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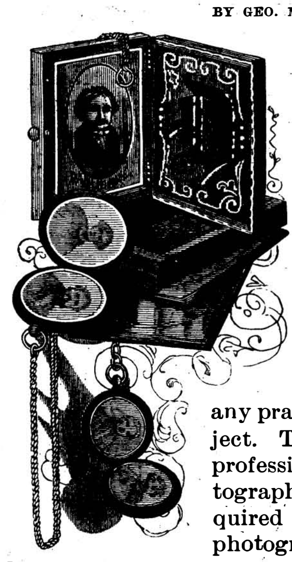
REMINISCENCES OF DAGUERREOTYPY.

BY GEO. M. HOPKINS.



DAGUERREOTYPY, although one of the most notable inventions of the present century, is already obsolete. It is nearly forgotten by those who practiced it, and is not preserved in all its details in the literature of photography. It is undoubtedly safe to say that a very small proportion of professional photographers, and a still smaller proportion of amateurs, have any practical knowledge of the subject. The writer, though never a professional daguerreotypist or photographer, very early in life acquired a practical knowledge of photography in the days when daguerreotypy was at its best. The interest then awakened has since been maintained through every phase of the growth and development of the art; and recently, depending on memory alone, the writer has extemporized apparatus, and successfully carried out the daguerreotype process.

It will be remembered that Neipce and Daguerre sought independently of each other for a method of producing sun pictures. Neipce at first employed plates coated with bitumen. He formed a partnership with Daguerre in 1829, but died before the invention now known as daguerreotypy was perfected.

After the death of Neipce, Daguerre improved the art to such an extent that Neipce's son allowed it to go under its present name. Both inventors received annuities from the government for giving the invention to the public.

In this country the art was first practiced by Morse, and was improved by Draper soon after it was introduced here.

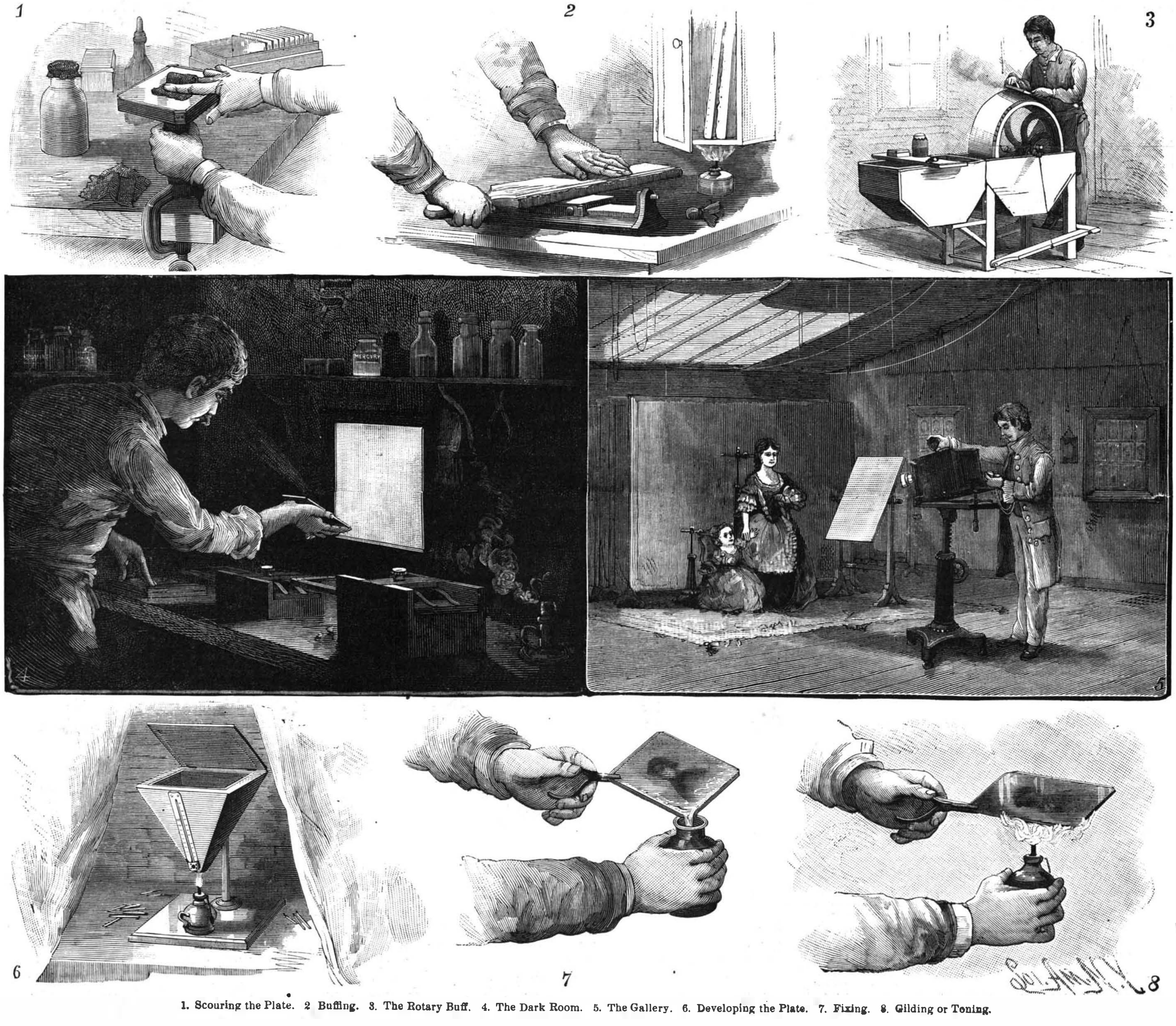
Daguerreotypy was very simple, easily understood, and easily managed, and was learned by many who found it a light business, requiring little capital and returning large profits.

The plates employed were copper faced with silver. The metal was hard rolled, and the plates, as received from the manufacturers, were flat and quite smooth, but not polished. The first step toward the preparation of the plate for use was to clip the corners and turn down the edges slightly, in a machine designed for the purpose, to bring the sharp edges of the plate out of reach of the buff employed in producing the necessary polish.

The plate was held, for scouring, in a block having clips on diagonally opposite corners for engaging the corners of the plate. One of the clips was made adjustable, to admit of readily changing the plates. The block was mounted pivotally on a support clamped to the table, as shown in Fig. 1.

