shower of condensed steam began falling, accompanied by pieces of iron, bricks, steam pipes and other *débris*. Scarcely a vestige of the furnace or boiler was left. The latter had not merely given way at a single point, but was literally torn into fragments. One of the largest pieces yet found was about a foot and a half long and a foot wide. It had been blown fully half a mile. One of the heads was found nearly half a mile from the bombproof. The other one had not been found at last accounts. The most of the pieces picked up were of irregular shape, with very ragged edges, showing the iron to have been of excellent quality.

Mr. Lawson has invented a boiler which he believes to be proof against explosions of this kind. It is constructed with a partition intervening between the flues and the top of the boiler, thus creating a steam compartment over the water, to be supplied with steam from the water through valves in the partition, which valves, to insure safety, must be smaller in the aggregate than the port or valve through which the cylinder is fed from the steam compartment. By this means the pressure is kept approximately uniform upon the surface of the superheated water, thus preventing the dangerous effect which must follow the sudden reduction of pressure from its surface. Mr. Lawson's next step will be to show that his improved boiler cannot be exploded.

How to Tell Good Butter.

The Legislature of Ohio has just passed a bill providing for the inspection of butter and cheese, "and all substances having the semblance of butter and cheese," and of dairies and other places where milk is sold or butter and cheese manufactured; to be done by inspectors appointed by the State Board of Health. The superintendent of inspectors of butter and cheese, Mr. Robert Orr, has issued a circular of instructions to his subordinates giving information which may be of value to butter makers and buyers generally. He says:

"When butter is properly churned both as to time and temperature it becomes firm with very little working, and is tenacious; but its most desirable state is that of waxy, when it is easily moulded into any shape, and may be drawn out a considerable length without breaking. It is then styled gilt-edged. It is only in this state that butter possesses that rich nutty flavor and smell, and shows up a rich golden yellow color, which imparts so high a degree of pleasure in eating it, and which increases its value manifold.

"It is not always necessary when it smells fresh and sweet to taste butter in judging it. The smooth, unctuous feel in rubbing a little between the finger and thumb expresses at once its rich quality; the nutty smell and rich aroma indicate a similar taste; and the bright golden glistening cream-colored surface shows its high state of cleanliness. It may be necessary at times to use the trier, or even use it until you become an expert in testing by taste, smell, and rubbing."

Don't Whip a Frightened Horse.

It seems to be a characteristic failing of most coachmen to lay the lash upon a horse that exhibits fear at an object in the street or beside the road. Mr. Bergh, President of our Society for the Prevention of Cruelty to Animals, says in the organ of that society, what every reasoning being ought to know, and that is to never whip your horse for becoming frightened at any object by the roadside, for if he sees a stump, a log, or a heap of tan-bark in the road, and, while he is eying it carefully, and about to pass it, you strike him with the whip, it is the log, or stump, or the tan-bark that is hurting him in his way of reasoning, and the next time he will be more frightened. Give him time to smell all of these objects, and use the bridle to assist you in bringing him carefully to those objects of fear.

Velocity of Light.

Professor G. Forbes lately explained to the London Physical Society the experiments made by him and Dr. Young to determine the velocity of light. The method employed was that of Fizeau; but instead of having one distant reflector, and observing the total eclipse of the reflected ray by a tooth of the revolving wheel, two reflectors, one a quarter of a mile behind the other, were used, and two rays, which were observed when of equal brightness. This method was found more accurate than Fizeau's own plan, and gave curves of brightness. The speeds of the toothed wheel were adjusted until the two rays appeared of equal brightness. The general result was that the velocity of the light of an electric lamp is 187,200 miles per second. Corner found the light of a petroleum lamp to be 186,700 miles per second, and Michelson that of the sun to be 186,500 miles per second. The higher number of Professor Forbes is probably due to the bluer light of electricity, for further experiments made with colored lights and the spectrum seemed to prove that blue light travels probably over 1 per cent faster than red light. The experiments were made at Wemyss Bay, in Scotland.

An Invention Called For.

A prospecting drill is in demand in the mining regions of the West. A Colorado correspondent writes that such an implement is much needed in that State. It should be a simple affair, worked by hand, light enough to be carried by a man, and not cost more than $25 or $30, as prospectors are as a rule poor men. It should be capable of drilling an inch hole from 15 to 30 inches deep, thoroughly practical, and such as one man can operate easily. Such a machine, he is confident, will find ready and remunerative sale.

As this is not the first time that the demand for a portable drill for single-handed use has been made known to us, and as there is an obvious and increasing need for such an aid to individual prospectors in the development of our mining regions East as well as West, it is safe to say that the problem is worth considering by inventors and manufacturers.

The Periodical Cicada.

The anticipated appearance of the seventeen-year locust, so called, in Illinois (referred to in a notice of Prof. Riley's paper, page 408, SCIENTIFIC AMERICAN), has been justified by fact. The cicada began to appear at Carrolton, Ill., May 20, and in the forepart of June became very abundant. At Vandalia, Ill., the woods were filled with them before the 10th, the noise of them being audible above the rattle of the cars to travelers on the railway. In other parts of Southern Illinois and in Kentucky the insects swarmed in myriads. At Little Rock, Fort Smith, and Hot Springs, Ark., they appeared in large numbers, and also as far south as Mobile.

Mica and Asbestos in the Black Hills.

It is claimed that the finest mica obtained in the United States is now taken from the mines at Custer, Dakota Territory. An open cut has been run 150 feet and a shaft sunk 24 feet on the ledge. At the opening of the cut the mica was 4 feet wide. Now, at the rear end of the cut it is 23 feet wide, and the maximum of the ledge has not yet been attained. The largest sheets are 8 by 16 inches, while the average sheets are 5½ by 6 inches.

Another useful mineral lately discovered in quantity in the Black Hills is asbestos. The mine is about six miles from Deadwood. It is said that the croppings can be traced for nearly 300 feet, while a large body of it has already been unearthed. Tests have been made which prove that this body of asbestos is equal to any yet discovered in America.

A Dairy Scheme.

A heavy dealer in cheese in Canada projects a great dairy farm or farming community to be suitably located in the West. The plan involves the establishment of a group of 224 farms of 160 acres each, each farm to be provided with a good house and stocked with 30 cows. Each farm is to have 40 acres of plowed land. For a calf ranch, 75,000 acres of grazing land will be leased, in addition to the regular farms.

The plan further contemplates the erection of a large cheese and butter factory, and a narrow gauge (2 foot) railroad to connect the farms with the factory. The railroad will have to be from 30 to 40 miles long, with 58 stations. The milk is to be collected twice a day. A capital of $400,000 is named as the sum required for carrying out the project. The farms are to be leased or sold to tenants, as they may prefer.

The Newfoundland Seal Catch.

The sealing operations about Newfoundland have been very profitable the past season. Twenty-seven steamers and many sailing vessels were engaged, the steamers making two trips each to the ice floes, where the seals are taken, during the season which lasted from March 15 to May 15. The total number of seals captured by the steamers was 334,513, young and old; the weight of the blubber and skins exceeded eight thousand tons; the approximate local value of the steamer catch being $850,000. The entire catch was as follows:

	Number of Seals.
Captured by steamers	334,513
Captured by sailing vessels	63,500
Captured in the northern bays of Newfoundland	17,000
Captured on so-called French shore of Newfoundland,	21,000
Captured on west coast of Newfoundland by schooners there fitted out	19,800
Total catch around the island	455,813

Estimated value in European markets, $1,250,000.

Hall's Life Raft.

Mr. Thomas Hall of Newton, Mass., has just received a patent for a life-raft which is both novel and practicable. It consists of a double float or raft made of cork or other light material in such form as to fit the outside of any ordinary ship's boat. The raft is made in two parts secured to opposite sides of the boat by suitable lashings. On shipboard the raft may be carried on deck or suspended from davits. When launched it is impossible to either swamp or sink it. Life-lines are provided on all sides, so that it will not only float those actually in the boat, but as many as can hang on by the lines.

A raft of this kind if generally adopted would save many lives, as in times of intense excitement the ordinary boats are very liable to be overcrowded and swamped in launching; they are also in great danger of being overturned by people in the water in their attempts to save themselves.

A Correction.

By the accidental omission of the word "city," in acknowledging the source of Prof. J. D. Parker's article on "Heath's Discoveries in South America," in a late issue of this paper, the *Kansas City Review of Science and Industry* was deprived of the credit which was its due.

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IMPROVED CAR TRUCK.

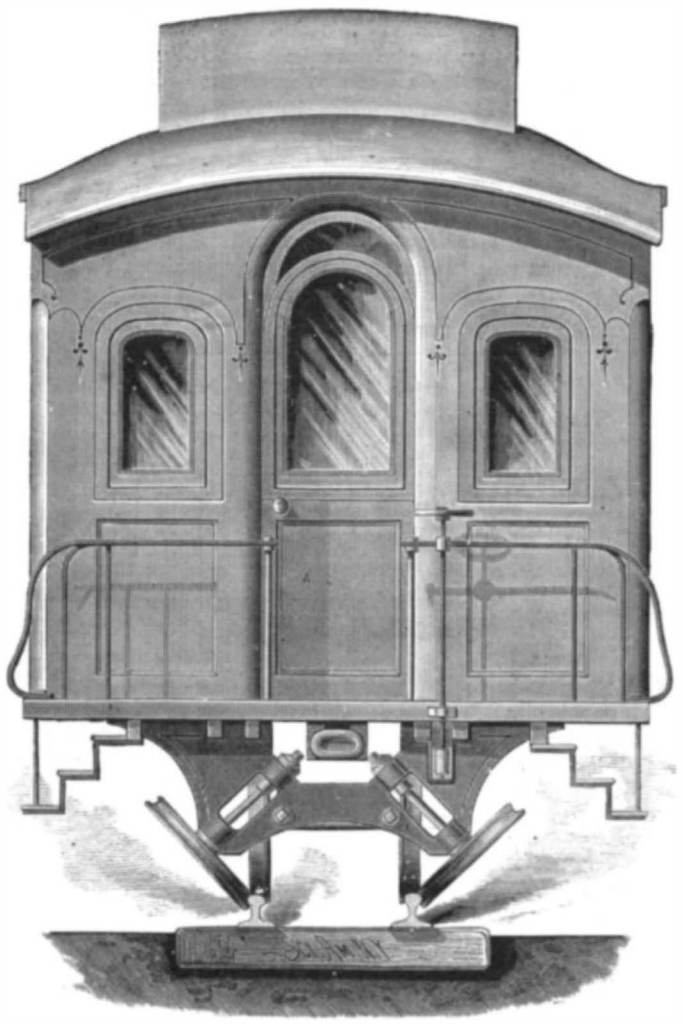
The annexed engraving represents an improved car truck recently invented by Mr. F. Beaumont, Jr., of San Antonio, Texas, which admits of greatly reducing the gauge of the road without diminishing the width of the car. It is easy to show that an immense saving can be made by using the narrow gauge instead of the broad gauge system of railroad building. With the narrow gauge all the heavier work of grading, embanking, tunneling, etc., costs far less, and an important proportion of land damages is avoided. Half the expense of rails is saved and shorter curves are practicable, which makes the constructive engineering both easier and cheaper. Roads of the ordinary narrow gauge of three feet cost about five-eighths as much as the broad gauge roads. And an equal degree of speed is also attainable with greater safety, as from the shortness of the axles the wheels slip less on the outer sides of curves, thereby diminishing the torsional strain on axles, which, as is well known, destroys the fiber of the iron, making the car axles useless after a time, and is frequently the cause of railway accidents.

A much larger saving in the cost of construction can be attained by the use of the improvements illustrated, without proportionately diminishing the size of the cars, as shown in the engraving, representing an end view of a car seven feet in width (usual width of narrow gauge cars) on a track of only eighteen inch gauge. The engraving so well explains the nature of the invention that but little need be said further, than that the improvement consists of the lateral wheels placed upon axles, inclined upward and inward at an angle of about forty-five degrees to the axles of the ordinary transporting wheels. These inclined axles have their bearings in the bolsters, one of which is placed at each end of the car truck. The inclined wheels run on the outside of their respective rails, their flanges projecting under the rail head, tending to keep the car in equilibrium, and permitting a much larger part of it than usual to overhang the rails in perfect security, thus enabling the gauge of the track, and consequently the road bed, to be greatly diminished in width, as shown in the engraving. When the car is seven feet the gauge is eighteen inches, and the tie is three feet long.

The inventor is fully aware of the necessity of some important modifications in switches, turnouts, etc., and has also invented a system of these, especially adapted to his method of narrow gauge, which makes it entirely practical.

The improvement is well calculated to cheapen the construction of railroads, so that they may be built in many instances where now it is impossible to build the present narrow gauge for lack of sufficient capital.

The invention has lately been patented by F. Beaumont, Jr., and Jno A. Fraser, assignee, of San Antonio, Texas, who may be addressed for further information.



BEAUMONT'S CAR TRUCK.

EXPANSION VOLTAMETER.

BY GEO. M. HOPKINS.

In the ordinary voltameter in which acidulated water is decomposed by electrolysis, and by which the strength of the current is determined by the volume of gas accumulating in a given time, there are several objectionable features which prevent it from coming into general use for the measurement of the strength of electric currents.

In the first place the electrolytic voltameter is incapable of indicating the strength of the current at any particular moment, and cannot, therefore, yield anything but a mean result. It offers considerable resistance in the circuit, its indications depend upon the acidity of the water, and the size and distance apart of the electrodes; and to secure accurate results the temperature and barometric pressure must be taken into consideration.

The voltameter shown in the engraving depends on the heating effect of the current on a thin wire of platinum or copper, the lineal expansion of the wire giving the index more or less motion, according to the strength of the current.

This instrument, like the electrolytic voltameter, is adapted only to strong currents, and, although it has one source of error to be compensated for—that is, the increase of the resistance of the wire with the increase of temperature—no account is taken of the environing temperature nor of barometric pressure, and the indication may be read at any moment; and, moreover, the increase of resistance due to increased temperature may be disregarded, since the normal resistance of the wire is almost nothing.

This voltameter finds its principal application in connection with the stronger currents, such as are employed in electric lighting, in electro-metallurgy, and in telegraphy, and it is a convenient adjunct to the dynamo-electric or magneto-electric machine. It must be adapted within certain limits to the current which is to operate it, but when the instrument is properly proportioned to its duties its indications may be relied upon.

A vertical plate of vulcanite supports a horizontal stud, upon which are placed two metal sleeves having a glass lining. To one of these sleeves is attached a counterbalanced arm, carrying at its upper end a curved scale, having arbitrary graduations determined upon by actual trial under approximately the same conditions as the instrument will be afterward subjected to in actual use. The other sleeve carries a light counterbalanced metal index, which moves in front of the curved scale. Each sleeve is provided with a curved platinum wire arm, dipping in mercury contained in an iron cup secured to the base. Two platinum or copper wires are stretched along the face of the instrument, and attached at one end to hooks passing through an insulating post, and after passing once around their respective sleeves on the index and scale, are attached to spiral springs, which in turn are connected with wire hooks extending through an insulating post projecting horizontally from the vulcanite plate.

Under each wire there is a horizontal meta bar communicating under the base with one of the binding posts. The two other binding posts are connected separately with the two mercury cups. It will be seen that with this construction the expansion of the rear wire will move the scale, while the expansion of the front wire will move the index. In order to apply the current to any required length of wire, there is upon each of the horizontal bars a clamp, which may be placed anywhere along the bar and screwed up so as to clamp both wire and bar.

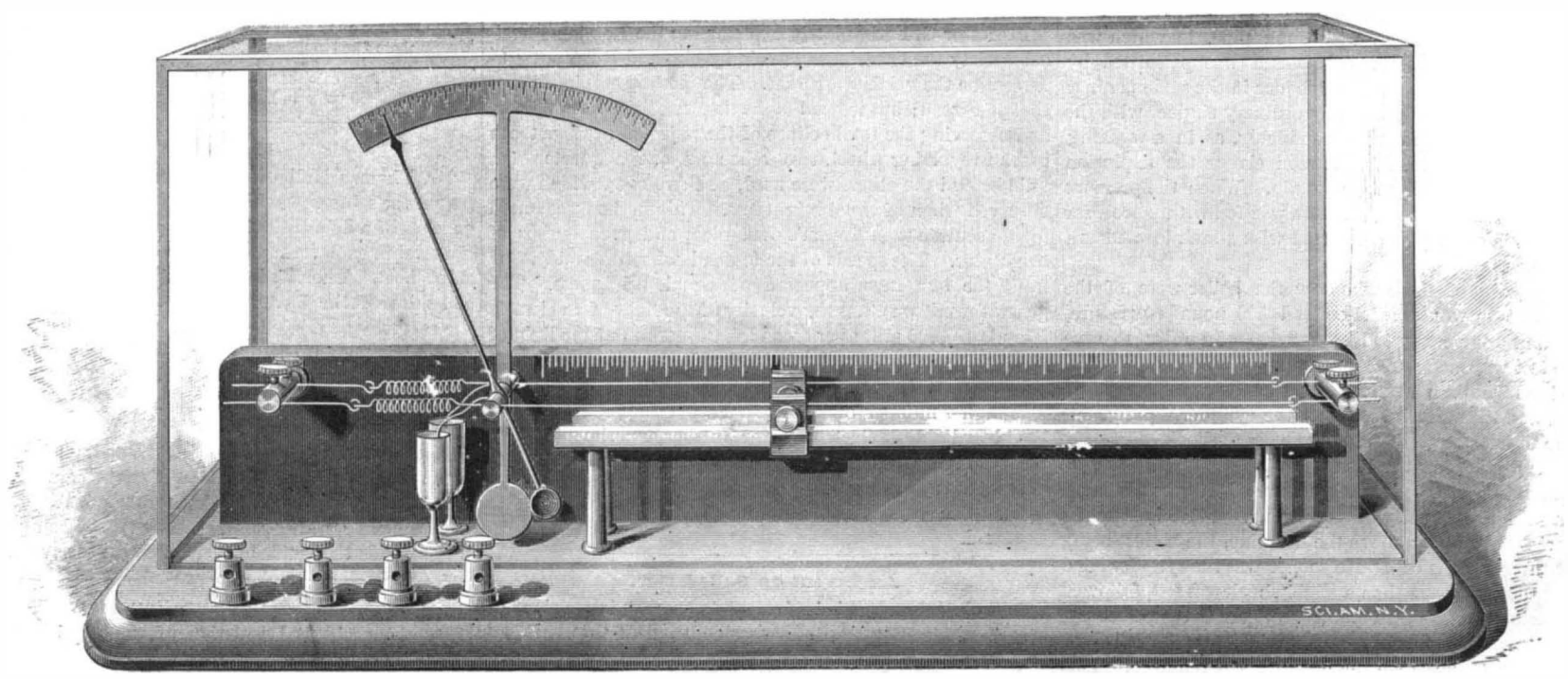
Usually the current to be measured will pass from the battery or machine to one of the binding posts, thence to the forward horizontal bar, thence through the expansion wire connected with the index, through the sleeve of the index, and finally through the mercury cup to the other binding post.

It will be observed that both scale and index will be moved in the same direction by the expansion of their respective wires, and that the atmospheric temperature affects both alike. This being true, it is unnecessary to take any account whatever of external temperature. The apparatus is inclosed in a glass case to prevent the cooling action of the draughts of air.

By connecting the index expansion wire with a battery having an electromotive force of one volt, the deflection is very slight, even with a very fine wire, but in a stronger current from a battery having an electromotive force of five volts and upward, slight variations will be readily indicated.

As mentioned before, the instrument must be adapted to the conditions under which it is to be used. For use with a moderate current, a No. 36 platinum wire, about the length of that shown in the engraving, answers a good purpose, but for heavier currents from a dynamo-electric machine, a larger and longer wire of copper will be required. It should be small enough to be heated somewhat by the current, but not so small as to offer any material resistance in the circuit. When the larger wires are used they are not wound about the sleeves of the index and scale, but are bent downward before reaching the sleeves, and the mercury cups are placed so as to receive their lower ends. Cords or small chains are attached to the angles of the wires and wrapped once around the sleeves and attached to the springs.

This instrument, placed directly in the circuit of a dynamo-electric machine, or in a branch circuit, will indicate the amount of current passing. When it is desired to compare two currents the expansion wire of the index is placed in one circuit, and the expansion wire of the scale is placed



EXPANSION VOLTAMETER.

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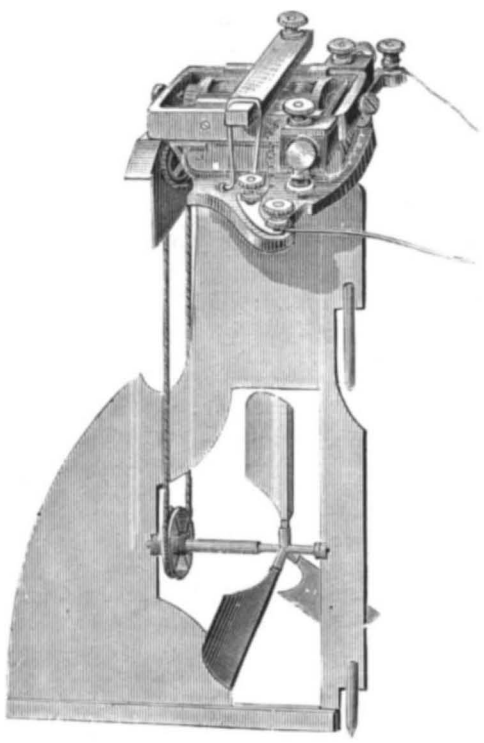
in the other circuit. In a delicate instrument of this kind the tension of the expansion wires should be only sufficient to keep the wires taut, as they are readily stretched when considerably heated.

THE ELECTRIC BOAT.*

Mr. G. Trouvé has just constructed an electric motor specially adapted to be used in a row boat or canoe. He made his first public experiment on the 26th of May, in Paris, on the Seine, in the presence of MM. Berger, Commissioner



THE ELECTRIC BOAT—DETAILS OF PROPELLING MACHINERY.