The scouring was effected by sprinkling on the plate the finest rottenstone from a bottle having a thin muslin cover over its mouth, and the rottenstone as well as the square of Canton flannel with which it was applied was moistened with dilute alcohol. The center of the Canton flannel square was then clasped between two of the fingers, and moved round and round with a gyratory motion until the plate acquired a fine dead-smooth surface. The last traces of rottenstone were removed by means of a clean square of flannel. The plate was then transferred to a block mounted on a swinging support, and buffed by the vigorous application of a straight or curved hand buff formed of a board about four inches wide and thirty inches long, padded with four or five thicknesses of Canton flannel, and covered with buckskin charged with the finest

(*Continued on page* 52.)



1. Scouring the Plate. 2 Buffing. 3. The Rotary Buff. 4. The Dark Room. 5. The Gallery. 6. Developing the Plate. 7. Fixing. 8. Gilding or Toning.

DAGUERREOTYPY.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 577.

For the Week Ending January 22, 1887.

Price 10 cents. For sale by all newsdealers.

JOHN ROACH.

This distinguished shipbuilder died at his home in Fifth Avenue, New York, January 12. He was born in County Cork, Ireland, in 1815, and came to this country when fourteen years of age, having less than three shillings in his pocket when he landed. This is substantially the story of many thousands of Irishmen who have come to America, but in none of them have the qualities of pluck, energy, and business capacity found more splendid exemplification than in the career of John Roach.

His first positions were in the Howell and Allaire iron works, New York, at 25 cents a day, and during this period he was obliged to work overtime nights and mornings to obtain a bare subsistence. His apprenticeship finished, he became a journeyman machinist at $9 a week, and by close work and rigid economy had, at the age of 25, accumulated $1,200, but the most of it was lost by the failure of his employer, and he was obliged to work as a mechanic for several years more; he worked hard, however, and was ambitious, and found himself, when 36 years of age, the owner of a prosperous iron foundry which had been started by himself and three of his fellow laborers.

From this period, notwithstanding frequent discouragements, Mr. Roach's business progress was steady. The war gave an immense impetus to all branches of manufacture, and in 1868 Mr. Roach purchased the Morgan Iron Works, of New York city, subsequently adding thereto the Neptune Iron Works, the Franklin Forge, and the Allaire Works, and four years later buying an extensive shipbuilding plant at Chester, Pa. All of these establishments, machine shops, boiler shops, iron foundries, rolling mill, blast furnace, and shipyard, were large and well equipped, it being Mr. Roach's idea to take the ore and the coal from the mines, and the wood from the forest, to his own workshops, and turn out therefrom the completely built and furnished ocean steamship. Shipbuilding on a more extensive scale than was ever before attempted in this country was thus inaugurated by Mr. Roach.

In New York and at Chester 3,000 men were employed, and 114 iron vessels have been sent out from his workshops. It has been estimated that 90 per cent of all the iron vessels flying the American flag have been turned out from Mr. Roach's yards. His work for the Government has not been as large as generally supposed. He built two sloops of war in 1873, six monitors, the engines of the Trenton, the sectional dock for the Pensacola Navy Yard, three steel cruisers, and the Dolphin. Among his other work may be mentioned the engines of the Dunderberg, the Bristol and Providence, and the hull as well as the engines of the Puritan, these famous steamers having the largest engines ever built in this country. He also built the Pacific Mail steamships Tokio and Pekin, the City of Para and Rio Janeiro for the Brazil line, with many others for the Mexican, West Indies, and coastwise trade, besides some fine specimens of steam yachts.

But Mr. Roach has filled a larger place in the public eye than would ordinarily come of the accomplishment of this great amount of work, important as it has been. During the last quarter of a century, the country has been gradually falling behind the rest of the world in shipbuilding. With the advent of iron ships, so far from taking the lead we unquestionably held in building wooden vessels, it seemed as though we were to have no ships of this class to carry the American flag. Mr. Roach has stood forth almost alone in making the most vigorous effort to encourage and develop this business. He has not only written and spoken much on the subject, in such way as so direct a business man could, but he has put his money, energy, and mechanical skill as well into the work, and in this way has succeeded, notwithstanding great obstacles, in demonstrating the possibility of easy success for American builders in this field, under slightly more favorable circumstances, as well as given to our flag some specimens of marine architecture that will compare favorably with vessels of a similar class made anywhere else.

In view of these facts, it is painful to have to record that probably his life was shortened, as his last year was certainly made extremely unhappy, by the consequences of the differences between his firm and the government as to the acceptance of the dispatch boat Dolphin. It is not necessary to go into details in regard to the matter, further than that they are largely charged to the exigencies of the time among political wire pullers and the blundering of the Secretary of the Navy, but their effect was to compel an assignment by him in July, 1885. It has since been decided that the fault found with the Dolphin was of a very minor and unimportant character, so far as the builder's work was concerned, but an irreparable injury had been done to the great shipbuilder. His assets were largely in excess of his liabilities, and a comfortable fortune will remain from them for his heirs, but a fatal blow had been struck to the extensive business which he had founded and developed, and which was the pride of his declining years.

John Roach's life was a brave and inspiring one. He started from about as lowly a position as one well could be placed in; such time as could be spared from absolutely necessary work he devoted to self-improvement in study, for which he otherwise had no opportunities; and in all his complicated business in after life, he was not only the master mechanic, but his was the designing mind; in all his business character his methods were simple and direct, so that he never had a lawsuit; to all of his little army of employes he was a personal friend and an example of the possibilities open to every one who wished to follow in his footsteps; and in his relations to the general public he was a patriotic and eminently useful citizen.

THE INVENTOR'S WORK IN AGRICULTURE.

The conditions of the welfare of countries have undergone very great changes during the last fifty years. Up to a comparatively recent period, it was almost an axiom of political economy that the farmers were the producers of the true wealth of a region. They worked a mine that was inexhaustible if proper treatment was awarded it. If the soil became spent, it was interpreted as a sign of faulty agriculture. Properly treated, the same land could be used, year in and year out, and would yield a constant return for labor expended and capital invested. The coal miner works out a deposit of coal and abandons the region, after cumbering many acres with heaps of culm. The metallurgist builds his furnaces near the source of supplies, to be abandoned when these fail. But the farmer, by his permanence of location, and by his improving, instead of exhausting, the land, seemed the founder of a country's prosperity. It is true that, in some instances, particularly where subjected to a heavy drain upon its mineral constituents by successive crops of cereals or tobacco, land became exhausted. Modern science, with improved systems of fertilizing and prescription of rotation of crops, endeavored, with much success, to overcome this trouble.