General of the Exposition Universelle d'Electricité, Antoine Breguet, editor of the *Revue Scientifique*, and numerous other spectators, who were greatly astonished to see the boat moving against the current without oars or the smoke generally inseparable from the steam engine.

This electric motor is furnished with a Siemens armature connected by an endless chain with a screw having three paddles, and placed in the middle of an iron rudder. The motor is placed on the upper part of the rudder, so that both the motor and propeller follow the movements of the rudder.

This motor, with all its accessories, only weighed five kilogrammes, and was placed in the rear of a little barge about five meters fifty centimeters long, by one meter two centimeters in breadth, and weighing eighty kilogrammes.

In the middle of the boat were placed two secondary batteries weighing twenty-four kilogrammes. Mr. Trouvé prefers two batteries, as they are more easily managed and have the advantage that they can be used either together or separately; also that in the evening one can be used for propelling and the other for lighting the boat.

The secondary piles are connected with the motor by two cords that serve both to cover the conducting wire and to work the rudder, and are furnished with handles that can be used to regulate the electric current.

This electric motor is complete in itself, and can be placed on a small boat. It is arranged in such a way that it does not interfere with the action of the boat or the use of the oars.

The ingenious inventor, before deciding on the endless chain, made various experiments with the different ways of propelling by cog-wheels by an endless screw and by friction. He found the two first too complicated and too easily clogged by the sand, branches, etc., floating in the water to be advantageously used, while the latter system, though perhaps the better, presented numerous practical difficulties. The endless chains are the best adapted for actual use, as their slower movement is more than compensated by their greater strength and regularity.

Besides her experimental trip, this electric boat has at six different times easily navigated the Seine for a distance of 200 meters. It is found that the boat, containing three persons, stemmed the current at the rate of one meter a second, and descended with a speed of two meters five centimeters. The current of the Seine at this place runs about twenty centimeters a second.

These trials are very interesting from an experimental point of view, and will, we hope, be an incentive to more important works. These will assuredly take place when the supply of electricity is more easily procured, for it cannot be denied that the present electric pile is not an advantageous arrangement, as it is difficult to mount and its power is limited.

Three experiments recall those made by Jacobi in 1829 to navigate the Neva by electricity. We reproduce from the *Merveilles de la Science* the account of this interesting attempt, which well deserves to be called the origin of electric navigation.

The voltaic apparatus that furnished the electricity to Jacobi's motor was composed of two Grove batteries, each containing sixty-four pairs of cells, the whole covering thirty-two square feet. This furnished so powerful a current that a piece of platinum wire, 2 m. long and as thick as a piano string, was immediately heated to a red heat on being exposed to the electric current.

There was so much nitrous gas liberated by the pile that the operators were seriously incommoded, and were several times obliged to interrupt their experiment.

The spectators, who stood on the banks of the Neva, were also forced to retire on account of the suffocating odor of the liberated gas that the wind blew on to the shore.

The barge, which was made with paddlewheels, and was large enough to hold twelve persons, succeeded, however, in sailing several hours on the river against both wind and tide.—*La Nature.*

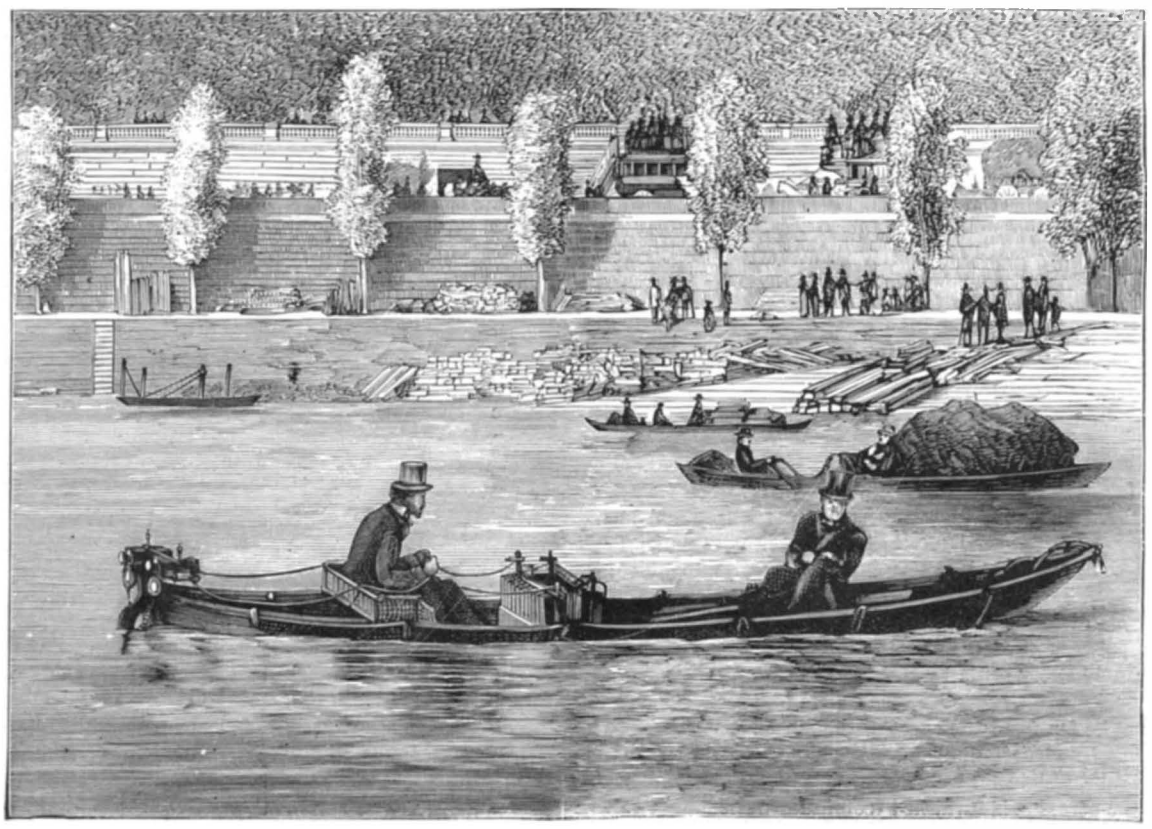
Large Flagstones.

It is said that the largest flagstone ever cut was laid in Chicago before the great fire. It measured 16x25 feet and was 12 inches thick. Lately one 15x25 feet was cut at Waterville, Oneida County, N. Y., and $5,000 have, it is said, been offered for it delivered in this city. The problem is to get it here, since it is too wide to pass railway bridges and tunnels, and would be too high if turned on edge. Equally great are the difficulties encountered by way of the Erie Canal.

Experiments with Binoxide of Hydrogen.

M. Paul Bert, who, in spite of his election into the French Chamber, continues his scientific experiments, found some time ago that oxygen gas at a certain degree of pressure had the property of destroying all kinds of organized ferments, while it was without action on the chemical ferments of the saliva and the pancreatic fluid.

A young French chemist, M. Paul Regnard, has recently renewed these experiments, but instead of using compressed oxygen gas, he has employed binoxide of hydrogen, that is to say, distilled water containing one per cent of the binoxide. He has found that a few drops of this weak solution arrest the fermentation produced by yeast, prevent the production of mycoderms in wine, prevent the putrefaction of milk and white of egg, urine, and saccharated yeast, but have no preventive action whatever as regards the sugar-producing properties of the ferments of saliva and the pancreatic fluid when acting upon cooked starch.



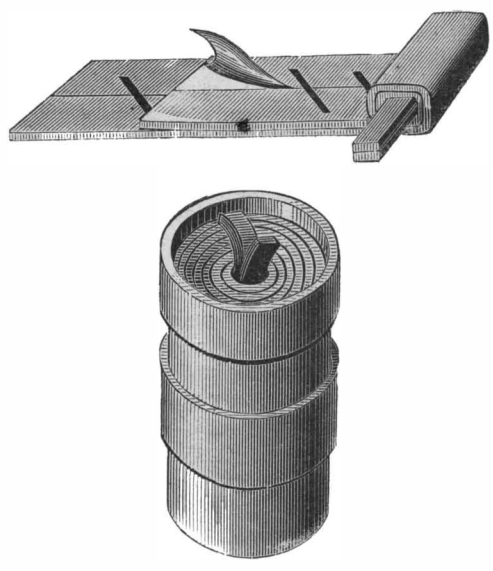
THE ELECTRIC BOAT

* In a note lately presented to the Academie des Sciences, M. Trouvé claims to have improved the Siemens armature. The poles, instead of being portions of a cylinder whose axis coincides with the axis of the system, are so turned that they gradually approach their surfaces to the magnet until the moment when the under side escapes from the influence of the magnetic pole, and the repulsive action commences. By this device, the point of total rest is practically avoided.

M. Trouvé adds that they proved this by constructing two Siemens armatures of the same diameter, one of which he modified in the above manner. He used them successively in an electric motor, and with the same pile he obtained a much greater working power from the modified form. More ample details may be found in "Comptes rendus des Séances de l'Academie des Sciences."

THE FAURE BATTERY—STORED-UP ELECTRICITY.

The current number of *Le Journal Universel d'Electricité* contains, says *Engineering*, a very ably written article by M. Frank Géraldy upon the Faure secondary battery, to which we recently referred. From this article we find the space to make the following extracts: "The posters bearing the words 'Power and Light' in enormous letters, are still visible on the walls; the noisy articles that have appeared in certain journals are not yet forgotten; however, the bills are beginning to disappear, the effect of the articles to decrease, excitement is on the wane, and the scientific press can at last be heard. It has, indeed, been difficult to discuss this matter sooner, for it was essentially necessary to have data and information as exact as possible, and these have not been obtained without trouble."



THE FAURE BATTERY.

The author then refers briefly to the secondary battery of M. Reynier, and proceeds to describe the Planté battery, which he states to be almost identical with that of M. Faure, M. Planté having, except in one point, long ago anticipated what M. Faure has recently brought forward, and which has been received with so much popular excitement. He then continues: "We will now proceed to the Faure secondary battery. It is protected by two patents dated October 20, 1880, and February 9, 1881, respectively. In these patents M. Faure describes principally those batteries composed of lead plates laid on frames covered with red lead, and protected by leather, attached by means of lead rivets, an arrangement similar to the rectangular batteries of M. Planté. The actual batteries are not so made, being constructed as follows: Two sheets of lead are taken 7·87 inches wide; one of these plates is 23·62 in. long, and 0·04 in. thick; the other is 15·75 inches long and 0·02 inch thick. Each plate is covered on both faces with a layer of red lead reduced to a paste by water, 1·76 lb. being spread over the larger plate, and 1·54 lb. over the smaller. On each face thus prepared a sheet of parchment paper is placed, and the whole is introduced into a sheath of thin leather. One plate is then put on top of the other and rolled up, strips of rubber being interposed obliquely, as shown in the sketch. The roll is then placed in a cylindrical lead cell, the outside of which is strengthened with copper bands, and the inside covered with red lead and leather, so as to increase the useful surface of the battery. The latter then presents the appearance shown in the sketch, and one of the projecting stems from the lead plates is bent over and soldered to the inclosing cylinder, which is ready for use when it has been filled with water with about 10 per cent of sulphuric acid. The apparatus when charged weighs about 20 lb. It will be seen that this differs from the Planté secondary battery only in the employment of red lead. The material chiefly employed is the same, the mode of construction is precisely similar, the leather takes the part of the cloth previously used by M. Planté; it has no merit in itself; on the contrary, it is a cause of resistance, and is liable to deterioration, being useful only to keep the red lead in place. It is, in fact, this red lead which constitutes the new feature, and gives the special advantage to the apparatus.

"According to the inventor there are two advantages gained. The long and delicate operation necessary to prepare the Planté battery is not required. (This operation consists in passing through the battery an electric current,

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when oxygen goes to one plate, and produces a thin coat of peroxide of lead, and hydrogen goes to the other plate.) The second advantage claimed is that the battery has a storage capacity much greater than that of Planté; the proportion, according to M. Reynier, being, as deduced from numerous experiments, forty times greater with equal weights of batteries. The first advantage claimed may be readily conceded, and it is one of considerable practical importance and value. The second cannot be admitted, as will be seen from what follows. M. Hospitalier and myself were very desirous to subject the Faure battery to precisely the same tests that we have made with the Planté battery.

"To do this we first addressed ourselves to the proprietors of the invention, who replied that they could not intrust us with the apparatus; that they would not object to trials, but only after some time. Since this communication we have heard nothing from them. In the absence of direct data we will reason on the figures supplied, and the experiments made by the proprietors of the Faure battery before the public. It has been said and repeated officially that in a Faure battery weighing 165 lb., there could be stored up a quantity of electricity able to produce an effort equal to one horse power, for one hour, or 3·28 foot-pounds per second and per pound of battery. We have only seen the apparatus producing power, on one occasion, at the Société d'Encouragement. Then it was far from giving this result; the battery weighed 326 lb., but instead of giving 1,070 foot pounds per second it only gave 339 foot pounds. The apparatus might have been working under unfavorable conditions; it might have been doing far less than its maximum. We do not wish to draw any deductions from this experiment, which was, however, a very unfortunate one, and we will for the moment accept the 3·28 foot pounds per pound of battery. We ought here to examine what is the duty of the apparatus. In reference to this M. Reynier made before the different societies an algebraical calculation which is published in the Transactions of the Academy. This calculation was met—at the Société de Physique—by many reasonable objections, the principal one being that it was useless, the only conclusion M. Reynier having drawn from it being that the more slowly the battery was discharged the better results that it gave, but no algebra was required to prove this. It is a general characteristic of the Planté secondary and of some primary batteries, as well as of dynamo machines. By using the battery very slowly, therefore, its duty is claimed to be 80 per cent, and as this proportion may be true of the Faure as well as of some other batteries, we will accept it. Admitting then this 80 per cent, 11,800 foot pounds of actual work per pound weight of battery would represent 14,750 foot pounds stored up within the battery. This figure is, up to a certain point, confirmed by an experiment made at the Société de Physique, where eight batteries, maintained, at a red heat during one hour and forty minutes, a platinum wire 13 feet long and 0·048 inch diameter. M. Reynier calculated that the total calorific work (interior and exterior) was equal to 253 foot pounds per second, or 1,518,000 foot pounds in all. According to M. Reynier, the weight of the batteries was 123 lb., so that the power stored up was equal to 12,341 foot pounds per pound of battery. There must have been a slight error here, because, as we have already seen, the useful weight of each battery cannot at the lowest estimate be less than 176 lb., giving a total of 140·8 lb., or 10,840 foot pounds per pound. According to the careful experiments we have made the useful storing power of the Planté secondary battery is 11,350 foot pounds per pound of battery, so that according to the different weights taken, the ratio of the latter to the former is 1·30, 1·08, or 0·95. This is a very long way off the forty times of M. Reynier. That gentleman, informed of this great difference, objected that the Planté battery we had employed must have been an exceptionally good one; those from which he had deduced his comparison had been furnished to him by M. Breguet. If this was the case these Planté cells did but little credit to the renowned maker who supplied. Besides, as a matter of fact, the batteries we experimented with were taken from those made by M. Planté for sale for medical and other purposes. Moreover it must be remembered that there are at present no Faure batteries made for sale, the ones already produced having been made by M. Faure's own hands or under his directions, and it is only just to institute a comparison between the Faure battery made by M. Faure, and the Planté battery made by M. Planté.

"The results we have given cannot be far from the exact truth; *a priori* there can be no reason why a battery in which the red lead is spread by hand, should be, weight for weight, superior to an apparatus in which the peroxide is furnished gradually by electricity, and experiments entirely confirm this deduction. The Faure battery is better adapted for industrial purposes, it has more solidity, and can, moreover, be made of larger dimensions; but these advantages might be obtained with the Planté battery if desired; the Faure cell does not require a preliminary electrical process to render it fit to receive the charge, which is a very great advantage, and besides it offers greater resistance for an equal surface, while it is less liable to damage than the other apparatus. But although the Planté battery has been in existence since twenty years, no one has ever suggested its employment as a means of producing power and light, and for several very good reasons, of which we will mention only one—that of transport—which has been treated in the company's prospectus as a detail of insignificance, and referred to only as it were in an excess of scrupulous minuteness.

"In order to furnish a force equal to one horse power during ten hours, ten batteries weighing 165 lb. each must be employed. This is throwing out of consideration the fact that a part of the charge only can be utilized on account of the fall of the potential below the necessary point, which would take at least 25 per cent off its utility. Making no allowance, however, for this, 1,650 lb. would have to be carried twice, that is to say, 1½ tons of battery would be transported daily, besides all other expenses, for a charge of 10 francs a day; we leave the reader to draw his own conclusion. In fact, to maintain that this mode of electrical distribution is more economical than by wires, where they can be used, is to maintain that the present system of distribution of water involves the sinking of an enormous capital in buried pipes, that in these pipes there is always a considerable loss, and that it would be cheaper to substitute a house-to-house system of water transport by means of improved barrels. But this is a point we do not press; it belongs to commerce, not to science, and this journal has nothing to do with money interests. But science suffers much from enterprises of this kind, it scares away confidence from serious undertakings, and exaggerated promises unfulfilled create the utmost distrust in subsequent undertakings of a cognate nature; the public not having obtained what they looked for turn away and refuse to have anything to do with more modest but useful applications which are offered to them. Will it not be thus with the Faure apparatus? The experiences obtained have much interest. The inventor mentions in his patents various special applications, especially for tramways, for which the battery may have a useful future. But why does not the inventor confine himself within the limits of possibility?

"Whatever future may be in store for it, we are at least indebted to it for having drawn special attention to the study of electrical accumulators. Since the announcement of the Faure battery, we know of four others in course of development, all of them of novelty and interest, and all promising a useful though less ambitious future.

"M. Reynier, at the last séance of the Société de Physique, remarked sadly that he did not ignore the relative imperfection of the apparatus he represented, but both M. Faure and himself had been unable to complete them themselves before bringing them before the public, and he trusted soon to be able to show far better results than those given up to the present time. It is an unfortunate position for a man of science to find himself exhibiting and praising without restriction an apparatus of which he sees and acknowledges the shortcomings; it is, in fact, a false position, and one which he would do better to avoid."

Roofing Slates.

Ten years ago the roofing slate industry in this country was not considered of sufficient importance to receive even a bare mention among the "special industries" of the census reports. Last year the capital invested in the manufacture of roofing slates in this country amounted to more than $8,000,000. Over 3,000 men were directly employed producing 600,000 "squares," or sufficient to cover 60,000,000 square feet. The quantity produced in the several States having slate quarries was:

Maine, 60,000 squares; Vermont, 130,000 squares; Pennsylvania, 320,000 squares; New York, 10,000 squares; Virginia and Maryland, 20,000 squares; other localities, 60,000 squares.

The Pennsylvania quarries, which produce more than half the slate turned out during the year, have been worked about 15 years. The largest quarry was opened in 1865. It contains 60 acres, gives employment to 200 men, and produces 40,000 squares a year. The most durable slates are those from Southern Pennsylvania (Peach Bottom) and the Maine slates. The latter rival the best slates of Wales. The dark blue or blue-black slates are most durable. The fancy colored slates—green, purple, red, variegated, etc.—do not hold their color. Red slate is most expensive: during the past season from $7 to $9 per square. The Peach Bottom slates have ranged from $5.50 to $6 50; Maine slate, $5.50 to $7.75; common Pennsylvania, $4.50 to $5.25; Vermont purple, $5 to $5.50; green and variegated, $3.50 to $4.50.

Elastic Adhesive Plaster.

Dr. W. P. Morgan, in a communication to the *Boston Medical and Surgical Journal*, states that he has been trying to obtain an elastic adhesive plaster, that when attached to the skin it should yield to the movement of the muscles and parts beneath it without the sensation of stiffness or an uncomfortable wrinkling.

Not being able to obtain an article of this description, I procured some India-rubber, and giving it a coat of plaster, such as is recommended in Griffith's Formulary under the name of Boynton's adhesive plaster (lead plaster one pound, rosin six drachms), I found the material I wished. After using it as a simple covering for cases of psoriasis, intertrigo, etc., I extended its use to incised wounds, abscesses, etc., and found it invaluable.

Placing one end of the strip of the plaster upon one lip of the wound, and then stretching the rubber and fastening the other end to the opposite lip of the wound, I had perfect apposition of the severed parts, the elastic rubber acting continually to draw and keep the parts together. When I have been unable to get the sheets of rubber, I have used the broad letter bands (sold by stationers) by giving them a coat of the plaster.

Correspondence.

Iridium.—A Letter from Mr. Holland.

We have received from Mr. John Holland, of Cincinnati, a small section of a small bar of iridium, cast by his new process, which we lately described in the SCIENTIFIC AMERICAN. Here is a metal that looks to the eye like polished steel, but is heavier and harder than steel, will not rust, and is not affected by the ordinary magnet. It seems destined to occupy in the near future a very important place in the arts. Mr. Holland writes us as follows:

To the Editor of the Scientific American:

As you considered my discovery of a cheap and effectual manner of melting iridium worthy of several editorial notices in my old favorite paper, the SCIENTIFIC AMERICAN (I have been a subscriber for it since 1858), I take the liberty of presenting you with a specimen of the metal, which please accept with my compliments. This specimen I broke off from a bar 12 inches long, which was cast in an open ingot. The ore was Russian, which I find softer and less refractory than the California iridium; still I have melted all kinds of the ore, and made it run about as free as silver. I use a common draught furnace and a Hessian crucible.

I will add that I have spent over $10,000 in money and been twenty years experimenting almost daily on this metal trying to melt and mould it. I now feel thankful that I have lived to accomplish it in a thorough and practical manner. The quantity of the ore is quite large in Russia and in California.

I hope soon to see it extensively used in the mechanical arts. It is very hard, will not oxidize, and is not magnetic.

I have kept one piece of it, 8 dwts. in weight, on the negative pole of a dynamo-electric machine for five weeks. There was no loss in weight, and had it not met with an accident by falling while hot it seemed likely to last for a long time. The light produced was white in color, and as the iridium is a good conductor of electricity the light was fully one-third stronger than the lamp made with both poles of carbon.