The agriculturist was thus advanced in his efforts by the chemist, and took a step forward toward a more scientific treatment of his materials. Coincident with, or a little in advance of, this epoch, the mechanical inventor appeared on the scene, and invented machinery which enabled horses to do the work of men. From the reaping hook to the cradle was an important step. It multiplied greatly the labor of a man. From the cradle to the reaper, from the pitchfork to the unloading machinery, from hand labor to the self-binder, from the flail to the thrashing machine, were still greater ones, as they did away with directly applied human labor. These inventions mark a revolution in farming.

The farmer or his laborers to-day do not one hundredth of the actual work. Steam or horse driven machinery are the agents. The farm is converted into a factory. Grain is sowed and fertilizers are distributed by machines. Improved cultivators are used in treating growing crops. After harvesting by power, thrashing machines are substituted for the old time flails. The farming of fifty years ago is becoming a lost art.

To a great extent, the farmer is deposed from his position as the principal producer of a region's wealth. This honor must be shared by others. The chemist has had his part in the change, but the inventor stands above all in this. To him the new condition is principally due. As the result of his work, the United States maintain numerous factories devoted entirely to the production of agricultural machinery. Every city and village have stores devoted to their sale. The farmer directs the operations of the machinery when completed, just as the engineer of a steamer superintends the running of the engine. It would be as truthful or logical to call the marine engineer the developer of commerce as to claim for the farmer the title of sole producer. In his work he has partners. Without the great agricultural implement works, he could do nothing. They, as well as he, are agents in production. The inventor who directs and plans the factories' work is also a partner, and is an actual producer. He may not make two blades of grass grow where formerly there was only one, but he has changed another ratio for the better. He has made the actual labor of a man far more efficient than before. The soil may produce no more, but the labor of those tilling it is many times more productive.

The future political economist should pay regard to the new order of things. The influence of the inventor has been particularly great in the field of agriculture. It has done away with the customs of many centuries; it has converted the farmer into a superintendent or engineer, and raised him from the despondency due to unending toil.

The immense grain farms of the West are the outcome of such factors. Steam and horses are the motive power, and improved machinery is the direct performer of the work. The system by which they are run could no more exist without the inventor's aid than the merchant navy could be profitably worked without compound engines and all the latest devices and inventions in steam machinery. The same applies to the smaller farms of the East. On them the work is done by machinery, and the farmer is being educated and developed into an engineer, capable of running and repairing complicated machines.

Inventions Made by Employes do not Belong to the Employer.

An interesting decision has lately been made by the Supreme Court of the United States, in which the rights of the employe inventors were considered and adjudicated. Judge Blatchford delivered the opinion of the court.

This is a suit in equity brought in the Circuit Court of the United States for the District of Indiana, by Charles H. Hapgood, James H. Hesse, and John Packer, trustees of Hapgood & Company, a dissolved Missouri corporation, and the Hapgood Plow Company, an Illinois corporation, against Horace L. Hewitt. The main object of the suit is to obtain from Hewitt the transfer of letters patent granted to him for an invention. The defendant interposed a general demurrer to the bill for want of equity. The circuit court sustained the demurrer and dismissed the bill (11 Biss., 184), and the trustees have appealed to this court.

The Missouri corporation was in existence from before August 1, 1873, to January 1, 1880, when it was dissolved. At the latter date the three trustees constituted its board of directors, and Hapgood was president. By virtue of the laws of Missouri, Hapgood and the two others became trustees of the corporation, with power to settle its affairs and recover the debts and property belonging to it. Hapgood was the president of the corporation during its existence, and had the control and management of its business. All the officers and employes were under his direction. He had power to hire and discharge all agents and employes of every grade, to determine the classes and kinds of goods that should be manufactured, and the general way in which the business should be conducted.

The corporation employed Hewitt to devote his time and services to getting up, improving, and perfecting plows and other goods, and to introducing the same. It was agreed between Hewitt and the corporation that Hewitt should fill the position of superintendent of the manufacturing department, and as such exercise a general supervision over that department, subject to the president. He agreed in such position to use his best efforts and devote his knowledge and skill in devising and making improvements in the plows manufactured by the corporation and in getting up and perfecting plows and other agricultural implements adapted to its trade.

Hewitt was, early in the summer of 1876, directed by the president to proceed at once to devise and build an iron sulky plow according to suggestions made—that is, he should retain in the new plow all the valuable features of the wooden sulky which the corporation had been manufacturing, should construct the plow of wrought and malleable iron, should adopt the other features suggested by the president, and the arch suggested by Black, and should add such additional features as might seem advantageous to him (Hewitt). He was directed to proceed with the work without delay, so that the corporation might be ready to manufacture the new plow for the season of 1877. In accordance with these directions, Hewitt devised and constructed a sulky plow of wrought and malleable iron, and after some delays, about the 1st of April, 1877, produced a plow satisfactory to the president.

During all the time that he was engaged in devising and constructing the new plow he was in the employ of the corporation, and drawing a salary of $3,000 a year. The time during which he was so engaged was the regular working hours of the factory. The men who did the manual labor on the new plow were all employes of and paid by the corporation, and all the materials used in its construction were bought and paid for by the corporation. The work as it progressed was under the general superintendence of Hewitt; but the work in the respective departments was also under the special superintendence of the respective foremen of those departments, who were also paid by the corporation. During the whole time of the construction of the plow it was understood by all the parties engaged therein, and by those at whose instance its construction was commenced, that it was being devised and constructed for the use and benefit of the corporation and as a model for the future construction of sulky plows by it.

After the plow was completed and had been accepted by the president as satisfactory, the latter directed Hewitt to go to Chicago and have the necessary malleable castings made for the construction of plows after the model. Hewitt did so, obtaining at Chicago castings, moulds, and other things necessary for the future building of plows after the model. During the time so spent he was drawing his regular salary, and all his expenses, as well as the price for the models, castings, and other things obtained by him, were paid by the corporation. During the time Hewitt remained in its employ he never made any claim of property in any of the devices and improvements made or suggested by him in the new plow, and never stated or claimed that he was entitled to a patent on any of said improvements, or that he had any rights adverse to the corporation in any of said improvements or devices, and never during the term of his employment asserted any right to a patent in his own name for such improvements or devices, or any of them. After his connection with the corporation had ceased, and after he had made an arrangement with the president whereby the latter bought back all his (Hewitt's) stock in the corporation, and after the corporation had been for many months, with the knowledge of Hewitt, engaged in the manufacture of such plows, Hewitt, on January 14, 1878, applied for a patent on the improvements in the plow, and on the 26th of March, 1878, a patent was granted to him covering certain parts of the plow, being devices which had been theretofore used by the corporation with his knowledge and consent. After this patent was issued he for the first time claimed, as he has since claimed, that he had and has an exclusive right to manufacture such parts of the plow as are covered by the patent, and has threatened to enforce his rights under the patent as against the corporation, its representatives, successors, and assigns, and to hold them liable in damages for any infringement of the same.

The bill also alleges that in devising and constructing the plow Hewitt was only performing his duty as an employe of the corporation and carrying out his contract with it; that he was doing only what he was hired and paid to do; that the result of his labors belonged to the corporation; that it became in equity and good conscience the true and rightful owner of the right to manufacture the plow; that if there is any part thereof which is patentable, the patent belonged to the corporation as equitable assignee of Hewitt, and that he was and is bound in equity and good conscience to make an assignment of the patent to the corporation or to its trustees.

The bill also alleges that upon the dissolution of the corporation of Hapgood & Company the stockholders thereof organized another corporation under the laws of Illinois, under the name of the Hapgood Plow Company, one of the plaintiffs; that the Hapgood Plow Company succeeded to the business of the prior corporation, and became by assignment from it the owner of all the latter's assets, whether legal or equitable, including the rights in the patent issued to Hewitt which such prior corporation had or was entitled to, whether legal or equitable, and its right to manufacture a sulky plow in accordance with the model plow made by Hewitt, including all the devices covered or claimed to be covered by the patent, and that all the rights in the premises which the prior corporation had have been fully transferred to and vested in the new corporation. The bill then alleges a refusal by Hewitt to assign the patent to the plaintiffs, and that he claims to hold it adversely to them.

The prayer of the bill is for a decree directing the defendant to make an assignment of the patent, or of such interest as he may have therein, and all of his rights thereunder to the Hapgood Plow Company, assignee of Hapgood & Company, or to the trustees of Hapgood & Company, in trust for the Hapgood Plow Company, vesting the title to the patent, or to the defendant's rights thereunder, in the Hapgood Plow Company, or in said trustees in trust for that corporation, and that he be enjoined and restrained from maintaining any action at law or in equity for any infringement of the patent by Hapgood & Company, or for the use by that corporation of any of the devices or improvements covered by the patent.

The decision of the circuit court (11 Biss., 184) was placed on the ground (1) that Hewitt was not expressly required by his contract to exercise his inventive faculties for the benefit of his employer, and there was nothing in the bill from which it could be fairly inferred that he was required or expected to do so; (2) that whatever right the employer had to the invention by the terms of Hewitt's contract of employment was a naked license to make and sell the patented improvement as a part of its business, which right, if it existed, was a mere personal one, and not transferable, and was extinguished with the dissolution of the corporation.

We are of opinion that the views taken of the case by the circuit court were correct. There is nothing set forth in the bill as to any agreement between the corporation and Hewitt that the former was to have the title to his inventions or to any patent that he might obtain for them. The utmost that can be made out of the allegations is that the corporation was to have a license or right to use the inventions in making plows. It is not averred that anything passed between the parties as to a patent. We are not referred to any case which sustains the view that on such facts as are alleged in the bill the title to the invention or to a patent for it passed.

In *McClurg v. Kingsland* (1 How., 202), the facts were in some respects like those in the present case; but the decision only went to the point that the facts justified the presumption of a license to the employer to use the invention as a defense by him to a suit for the infringement of the patent taken out by the employe.

The circuit court cases referred to do not support the plaintiff's suit. In *Continental Windmill Co. v. Empire Windmill Co.* (8 Blatchf. C. C. R., 295), there was an agreement that the employe should receive $500 for any patentable improvement he might make. In *Whiting v. Graves* (1 Holmes, 222), it was held that an employment to invent machinery for use in a particular factory would operate as a license to the employer to use the machinery invented, but would not confer on the employer any legal title to the invention or to a patent for it. In *Wilkens v. Spafford* (1 Holmes, 274), the contract was that the employer should have the exclusive benefit of the inventive faculties of the employe and of such inventions as he should make during the term of service.

Whatever license resulted to the Missouri corporation from the facts of the case to use the invention was one confined to that corporation and not assignable by it. (*Troy Iron and Nail Factory v. Corning*, 14 How., 193, 216; *Oliver v. Rumford Chemical Works*, 109 U. S., 75, 82.) The Missouri corporation was dissolved. Its stockholders organized a new corporation under the laws of Illinois, which may naturally have succeeded to the business of the prior corporation; but the express averment of the bill is that it took by assignment the rights it claims in this suit. Those rights, so far as any title to the invention or patent is concerned, never existed in the assignor. As to any implied license to the assignor, it could not pass to the assignee.

As to so much of the prayer of the bill as asks that Hewitt be enjoined from maintaining any action at law or in equity for any alleged infringement of the patent by the prior corporation, or for its use of any of the devices or improvements covered by the patent, which is all there is left of the prayer of the bill, any suit to be brought would not be a suit against the corporation, for it is dissolved, and could not be a suit in equity against its trustees, for they are not alleged to be using the invention. It could only be a suit at law against the trustees or the stockholders of the old corporation for infringement by it while it existed. The theory of the bill is that there is a perfect defense to such a suit. In such a case a court of equity, certainly a circuit court of the United States, will not interfere to enjoin even a pending suit at law, much less the bringing of one in the future. (*Grand Chute v. Winegar*, 15 Wall., 373; 1 High on Injunctions, secs. 80-93, and cases there cited.)

Decree affirmed.

Impure Ice as a Cause of Disease.

The State Board of Health, having been asked by the Board of Health of Syracuse to examine into the purity of ice taken from Onondaga Lake, from the Erie Canal at Syracuse, and from Cazenovia Lake, has not only made a careful investigation into the quality of ice from those sources, but has also prepared a report on the general question of the pathogenetic powers of contaminated ice. The Board comes to these conclusions: Ice formed in impure water has caused sickness; it may contain from eight to ten per cent of the organic matter dissolved in the water, and in addition a very large amount of the organic matter that had been merely suspended or floating in it; it may contain living animals and plants, ranging in size from visible worms down to the minutest spores, and the vitality of these organisms may be unaffected by freezing.

Hilborne L. Roosevelt.