Thanking you for your kindly notices, I beg to say that I feel more satisfaction in the realization of the benefits this metal will be to the mechanical world than for any money I may make by it.

JOHN HOLLAND.

Cincinnati, June 18, 1881.

The Pursuit and Destruction of Icebergs.

To the Editor of the Scientific American:

From accumulated observations during many years past there is reason to anticipate an unusually heavy flow of icebergs along and obstructing the steamship commercial zone of the Atlantic Ocean as the summer advances. During the last year, 1880, the iceberg drift was reputed to have been almost unprecedented, and in repeated instances marine disasters have been attributed to that cause. The severity of the recent winter throughout the high northern latitudes would seem to strengthen the apprehension of their impending recurrence. Recently in connection with the subject of Arctic exploration, I have suggested that when a ship becomes beset by ice floes and icebergs, torpedoes should be employed, charged with dynamite and other explosives, and in cases of urgency the artesian auger resorted to for the purpose of rending and demolishing formidable icebergs to, set ships free from their fatal embrace.

Considering the transcendent importance of a safe route of ocean transit, it would seem expedient that the great commercial powers should co-operate in the employment of explosives and every other resource of modern engineering to free the ocean of these leviathans of the Arctic zones. The pursuit would, perhaps, prove a pleasant recreation, stimulating the ambition of the gallant sons of the sea.

June 17, 1881. DANIEL RUGGLES.

Three Horses Abreast.

The American Express Company has introduced into New York the system of harnessing three horses abreast, after the fashion of the London omnibuses. The change has been made on two of the wagons for an experiment, with very satisfactory results. The wagons are supplied with two poles instead of one, and each of the three horses is attached to a separate whiffletree. This is found to be a decided improvement over the system sometimes used of putting one horse in shafts and another at each side. The harnessing is practically the same as with two horses, with two poles instead of one. The experiment is tried upon the wagons that deliver goods in the upper part of the city, not only because the loads are frequently too heavy for two horses, but to enable the drivers to make up for lost time with an increased rate of speed, when from any cause they are delayed at the start.

Alligator Leather.

The rapid increase in the demand for alligator leather in Europe makes it possible that alligator farming may become an important industry in our Southern swamps. The foreign demand already amounts to many thousand hides a year. The tanning of alligator hides began about twenty years ago. At first Louisiana furnished the skins and New Orleans was the center of the traffic. The general slaughter of alligators soon made them scarce in that State and now Florida is the chief source of supply. The tanning is done here at the North.

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THE PROSPECTS AND PRESENT STATE OF PHOTOGRAPHY IN NATURAL COLORS.

IN TWO CHAPTERS.

II.

Of the various processes for producing pictures by photo-mechanical means only one has up to the present time been submitted to the ordeal of commercial application—that of Leon Vidal. Having departed entirely from the first methods proposed by himself when Secretary of the Photographic Society of Marseilles, he now, as director of a photo-chromic company in Paris, effects a happy combination of two previously well known processes, and examples of the results are at present in the office of the SCIENTIFIC AMERICAN, and challenge admiration on account of their technical merit.

Premising that it is now easy to prepare a printing surface similar to that on a lithographic stone, but which possesses a discriminative power of absorbing moisture and assimilating printer's ink in strict proportion to the intensity of the lights and shadows of nature, it follows that half tone may be produced by mechanical agency. Photochromy by Vidal's system consists in an application of this process combined with the essential principles of chromo-lithography. It differs from the latter, inasmuch as not only does it yield the most perfect gradation of tint or tone, but the drawing is effected by photography instead of by the skilled artist.

The principle underlying this method will be best understood by our giving a brief description of the method by which we saw produced a rose tree clad with foliage and adorned with numerous bright red blossoms. From the original negative were obtained three others, in one of which the trunk, branches, and leaves were entirely stopped out, leaving nothing but the flowers. From a second were stopped out all but the leaves, while in the third the trunk and large branches alone were allowed to remain. By methods well known to lithographic printers three printing forms were then prepared, one from each negative. These were made by coating a thick plate of glass with gelatine containing bichromate of potash, which, when dry and exposed to the action of light under a negative, acquires the property of absorbing and rejecting water in certain parts, and thus interpreting the action of the light when an ink roller is applied. The cliche from the leaves was inked with a semi-transparent green ink, and the prints from this showed faultless gradation of tint together with structural detail. When the whole of the greens had been printed, the form containing the flowers, inked with red, was then placed in the press and by means of careful registration the blossoms assumed their proper places among the leaves. A third printing, this time from the tablet containing the brown trunk and larger branches, completed the operation. The picture, the mode of producing which is now described, when shown to several artists evoked much surprise as to the method by which it could possibly have been made, but at that time Vidal's modern method was unknown and the experiment described was only a tentative one.

It will here be recognized that by the system of overlapping, secondary, tertiary, and indeed numerous colors and tints may be produced. The process applies to everything that can be reproduced by photography, including portraits and landscapes as well as rose trees.

But, query, cannot nature herself be made to do the stopping out part when preparing the several negatives for printing each its separate color? This problem was taken in hand recently by M. Ducos Duhauron, who based his experiments on the theory that the primary colors combine to form every known tint. It is enough to interpose between nature and the sensitive plate a transparent colored medium to insure that medium stopping from reaching the sensitive surface rays which cannot be transmitted by it. But the method of M. Duhauron dips deeper beneath the surface than would be imagined by a superficial observer. He employs three colored glass plates or other transparent media the *complementaries* of the primary colors, each of which will transmit two of its constituents and debar access to the remaining unit—three primary colors being assumed for the sake of explanation to be theoretically correct. If for the production of each monochrome a screen were employed of the same color the negative would represent that color by black, and the two remaining ones by transparent glass, there being in the print none of the color in the part where it was desired it should exist, while it would be elsewhere present.

The screens found most useful for effecting the stoppage of certain rays of light are formed by first collodionizing a plate of glass, and then coating it with a lac or sandarac varnish containing one or other of the aniline dyes modified by other transparent pigments. The colors required in the finished masks or screens are green, orange, and violet, and the mask thus tinted is placed either immediately in front of the sensitive plate in the camera or in near juxtaposition to the lens. From three negatives obtained from nature, each under a mask of a different color, are printed by the carbon, or, more properly, the pigment-printing process, proofs, which, executed in pure colors, are then superimposed on each other and detached from the paper on which it was borne. The resulting picture shows every tint of nature. To prepare the three pigmented papers which are thus made to yield up their colors, Prussian blue represents the blues, carmine the reds, the yellow being produced by chrome yellow. Each of these is mixed with gelatine when applied to its special sheet of paper. The method of printing is essentially that employed in the carbon process, bichromate of potash forming the sensitizing compound. After printing, each integral portion of the picture is superposed and set off upon the other, the result being a photograph in the colors of nature.

It is important, of course, that the three negatives be taken not only simultaneously, but from the same standpoint, a condition of things which one at first sight would say cannot be attained. But here the ingenuity of M. Duhauron again steps in to indicate in what manner this seemingly impossible feat is accomplished. Three cameras, each fitted with its respectively colored glass mask, are ranged alongside each other, all in a row, facing a dark mass of velvet or other black material, and side on to the view or object to be photographed. Erected in front of the lens of the outside one is a faultless plate of glass placed at an angle of forty-five degrees. This acts the part of a reflector, throwing enough rays into its camera by which to enable a brilliant picture to be taken. But as the reflecting mirror is a transparent sheet of glass, a large volume of the light is transmitted through it as well as reflected by it; and the second camera, also fitted with a similar transparent reflecting plate of glass, catches up a portion of the rays thus transmitted, and reflects them through its own lens to its interior. What is not reflected by the second plate is received upon a third one attached to the third camera of the series. It, however, is a mirror proper, the glass being silvered, and the remainder of the rays not utilized by the other two cameras are here rendered subservient to the production of the picture. We may here observe that there is more ingenuity displayed in this, as well as more modifications and applications that may arise out of it, than is imagined by its ingenious originator.

Effective colored pictures have been produced by superposing transparent prints, such as those by Woodburytype, upon colored bases; this, however, belongs to the department of the mechanical application of pigments.

NEW INVENTIONS.

A simple and inexpensive combined hame and collar has been patented by Mr. James B. Law, of Darlington Court-House, S. C. It consists in a broad wooden hame strengthened by iron plates at the bottom, and provided with suitable means for protecting the horse's neck from injury.

Mr. Henry Dainty, of Brooklyn, N. Y., has patented an apparatus for burling wool and carbonizing cotton from mixed rags, so constructed that vegetable impurities and fibers can be removed or carbonized from the animal fibers in much less time and without any danger to the operator from the carbonizing gas when emptying and refilling the apparatus. The invention consists of a carbonizing chamber having slides, drawers placed upon the slides to receive the material, doors hinged at their lower edges, a furnace, a gas-generating retort having gas-discharge pipe leading into the carbonizing chamber, and a detached cover for removing the refuse without drawing the fire, a smoke flue surrounding the gas-discharge pipe, a steam jacket for heating and drying the gas, and an exhaust fan blower having its pipe provided with a valve for withdrawing the gas from the carbonizing chamber when opened, to protect the workmen.

An improved washing machine has been patented by Messrs. Henry Ruppert and John Mullerweiss, Sen., of Sebewaing, Mich. This invention consists in a novel arrangement, with a tub, of two curved oscillating and reciprocating rubbing surfaces, and devices for operating them.

An improved machine for boarding and breaking raw hides has been patented by Mr. William Coupe, of South Attleborough, Mass. This is an improvement on the machine for boarding and breaking raw hides for which Patent No. 202,414 was issued to the same inventor April 16, 1878.

Mr. Henry Cull, of Johnstown, Pa., has patented an improvement in stock cars designed to permit the ready feeding and watering of the animals while being transported over long railroad routes. The invention consists in the improved method of arranging the cattle in the car and holding them in their places.

An improvement in devices or apparatus for temporarily connecting the ends of a belt, so that the slack may be taken up without necessitating the detachment of the belt from the pulleys on which it runs, has been patented by Mr. Peter S. Graham, of Cumberland Mills, Maine.

The Manufacture of Cotton Seed Oil.

The census of cotton-seed oil mills discovered fifty-six, the most of them in the Southwest. Louisiana has nine, of which New Orleans has six; Mississippi has nine; Tennessee and Texas each eight; Arkansas four; Missouri and Alabama each two, and Georgia one. The amount of seed used is about 410,000 tons yearly. After being dusted and stripped of lint, the seed goes to a revolving cylinder set with knives, which cut the seed very fine. There the hulls are separated from the meal, and the latter is pressed between rolls and packed in woolen bags, which are placed between horse-hair mats and subjected to a hydraulic pressure of about 200 tons. The expressed oil is either barreled in the crude state or pumped to a refining room, where it is treated with caustic soda obtaining 82 per cent of fine oil.

The first product derived from this process is the lint, which amounts to about 5 per cent of a crop; that is, the country gin takes 95 per cent of the crop, and the seed retains 5 per cent, which the mills secure. The cotton is very white and clean, but very short, and the best of it sells at eight cents per pound. It is used to make cotton batting. The crop of the oil mills amounted to 5,000 bales last year.