On December 29, 1886, this eminent organ builder, electrician, and inventor died at his residence in this city. He was born in New York in 1850, and was a son of S. Weir Roosevelt. In early youth he began to study organ building in Hall & Labagh's factory, and afterward prosecuted his studies in Europe. Grace Church and Trinity Church in this city and the Cathedral of the Incarnation in Garden City (the A. T. Stewart memorial) contain his instruments. In the centennial main building, also, one of his organs was erected, and was listened to by the many who in 1876 visited Philadelphia. He had factories here, and in Philadelphia and Baltimore. He was much interested in electrical inventions. He applied electricity to organ movements, with considerable success. He was largely interested at one time in the New York Bell Telephone Company, but sold out just before the stock took its upward leap. He received up to the time of his death a royalty on a detail of the telephone apparatus. Outside of his main business of organ building he was well known among electricians, and was an intimate friend of Edison. The Garden City organ, one of the largest in the world, and provided with Wacker's electrical movement, has been described in these columns.* It is, probably, entitled to be considered his greatest work. His record covering the electrical and musical fields is a very remarkable one for one who still was comparatively young. He leaves a widow and one daughter.

George Crompton.

George Crompton, distinguished as the inventor of many improved looms, died at his home in Worcester, Mass., December 29 last, in the 56th year of his age. He was born at Ramsbottom, England, March 3, 1829. He was a man of much executive as well as inventive ability. His productions in the line of looms have long been famous for superior excellence.

*See SCIENTIFIC AMERICAN, August 7, 1886.

IMPROVED METALLIC PRINTING BLOCK.

By means of the metallic printing block which we herewith illustrate, electrotype and stereotype plates can be firmly locked in position or released by the simple turning of a key which actuates certain clamps attached to the block.

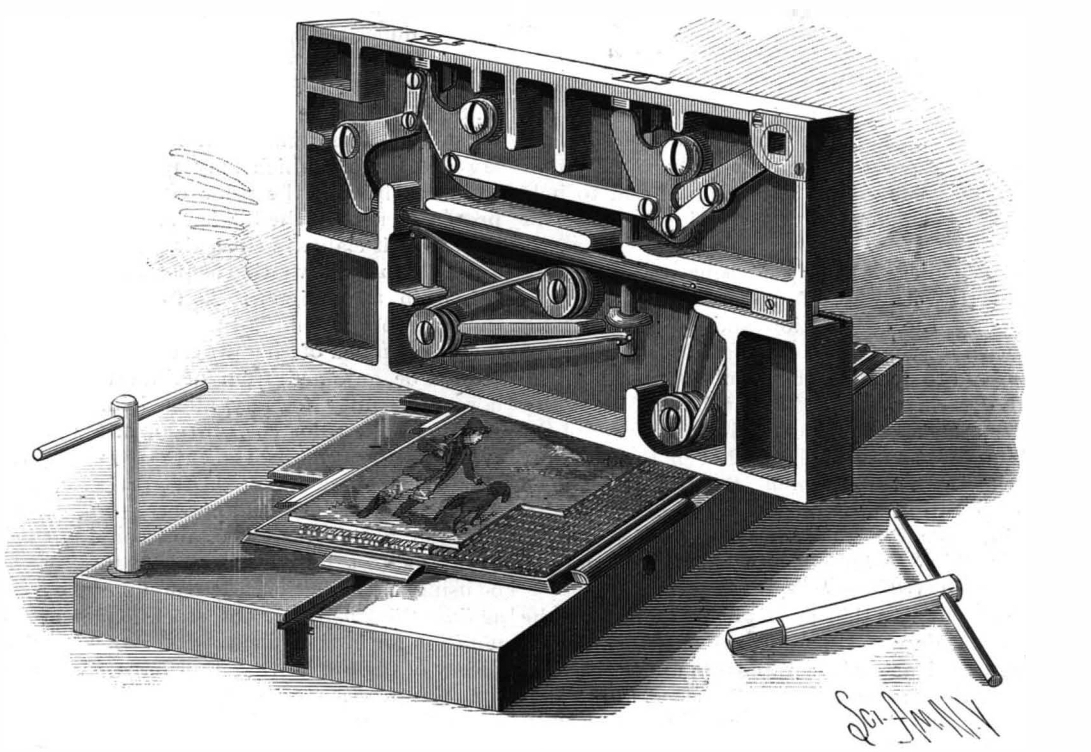
The block is of suitable size and shape, and is provided on its upper face, on one side and one end, with two or more fixed clamps; on the other side and end are two or more movable clamps, which project above the upper surface of the block and move in grooves. Each movable side clamp is secured to one end of a rod sliding in bearings formed below the face of the block. Projecting from the rod near its other end is a lug, against which rests one end of a spring formed of a phosphor-bronze wire, coiled around suitable bolts held on the bottom of the block. Each movable clamp has a downwardly extending lug, against which rests one end of a bell crank lever pivoted to the bottom of the block, and pivotally connected with a bar which connects the lever on one clamp with that of the next following clamp. To one of the levers is attached a link, connecting with an arm secured to a post placed in one corner of the block, and provided with a square recess in which fits a key inserted from the face of the block.

The end clamp is secured to the end of a rod sliding in bearings formed on the bottom of the block, and provided with a pin, against which presses a spring. The opposite end of the rod operates one arm of a bell crank lever pivoted to the bottom of the block and connected by its other arm, by a link, with one of the bell crank levers operating the side clamps.

The operation of this device is as follows:

To release the plate from the clamps, the key is inserted in the square recess in the post and the latter turned to bring its arm against the adjacent bell crank lever. This motion forces the levers to swing outward and carry the side clamps in the same direction, and thereby release the plate at one side. As the side clamps commence to move, the end clamp also moves outward by the action of the bell crank lever connected with its rod. The outward movement of the clamps compresses the springs, but as the link on the arm of the key post passes its center line, the clamps will remain in their outward position, when the plate can be removed.

To lock the plate in position, the key is turned in the inverse direction until the link has passed its center line with the post, when the springs act to force the clamps inward in contact with the plate, which will be securely held on the face of the block. One of the most important advantages in connection with this block is the fact that the pressman who is printing cut work from fine electrotype plates will find that his overlays will last four or five times longer than when mounted on the usual wooden blocks. In fact, it insures good work from flat plate printing without preparation. This invention has been patented by Mr. John M. Hawkes, whose address is care of A. S. Barnes & Co., No. 111 William Street, New York city.

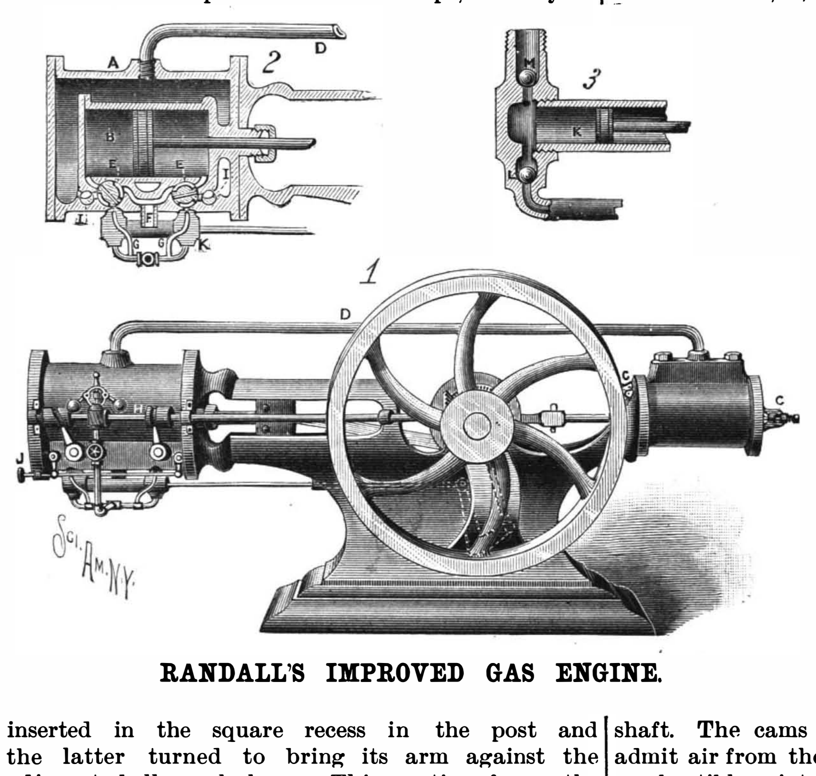


HAWKE'S IMPROVED METALLIC PRINTING BLOCK.

IMPROVED GAS ENGINE.

In this engine the wheel receives two impulses at every revolution, and the construction is such that it is not necessary to revolve the wheel until the charge of gas and air is compressed, as enough compressed air is retained to start the engine. The piston rod guide, supported by the base, is provided with a flange, to which is secured the air jacket, A, of the power cylinder, B, as shown in the sectional view of the power cylinder, Fig. 2. Within the cylinder is fitted a piston, whose rod passes through a gland of the usual form, and connects with the crosshead. The air compressor cylinder is secured to the base axially in line with the other, and its piston rod is connected with the crosshead to which the piston rod of the power cylinder is attached, so that the two pistons move together. The heads of the compressor cylinder are provided with suitable valves, C, for the admission of air. Ports lead from each end of the cylinder to valve chambers, which communicate with each other and with the pipe, D, leading to the air jacket, A, of the power cylinder. In the lower side of the cylinder, B, are formed ports communicating with the valve chambers, E, which communicate through the passage, F, with the exhaust pipe. Air supply ports connect these chambers with the air space of the jacket.

In the lower sides of the chambers, E, are ignition ports, through which the explosive charge in the cylinder is ignited by the continuously burning gas jets, G. In the chambers, E, are placed oscillating valves, chambered on diametrically opposite sides and formed with a small transverse aperture for igniting the charge in the cylinder. To the valve spindles are secured arms which extend upward, and are received in grooved cams secured to the lay shaft, H, which is driven by beveled gearing by the main crank shaft. The cams are so arranged that the valves will admit air from the jacket to the cylinder, igniting the combustible mixture at the proper time in the stroke of the piston, and open at the end of the stroke to permit the products of combustion to escape. The air ports, I, are provided with valves, whose spindles are connected with the rod, J—one end of which is threaded and passes through a nut secured to the air jacket—so that when the latter is turned both valves will be simultaneously adjusted.



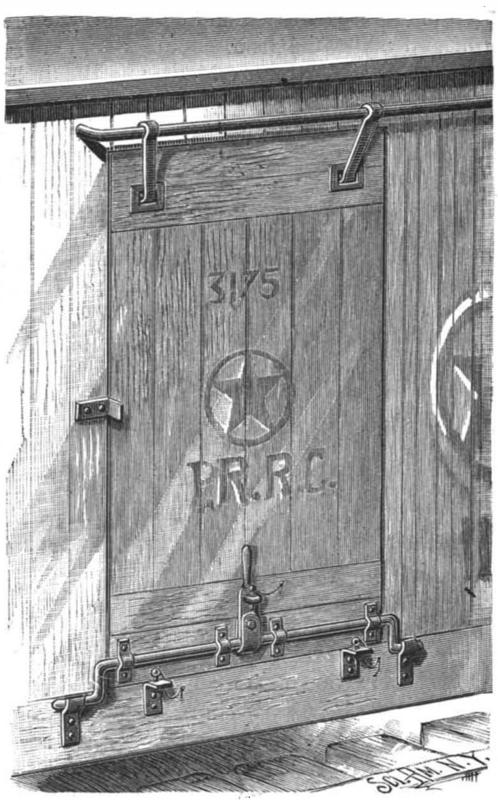
RANDALL'S IMPROVED GAS ENGINE.

Below the air jacket is suspended a gas compressor cylinder, K, one end of which is shown in the enlarged sectional view, Fig. 3, each end of which is provided with a suction valve, L, and discharge valve, M. The upper ends of the valve casings are connected directly with opposite ends of the power cylinder. The piston of the gas compressor is operated by an eccentric on the main shaft, through the intermedium of an angle lever and connecting rods. The spindle of a governor regulating the gas supply is operated through spiral gearing from the lay shaft.

Gas having been admitted to the supply pipe and the jets lighted, the engine is revolved by means of the flywheel, thus drawing in air at the air compressor and forcing it into the air jacket. At the same time the gas compressor takes charges of gas from the supply pipe, and forces them alternately into opposite ends of the power cylinder. As soon as the back end of the power cylinder has received a charge of the explosive mixture behind the piston, fire is communicated to the charge by the burning gas in the cavity of the valve. The piston is pushed forward, imparting motion to the crank shaft and to the piston, of the air compressor. The products of combustion in the opposite end of the power cylinder escape through the exhaust pipe. These operations are performed at the other end of the cylinder as the piston moves back. The air in the jacket is subject to compression and expansion, thereby utilizing the heat of the cylinder, which is usually carried off by water employed in keeping down the temperature. This invention has been patented by Mr. Norman B. Randall, of Hancock, N. Y.

IMPROVED DOOR ATTACHMENT.