Second. The hulls constitute about one half of the seed. They are used for fuel to run the mill, and thus the mills do not need to buy any coal. The ashes make a valuable fertilizer, and they are also leached for the purpose of obtaining lye to make soap.

Third. The oil amounts to about 15,000,000 gallons in the United States, and about 10,000,000 gallons are yearly exported to Europe, where it is used to adulterate olive oil. Three gallons of cotton-seed oil and one of olive oil make four gallons of the average olive oil, and the cotton oil can hardly be detected. The question naturally arises, If we have to eat olive oil which is made from cotton seed, would it not be well for home manufacturers to prepare it, and not allow the consumer to pay two freights across the Atlantic?

Fourth. The oil cake is of a rich yellow color, and is used principally to feed stock, for which use it is ground and fed like corn meal. It is shipped in sacks, each weighing 200 pounds.

Fifth. The deposit left when the oil is refined is used to make soap, and also for making dyes.

Ransom Cook.

Ransom Cook, who died at Saratoga, New York, May 28, was a representative American mechanic. When a young man he used to boast that he was the master of twenty-six trades.

He was born in Wallingford, New Haven County, Conn., November 8, 1794. His parents removed to Saratoga County, New York, in 1801, and in 1813 he began to work at the trade of a chairmaker. He owned the first shop using steam power in the county. His inventive faculty was early developed, and he took out many patents. One of the first, granted in 1842, was for an improvement in the manufacture of wrought iron and steel cannon. This idea was appropriated by Sir William Armstrong, who made both fame and fortune out of it. Other patents were for a lunch case, for a fan blower, for a hydraulic apparatus for producing a blast, for an improved hydraulic blower for furnaces, for an improved electro-magnetic ore separator (a very ingenious machine, made by Mr. Cook when he was 80 years old), an improvement in blast pipes for carrying heated air and gases to furnaces, an improvement in scissors, an improved boring instrument known as the "Cook auger," an improved machine for turning the lips of augers, an improved bit for boring wood, an improvement in ventilating and excluding dust from railway cars, an improved exhaust fan, and an improvement in the mode of straining saws for sawmills. There were several others of more or less importance.

Mr. Cook pursued this branch of mechanics for enjoyment rather than for the money to be derived from it, although some of his inventions, particularly the patent auger, were very profitable. He was making a machine and wanted an auger that would bore at an angle with the grain without starting with a gouge. He hit upon the idea of examining the lips of the worm commonly known as the wood-borer with a microscope, and from this model, furnished by nature, he made his auger, which was very successful. His workshop was a curiosity. He made all his own models, and had engines and machinery well adapted to the purpose. He had also accumulated one of the most complete and valuable collections of scientific and mechanical books in the country. His library contains more than 3,000 volumes, some of them very rare.

Sir Josiah Mason.

Sir Josiah Mason, the founder of the new Science College at Manchester, Eng., has just died. He began life as a street hawker, and, after trying many trades, he succeeded in establishing himself in the manufacture of split rings by machinery. Subsequently he added the manufacture of steel pens. In 1874 his pen works employed over a thousand hands, consuming half a ton of rolled steel a day. In addition to great business capacity Mr. Mason was remarkable for his practical wisdom and benevolence. In 1860 he established an orphanage, upon which he has expended $1,500,000. Nearly as much more was nobly invested in the Mason Science College.

Cod Fishing with Nets.

The Norwegian method of netting cod, which the U. S. Fish Commission have persuaded our New England fishermen to try, has proved of signal advantage over the old way of fishing with bait. Many more fish are caught, the fish are larger, and the cost of bait is saved. The first trial of the gill nets was made last winter in Ipswich Bay, north of Cape Ann, Massachusetts. As reported by Captain Collins, of the Fish Commission, the results were most satisfactory. On a trip ending January 11, 35,000 pounds of cod were taken by a smack, 8,000 pounds of which were caught in a single morning. Two other vessels, absent just the same length of time, but using trawls, only got 4,000 and 8,000 pounds. The same vessel using the nets made another trip, taking in four days 35,000 pounds of fish again, having caught in one single day 18,000 pounds. Now, on this same day another vessel set, quite close to the nets, 10 trawls of 1,000 hooks each, and only caught 2,000 pounds of fish. The total results of Captain Martin's enterprise, who was the first to use the nets, may be stated as follows: In not quite two months, from November to January, he took 111,000 pounds of cod, while no trawler, with the same luck, had landed one-third of the quantity.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Rowland's Vertical Engine. Wearing parts of steel. Broad bearings. F.C.& A.E.Rowland, New Haven, Conn.

Ladies can wear boots one size smaller after using German Corn Remover. 25 cents of druggists.

Owners of steam boilers can save fuel, repairs, and delays by using Hotchkiss' Mechanical Boiler Cleaner, which removes all mud or scale making properties from the boiler. Send for circular. 84 John St., New York.

Uniform in price and quality. Van Beil's "Rye and Rock." $1 per bottle.

Wanted.—An experienced Machinist and Tool Maker, who is also able to design and construct light machinery. Address, with references, A. B., Box 773, N. Y. city.

4 Roll Planer and Matcher; simple and substantial; weight, 3,500 lb.; price, $500. O.L. Packard, Milwaukee. Wis.

The man who invented the German Corn Remover is a public benefactor. 25 cents. Sold by all druggists.

Houghton's Boiler Compound contains nothing that can injure the iron, but it will remove scale and prevent its formation. Houghton & Co., 15 Hudson St., N. Y.

Lead Foil for Secondary Batteries. E. M. Wood & Co., Worcester, Mass.

Manufacturers and others, send postal at once to *Manufacturers' Gazette*, Boston, Mass., for first number free. Ready first week in July.

Tarred Roof'g, Sheath'g Felts. Wiskeman, Paterson, N.J.

Silica Paints (not mixed); all shades. 40 Bleecker St., N.Y.

Callow's Lettering Pat., illus. p. 358. Catalogue free.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Propellers, 12 to 26 in. Geo. F. Shedd, Waltham, Mass.

Abbe Bolt Forging Machines and Palmer Power Hammers a specialty. S. C. Forsaith & Co., Manchester, N. H.

List 26.—Description of 2,500 new and second-hand Machines, now ready for distribution. Send stamp for the same. S. C. Forsaith & Co., Manchester, N. H.

Combination Roll and Rubber Co., 27 Barclay St., N. Y. Wringer Rolls and Moulded Goods Specialties.

Cope & Maxwell M'f'g Co.'s Pump adv., page 397.

Punching Presses & Shears for Metal-workers, Power Drill Presses. $25 upward. Power & Foot Lathes. Low Prices. Peerless Punch & Shear Co., 115 S. Liberty St., N.Y.

Improved Skinner Portable Engines. Erie, Pa.

"Rival" Steam Pumps for Hot or Cold Water; $32 and upward. The John H. McGowan Co., Cincinnati, O.

The I. B. Davis Patent Feed Pump. See adv., p. 13.

The Eureka Mower cuts a six foot swath easier than a side cut mower cuts four feet, and leaves the cut grass standing light and loose, curing in half the time. Send for circular. Eureka Mower Company, Towanda, Pa.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

4 to 40 H. P. Steam Engines. See adv. p. 414.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 10 Cortlandt St., N.Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

Gardiner's Pat. Belt Clamp. See illus. adv., p. 413.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

The Sweetland Chuck. See illus. adv., p. 396.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N.J.

Skinner's Chuck. Universal, and Eccentric. See p. 397.

For best Duplex Injector, see Jenks' adv., p. 413.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 414.

Peck's Patent Drop Press. See adv., page 14.

For the best Diamond Drill Machines, address M. C. Bullock, 80 to 88 Market St., Chicago, Ill.

Brass & Copper in sheets, wire & blanks. See ad. p. 13.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

The None-such Turbine. See adv., p. 413.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Wren's Patent Grate Bar. See adv. page 13.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Eagle Anvils, 10 cents per pound. Fully warranted.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser M'f'g Co., Waynesboro. Pa.

Baxter Wrenches fit peculiar corners. Indispensable to first-class mechanics. Greene, Tweed & Co., N. Y.

Houston's Four-Sided Moulder. See adv., page 14.

New Economizer Portable Engine. See illus. adv. p. 12.

Cutters for Teeth of Gear Wheels formed entirely by machinery. The Pratt & Whitney Co. Hartford, Conn.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Long & Allstatter Co.'s Power Punch. See adv., p. 13.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 12.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

Saw Mill Machinery. Stearns Mfg. Co. See p. 13.

Use the Vacuum Oils. The best car, lubricating, engine, and cylinder oils made. Address Vacuum Oil Co., No. 3 Rochester Savings Bank, Rochester, N. Y.

Wiley & Russell M'f'g Co. See adv., p. 396.

For Machinists' Tools, see Whitcomb's adv., p. 12.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

For Mining Mach'y, see ad. of Noble & Hall, p. 14.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) S. L. R. writes: 1. We have a boiler 15 feet long, shell 4½ feet in diameter, having eighty 3-inch flues. We wish to burn shavings and sawdust. How much grate surface should we have? A. About 36 square feet. 2. What kind of grate? A. A thin, plain grate with narrow openings. 3. How high should the chimney be and what size the flue? A. 6 feet, and 36 inches square. 4. The engine is 14x30. What should be the size of the steam pipe leading to the engine, and what size the exhaust? A. Steam 3½ inches diameter, exhaust 5½ inches diameter. The furnace should be at least twice the usual depth for coal.

(2) E. J. C. writes: A well known writer on stationary engines says of the curved or coiled pipe that connects the boiler and steam gauge: "The cock which is placed at the lowest part of the inverted siphon pipe is designed to draw off any water which may have collected in it; if the water was not drawn off it would rise into the gauge and the steam pressure would be incorrectly indicated." Please explain. A. It would act like a siphon gauge, by the difference of height of column of the liquid in the two legs of the siphon; but as these siphons are usually made, the inaccuracy would be inappreciable.

(3) L. G. G. asks: What is the best and most economical way of producing a bright surface upon several iron pins, ¼x½x3, having the fire scale still on? A. Use emery wheels.

(4) A. D. W. writes: If your correspondent, J. A. D., will put a cock into the top of the air chamber of his Niagara pump and fill it with water it will be all right. Such at least is my experience with one of them. I take it the steam takes the place of the air, and then a current of air causes condensation, which produces a vacuum which tends to hold the valves.

(5) G. G. M. asks if there is not some mistake in reference to $500,000,000 gold weighing 4,500 tons, as stated in No. 24, late volume, under head "The sub-treasury gold wagon." A. Yes; it should be 1,000 tons.

(6) W. W. asks: Will the boilers used in ranges, some of which are warranted to stand 200 lb. pressure per square inch, answer for an engine 1½x8? How would you arrange it to obtain the best results? A Yes; for moderate pressures, say, not over 40 lb.; we have seen them set in masonry; they may be set either vertically or horizontally.

(7) E. L. B. asks: Can you inform me how the hydrostatic press and jacks came to be commonly called hydraulic press and jacks? A. We cannot; either term is correct. When the pressure is being exerted, the fluid is in motion: it is then hydraulic. When the pressure is obtained, and the water is at rest, it is then properly hydrostatic.