The object of the invention herewith illustrated is to so arrange the door that, when it is in position to close the opening, its outer face will be flush with the outer face of the car, or other structure, in connection with which it is arranged. Formed in the upper part of the door are recesses, within which are hinged the lower ends of straps, whose upper ends are bent around a horizontal rod secured above the door. The upper and lower edges of the door, and also of the opening, are beveled from the outside upward toward the inside, while each side edge is beveled toward the inside. Held by clips to the lower part of the door is a crank bar having a central handle pivotally mounted within a socket carried by the bar. The crank arms extend downward and outward from either side of the door, and are arranged to enter open brackets secured to the sill of the car, as plainly illustrated in the engraving. Just beneath



SHEWMAKER'S IMPROVED DOOR ATTACHMENT.

the door are placed two stops, having outwardly extending flanges, that are apertured to receive pins, which prevent any accidental displacement of the door after it has been closed. In the handle is a slot, through which passes a staple secured to the door, a pin serving to lock the handle in place. When it is desired to open the door, all the pins are removed and the handle is swung downward and outward, thereby partially rotating the crank bar and forcing the lower part of the door outward. The door is then swung clear of the opening, and slides along the upper bar. The handle will turn upon its pivot, and drop out of the way. To replace the door, its upper end is inserted within the opening, the lower end is forced inward, and the lever turned so as to force the crank arms into engagement with the brackets, when the handle is raised to force the door into place.

This invention has been patented by Mr. John W. Shewmaker, of Terre Haute, Indiana.

IMPROVED AUTOMATIC STEP LADDER.

The step ladder herewith illustrated is so constructed that the steps will be held in a horizontal position, no matter at what angle the ladder may be placed. The two pairs of side bars are pivoted to the ends of the steps and to the under surface of the platform, as clearly shown in the engraving. This construction allows all the steps to remain parallel with each other and with the floor, while the bars may be inclined at any required angle. Near the upper ends of the front bars are pivoted the upper ends of the legs, which are curved on a semicircle and pass through staples inserted near the upper ends of the rear side bars. The curved part of the legs is

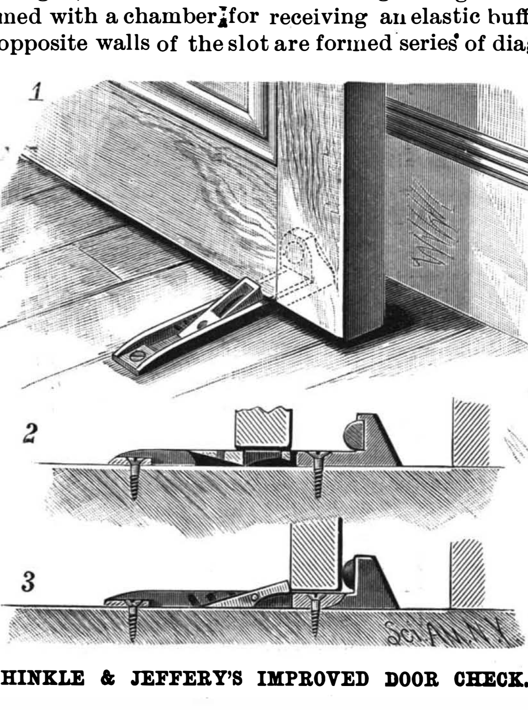
MACNIDER'S IMPROVED AUTOMATIC STEP LADDER.

serrated to engage with the staples and hold the legs and bars in any position in which they may be adjusted. A stop pin limits the rearward motion of the legs. As the legs are swung on their pivots to adapt the ladder for use, the side bars will swing over and the steps will maintain their horizontal position independently of the inclination of the bars. The platform is preferably inclosed by side pieces, to form a convenient receptacle for brushes, etc.

This invention has been patented by Mr. Q. Macnider, of Belleville, Ontario, Canada, who will furnish all further particulars.

IMPROVED DOOR CHECK.

This simple device is for arresting the motion of a door while being opened and for fastening it in an open position. The base plate is formed with a longitudinal slot extending through the greater portion of its length, and has at one end a right angled arm, formed with a chamber for receiving an elastic buffer. In opposite walls of the slot are formed series of diagonal slots, inclined away from the buffer, and to the slot is fitted a latch having, near its center, trunnions, which may be placed in any pair of diagonal slots, according to the thickness of the door. The weight of the latch is so distributed that, normally, the end next the door will project above the plate and into the path of the door. The door check is secured to the floor with the buffer at the point where it is desired to arrest the door when opened, and the trunnions of the latch are placed in a pair of the slots, so as to leave a space between the end of the latch and the buffer, about equal to the thickness of the door. When the door is opened, it glides over the latch, as shown in the sectional view, Fig. 2 ; and when the door has passed the latch, the lighter end of the latter rises in front of the edge of the door, and holds it in an open position, as shown in Figs. 1 and 3. The latch is operated by gravity alone, and the check is not therefore liable to derangement.



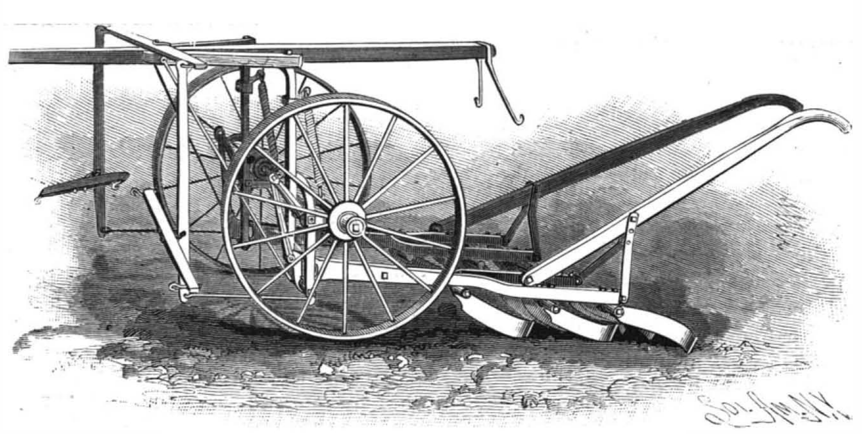
HINKLE & JEFFERY'S IMPROVED DOOR CHECK.

This invention has been patented by Messrs. W. A. Hinkle and F. C. Jeffery, of Galveston, Texas.

IMPROVED WHEEL CULTIVATOR.