(8) D. R. asks how to feed turtles and fishes? How often should fresh water be supplied? How long will a turtle live with nothing to eat? A. Feed the turtles and fish on earth worms after they have been placed in grass or moss over night to scour them of all earthy matter, then cut them up to one quarter of an inch and feed to the animals. Look out that none are left after the animals have had all that they require. Remove from the aquarium what are left, or decomposition will take place, which will spoil the water and turtles. Raw beef answers well as a food for fish. In a true self-supporting fresh water aquarium the water needs never to be removed if the proper kinds of plants are used for oxygenation. A good sized turtle will live three months without food, a young turtle one month.

(9) A. W. asks: How much steam pressure will a boiler stand, 15 inches diameter by 30 inches high, made of cold rolled copper, No. 21 English wire gauge? A. Not over 16 lb. per square inch. The heads should be braced with care, and it should be tested with water pressure to at least 80 lb. before using.

(10) E. F. J. asks if any benefit is derived from combining magnesium with steel. A. A half per cent of magnesium changes coarse-grained into fine-grained steel and greatly improves the quality. The magnesium is introduced through an opening in the cover of the crucible, after inserting some small bits of charcoal, in order to remove the free oxygen. Without this precaution there would be danger of an explosion.

(11) C. wants to know how to make shoe blacking. A. Mix intimately 1 pound of molasses, 1 pound of best bone black, in very fine powder, and ¼ pound olive oil; then add ¼ pound sulphuric acid, previously diluted with ¾ pound water. The whole is allowed to stand for three hours or longer, and afterward as much water is added as is necessary to give it the proper consistence.

(12) G. I. J. asks: Is there any device by which I may regulate the strength of the current from a powerful electric battery? The ordinary resistance coils will not do. I wish to change the strength gradually by means of a resistance placed at some point in the circuit. A. You can make resistance coils that will answer your purpose, by making a wooden reel in the shape of a cross, and winding uninsulated wire upon it so as to have an air space all around each convolution. If the current heats the wire so that it will burn wood, you may place strips of asbestos board along the edges of your reel.

(13) M. E. W. asks how to find the point at which to place the weight on a safety valve so that steam will blow off at the required pressure. A 1. Multiply the pressure per square inch by the area of the valve; the product is the total weight required upon the valve. 2. Divide this total pressure by the weight to be hung on the valve lever; the quotient is the number of "leverages" which you must give the weight from the fulcrum. Suppose 100 lb. steam and 12 inches area of valve; then total pressure on the valve is 1,200 lb.; and if the weight be 80 lb., then 1,200÷80=15 "leverages." Now, if the distance from fulcrum to center of valve be 3 inches, then the weight must be set at 3x15=45 inches from fulcrum, or 42 inches from center of valve. Of course this does not take into account the effect of the lever or weight of the valve.

(14) O. R. M. asks for a simple method of testing or assaying specimens of rock. A. Charge into a 6-ounce crucible, 1 ounce each of the ore and dry bicarbonate of soda, 2 ounces of litharge (free from silver), ½ ounce of argol, and cover with ¼ inch of dry salt. Heat the crucible until the contents are in a quiet state of fusion, remove from the fire, cool, break, and clean the lead button by pounding on an anvil. If the button weighs more than, say, half an ounce, scorify it down in a scorifying dish in an open muffle. Heat 1¼ inch bone ash cupel in the muffle, drop into it the button, and keep up the temperature of the muffle to a bright red heat until all the lead has been scorified off and absorbed by the cupel, and the small bead of gold or silver (if the ore contains any) becomes well rounded and clear. The ore must be finely powdered, and the whole of it passed through an eighty-mesh sieve.

(15) A. S. asks for information as to the direct determination of silver in galena on Volhard's principle. A. From two to five grammes of the galena, according to its supposed richness in silver, are very finely ground and intimately mixed in a porcelain mortar with from three to four times its weight of a flux composed of equal parts of soda and saltpeter, placed in a porcelain crucible, covered, and heated over a burner to thorough fusion, when the mixture is well stirred with a glass rod. It is then let cool and placed in an evaporating dish partly filled with water, in which the melted matter is softened, dissolved out of the crucible into the dish, which is then heated, and the watery solution is filtered into a flask. The residue on the filter, after being well washed, is rinsed back into the dish, very dilute nitric acid is added, and the whole evaporated to dryness. The dry residue is taken up in water acidulated with nitric acid, heated, and filtered into the same flask in which is the aqueous solution. The residue is washed with hot water, the filtrate is allowed to cool in the flask, ferric sulphate or iron alum is added, and the liquid is titrated.

(16) H. J. asks how to make a good quality of domestic grape wine? A. Put 20 lb. of ripe, fresh picked, and well selected grapes into a stone jar, and pour on them six quarts of boiling water. When the water has cooled enough, squeeze the grapes well with the hand; cover the jar with a cloth, and let it stand for three days; then press out the juice, and add ten pounds of crushed sugar. After it has stood for a week, scum, strain, and bottle it, corking loosely. When the fermentation is complete, strain it again and bottle it, corking tightly. Lay the bottles on their side in a cool place.

(17) A. W. asks: By what means can an enameled surface be gilt with a name, same as on a lead pencil? A polished pencil, having a coating of shellac, can be stamped with gold by aid of a heated dye; not so an enameled surface—the gold will rub off entirely. A. Use thin gold size and a hot brand.

(18) A. B. asks how to case-harden small articles. A. Make a paste with a concentrated solution of prussiate of potash and loam, and coat the iron therewith; then expose it to a strong red heat, and when it has fallen to a dull red, plunge the whole into cold water.

(19) R. W. inquires how to prepare emery for optical purposes. A. Mix four pounds of the flour emery of commerce with one ounce of powdered gum arabic, and then throw the powder into two gallons of clean water. Collect the deposits at the end of ten seconds, thirty seconds, two minutes, ten, twenty, and sixty minutes, and that which is not deposited by one hour's subsidence is thrown away as useless for grinding lenses. The use of the gum arabic renders the water slightly viscid.

(20) J. N. L. asks: 1. Is there any liquid fuel, sootless and smokeless, that could be used in bed chambers having no flue or means of keeping up an ordinary fire? A. We know of no cheap fluid that we can recommend for such purposes. Fires without flues to carry off the products of combustion should never be used in sleeping apartments under any circumstances. 2. If gasoline or other liquid will answer for such purpose, about what would be the cost per hour to heat 1,000 square feet 100° Fah.? A. Gasoline cannot be used in this way.

(21) R. W. S. writes: I have a telegraph line a few rods over one mile in length. Wire is No. 14, well insulated. Have two twenty ohm sounders on the line and six cups, gravity battery all at one end. When battery sets one way I get no current at all. Reverse it, and the sounders work faintly. What is the trouble? Is main line of too great resistance for battery, or are the grounds weak? Have had some experience in making grounds, and never before had anything which would not work well. I thought four cups would run the line. A. If your line wire is iron, the resistance is too great; you must use a larger wire or more battery. If your wire is copper, your grounds or connections must be at fault.

(22) C. W. R. asks how the magic solder wire is made, such as pedlars sell for mending tinware, copper, etc. It is some kind of composition of chemicals run together, then drawn out into wire, and is to be used without the acid, simply by holding the light or heat underneath the place to be mended, then simply let the solder melt. A. For an easily fused solder melt together in a crucible or iron pot, at a very moderate heat: bismuth, 1 part; tin, 3 parts; lead, 2 parts, and cast in slender sticks. For the common solder wire melt together equal parts of tin and lead and pour it through a vessel having a very small opening in it, into a tub of water. If the metal is the right temperature, and if the apertured vessel is supported the proper distance above the water, the stream of melted metal will be cooled, forming a more or less perfect wire.

(23) N. E. writes: 1. I am running a band saw, and have a great deal of trouble with the lap. We use common solder, but it will not hold the ends together but a short time. The saw is two inches wide by one-sixteenth thick. How long should I make the lap, and what is the best solder, or how can I braze it? Can you give me a receipt to make a solder better than the common solder that tinsmiths use? A. Make your lap about an inch long. Coat the adjacent surfaces well with borax paste, and wire the two ends together with iron binding wire. Support the joint over a large piece of charcoal, and apply pieces of silver solder to the edges of the joint, having previously coated the solder with borax. Now with a strong blow pipe flame heat the saw at the joint until the solder flows. 2. I have about 100 of the SCIENTIFIC AMERICAN I wish to bind. What is the cheapest and the best binding that I can get? A. We know of no cheaper way than to employ a bookbinder.

(24) W. W. C. asks: 1. How can I preserve some manuscript written on common paper and with an ordinary lead pencil so that it will not rub off, or in other words, how can I make the writing indelible? A. Lead pencil marks cannot be rendered indelible, but if the lines are washed over with a clear solution of ¼ oz. of gum arabic in 6 oz. of water they will not rub off readily. 2. Two bodies of exact size and shape, but of unequal weight, and each presenting an entirely smooth and non-compressible surface to the atmosphere, are dropped from a given height at the same time: will they reach the ground together? Some philosophers say they will, others say they will not unless they be dropped in a vacuum. A. In a vacuum, yes; in the air, no; the heavier body is capable of overcoming the resistance of the air more easily.

(25) J. J. S. writes: I wish to know something of the nature of nitro-glycerine. Please answer the following questions through SCIENTIFIC AMERICAN: 1. After being prepared, and coming suddenly or otherwise in contact with air, does it (the air) have any effect on its explosive properties? A. The air has little or no effect upon it. 2. In its liquid form for what purposes is it generally used and when so used? How is it exploded? A. Chiefly in blasting, in tunneling, and mining. It is used extensively for cracking the rock in the bottom of "dry" petroleum wells. It is exploded by fulminating or percussion caps by electric spark or fuse. 3. Where is it made, and what size cans is it generally put up in? Also the difference in explosive power while in liquid form, and such preparations as "giant powder," "dynamite," and other high explosives having nitro-glycerine as a basis. A. See article on nitro-glycerine, pages 344, 345, current volume of the SCIENTIFIC AMERICAN. The cartridges usually vary from four ounces to five pounds or more. With regard to the relative efficiency of dynamite, giant powder, and nitro-glycerine, consult Mowbray's "Trinitroglycetine." 4. I read of two empty glycerine cans being found in the woods somewhere in Pennsylvania by two small boys. A man to whom they were shown attempted to open them, causing an explosion, thereby losing his whole arm, tearing it from his body. Now, the cans being empty, how do you account for the explosion? What are the most serious objections to its being handled in liquid form? A. Such packages always retain a little of the explosive adhering to their sides after their contents have been poured out.

(26) W. C. R. says, in answer to N. J. A., who asks for the best method of preserving fence posts: "My experience is to bore a large hole in the end of the post that is to be put in the ground, fill it with salt, and then plug the hole tight with a wood plug."

(27) C. M. K. asks: Can you inform me of any means by which the flesh can be taken from the bones of small birds, leaving a perfect skeleton? A. The following method will answer in some cases: Put the bones in a strong, warm alcoholic solution of caustic potash for a short time, then immerse them in running water until clean.

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(28) J. P. F. asks: When ironing shirts, etc., what is the best way to put on a gloss? A. Raw starch, 1 oz.; gum arabic, 1 drachm; white of egg or blood albumen, ½ oz.; soluble glass, ¼ oz., water, q. s. Make the starch into a fine cream, dissolve the gum in a little hot water, cool and mix it with the albumen, and beat up the mixture with the starch liquid. Then add the water-glass (solution) and shake together. Moisten the starched linen with a cloth dipped in this liquid, and use a polishing iron to develop the gloss.

(29) G. A. C. asks if paper is saturated with cupric ammonia, can metallic copper be reduced on the surface and in the fibers of the same, and by what process? Iron will not. Will an acid, hydrogen, or tin dust, will anything? A. Try exposing the paper for some time in a current of heated hydrogen; or dip the saturated paper in ammonium sulphide; rinse, spread on a plate of copper, dip in dilute sulphuric acid, connecting the copper by wire with the zinc pole of a good battery, the other pole being connected with a second strip of copper also immersed in the dilute acid. If the current is strong enough to decompose water it will reduce the copper on the paper.

(30) A. M. F. asks as to the average number of tons of coal consumed daily by any steamer of the following lines, on a voyage across the ocean: White Star, Cunard, Inman, Anchor. Also the number of firemen generally employed on any one ocean steamer. A. White Star steamers, 95 to 100 tons per day; 18 firemen. City of Berlin, City of Brussels, each 110 tons per day; about 28 firemen. Ansona, 120 to 130 tons per day; 24 firemen.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

F. McL.—Nos. 1 and 2, calcite—carbonate of lime. No. 3 is quartz.—M. M. R.—It is a split leather—that is a thin sheet cut from thick tanned leather by appropriate machinery. It may be purchased from leather dealers.—J. M. P.—No. 1. Quartzose rock with horn silver—a rich ore. No. 2. Quartz rock with selvage. No. 3. Chiefly iron—copper sulphides.

COMMUNICATIONS RECEIVED.

On a Growth of Grain in Ice. By D. J. B.

Electric Light for Purifying Sewers. By J. G. S.

NEW BOOKS AND PUBLICATIONS.

THREE HUNDRED YEARS HENCE: OR, A VOICE FROM POSTERITY. By William Delisle Hay. London: Newman & Co.

A highly imaginative forecast of human affairs, in the guise of a series of lectures delivered by a Professor of History in the year A.D. 2180, tracing the progress of humanity from the beginning of the "Era of Development," A.D. 1880. The author has a curiously inventive turn of mind, and has filled his book with novel ideas and pictures at once original, whimsical, and plausible.

THE STUDENT'S DREAM. Published for the author. Chicago: Jansen, McClurg & Co.

If the author is, as he professes to be, a youthful student, his ambitious attempt to forecast the philosophy of the future is not a discreditable performance. When he is older and knows more he will dream less.

PEACE MAKER GRANGE; OR, CO-OPERATIVE LIVING AND WORKING. By Samuel Leavitt. New York: Published by the author, No. 5 Worth street. 25 cents.

A suggestive story, reprinted from the *Phrenological Journal*, describing the development and working of an ideal yet entirely human, thrifty, and practical community. Unlike most social reformers Mr. Leavitt sedulously conserves what is good in human experience, and seeks to reconstruct society by lifting life and labor to a higher, purer, and kindlier level, by sloughing off the barbaric elements of modern civilization, not by relapsing toward barbarism. The work is germinal and is worthy of a better dress.

DR. J. H. McLEAN'S PEACE MAKERS. By Dr. James Henry McLean, St. Louis, Mo., projector, inventor, and patentee, with Myron Coloney, New Haven, Conn., mechanical inventor and patentee. New York, 1880.

An illustrated catalogue of deadly engines, by means of which the inventors expect to command peace throughout the world, by making war so terrible and destructive that nations shall not dare to engage in it. How many of Dr. McLean's devices—which are as marvelous in number, variety, and scope, as they are threatening on paper—will prove of practical utility, remains to be seen.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

June 7, 1881,

AND EACH BEARING THAT DATE

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Advertising balloon, H. T. Sisson 242,483
Amalgamation of gold and silver, compound for facilitating the, W. H. C. Mathews *et al.* 242,669
Amalgamator, J. W. Moore 242,469
Ashes, hopper for leaching, A. B. Alexander 242,577
Axle box, car, W. H. Taylor 242,715
Axle support and skein fastener, combined, J. Schofield 242,480
Bale tie, I. A. Kilmer 242,655
Baling press, T. W. & C. L. Ames 242,421
Baling press, N. Arave 242,580
Baling press, J. Brown 242,593
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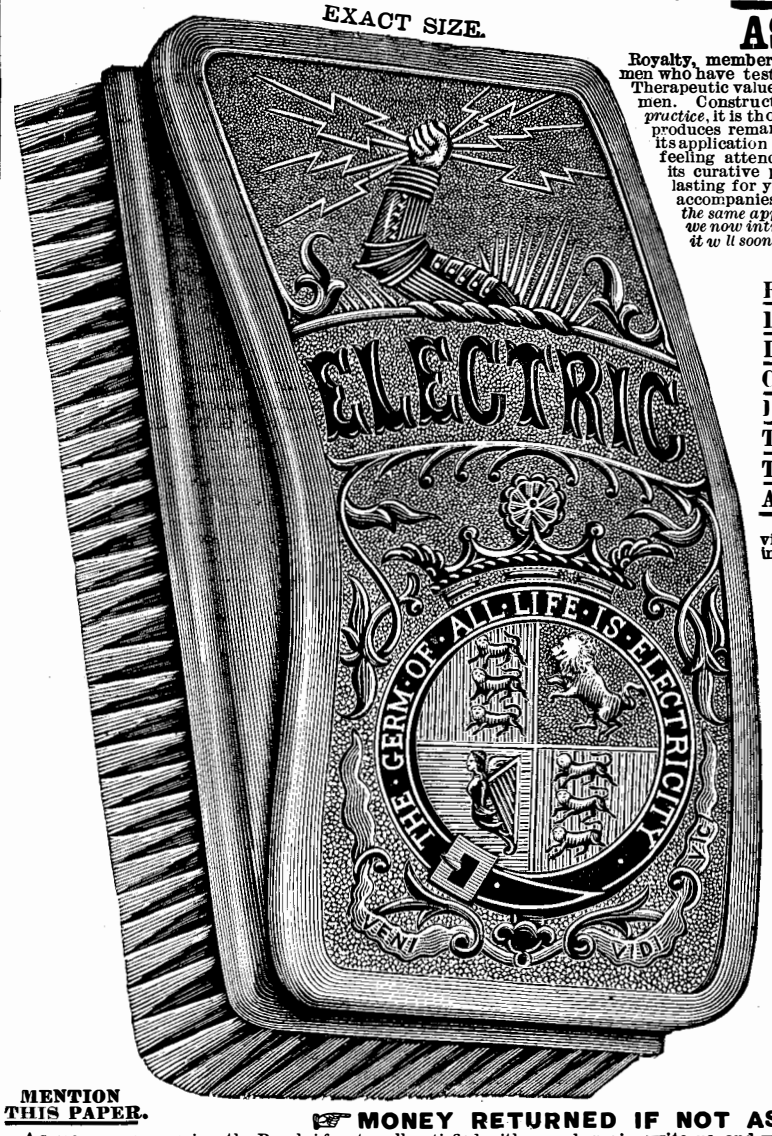

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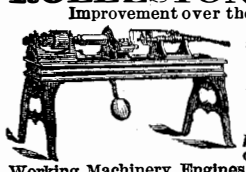

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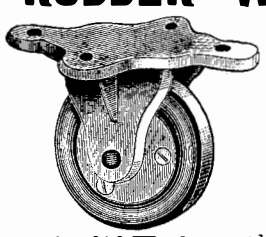

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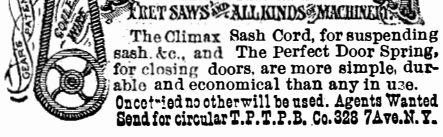

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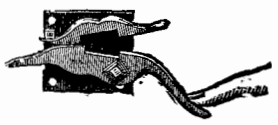

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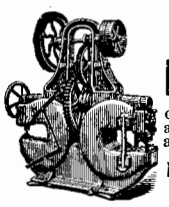

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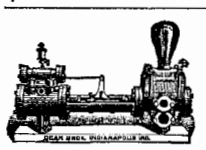

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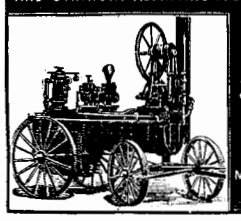

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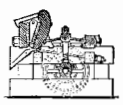

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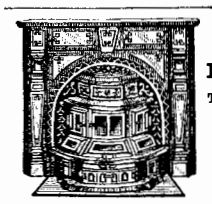

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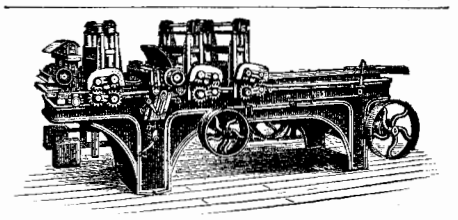

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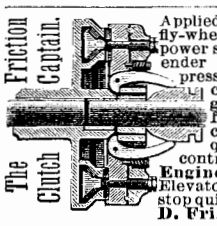

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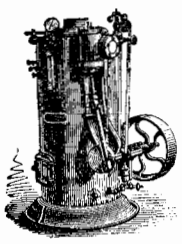
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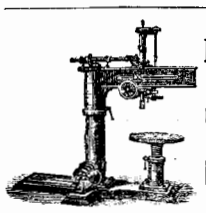
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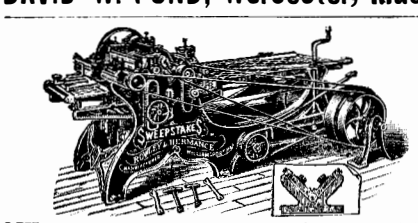

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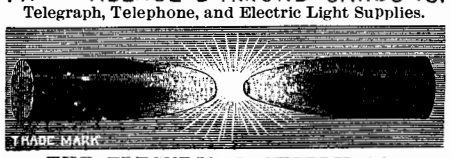

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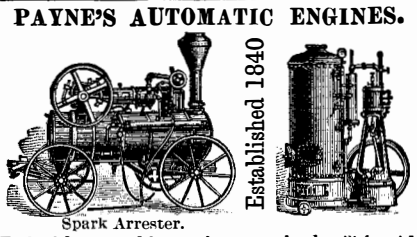
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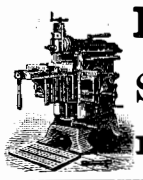
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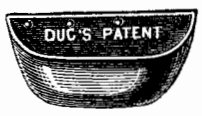

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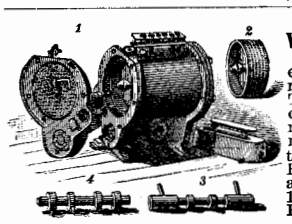

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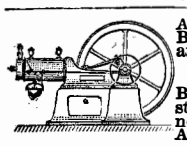
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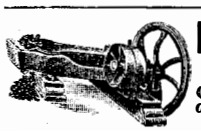
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