The main frame is bow shaped, and to it is attached the tongue. Hinged to the main frame, upon bolts, are the axle frames, which are each provided with a wheel, and each is formed with a square frame that reaches in front of the axle on which the wheel is placed. Each axle frame is formed with an upwardly inclined arm, which acts as a lever for holding the gang bars in position, and the rear inner corner of each frame is connected to the upper portion of the main frame by a coiled spring, which serves to counterbalance the axle frame and prevent it from tilting. The gangs are duplicates of each other, each being provided with three sets of curved knives. The rear knives are curved outward, while the central and upper knives are curved inward, so they will counteract the side draught of the rear ones.

The knives are so arranged that all the ground traversed by the gang will be tilled. The sets of knives are secured rigidly to suitable cross pieces, attached to the main frames of the gangs, which are bolted to the rear ends of the gang bars. Each gang is provided with a handle, by which the plowman can hold and control the cultivator as it is drawn over the ground. The connections of the gangs to the gang bars are vertically adjustable, so that the penetration of the knives may be regulated. The gang bars are connected to yokes, hinged to the main frame below the axle frames, each by a vertical bolt which passes through any one of a series of holes made in the yoke. The bars swing on their bolts, while the yokes turn upon their horizontal bolts, so that a universal connection is thus formed for connecting the gangs with the main frame, which gives the gangs perfect freedom and enables the plowman to fully control them.



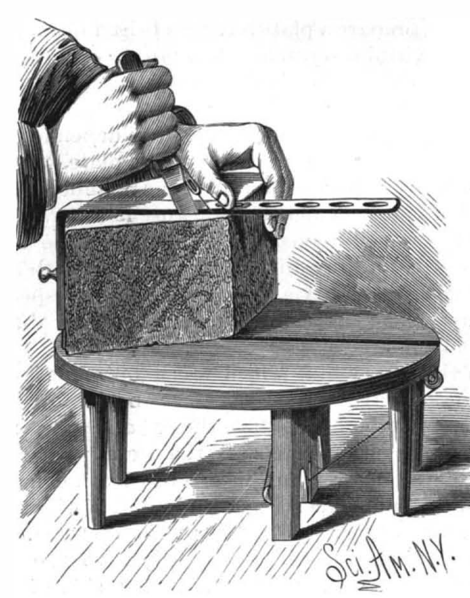
SCHWALLER'S IMPROVED WHEEL CULTIVATOR.

The series of holes in the yokes permit of lateral adjustment of the gangs to suit the width of rows to be cultivated. The knives can be set at different angles to the frame, up or down, independently of each other, and as the weight of the main frame comes in front of the axle, the gang bars are forced downward, so as to cause the cutters to penetrate the ground. In this manner the knives themselves carry a part of the weight of the frame, while the coiled springs exert a downward pull upon the frame. The combined downward action of the weight of the frame and the springs upon the gangs may be regulated as required. Upon the rear end of the tongue are secured hooks, on which the gangs can be supported when the cultivator is being transported to or from the field.

This invention has been patented by Mr. Joseph C. Schwaller, of Halbur, Iowa.

CHEESE CUTTER.

By means of this device, which is the invention of Mr. Samuel P. Hodgen, of Pittsfield, Ill., a full cheese can be divided into two parts and slices cut from either, without crumbling or hacking the cheese. To the front end of one of the halves of the platform, which is divided by a central slot, is secured an upright on which an angular guide or gauge is vertically adjustable. One end of a spring cord is secured to the under side of the platform, and is led, parallel with the slot, over a grooved pulley at one end, then around a pulley on a cross piece placed on the under side of the platform, at right angles to the slot, and the other end is connected with a knife. When a cheese is to be halved, it is placed upon the platform, and the gauge is adjusted until its horizontal arm rests on top of the cheese. The knife blade is then inserted in the bottom of the cheese, on the back side of the cross piece, and drawn to the back edge of the platform, then up the back edge, along the front edge of the gauge, down the front and along the slot to the starting point. By then pulling on the wire, which follows the movement of the knife, and is guided in the slot, the inner part of the cheese is cut. The cutting of halves of the cheese is done from the center to the edge, and down in line with the gauge

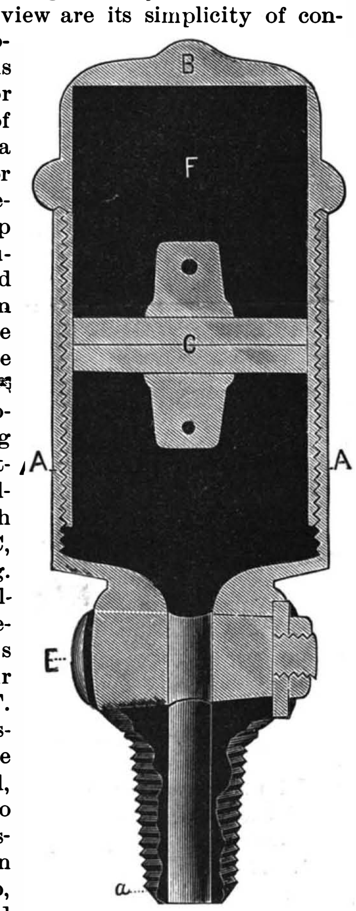


HODGEN'S CHEESE CUTTER.

and slot, either by the use of the knife or wire, or of both combined. The knife cuts mainly through the crust part of the cheese, the inner, soft part being cut by the wire, which is kept taut by the spring, so that it will follow the cut started by the knife point.

COMPRESSED AIR GREASE CUP.

The great merits of the grease cup shown in the accompanying sectional view are its simplicity of construction and its automatic and continuous feed. It is designed for the manipulation of grease or "dope," a composition which, for some purposes, is superior to oils. This cup feeds the grease continuously till emptied, and requires no attention whatever beyond the mere filling from time to time.



The cup, A A, is provided with a regulating valve, E, above the outlet orifice, *a*. B is a hollow cap, provided with an air tight piston, C, with hydraulic packing. The operation is as follows : The cap being removed, the piston is drawn in to supply air to the air chamber, F. The packing of the piston and the inside of the cap are slightly greased, to reduce the friction to a minimum. The piston is then replaced in the mouth of the cap, when the cup is filled completely with grease. The cap is then screwed down the entire length of the threads. As the piston, C, located within the cap, is forced inward, it is evident that a quantity of air will be confined and compressed in its rear, in the chamber, F. It will be seen, therefore, that upon the opening of the regulating valve, E, sufficiently to permit the proper amount of grease to escape, the compressed air in the rear of the piston is allowed to expand, exerting a constant and even pressure upon the grease to force it from the cup, this action being automatic. As the attendant has absolute control of the outflow of the contents, by means of the valve, the economy and convenience of the cup are assured. This cup, according to its size, will manipulate its contents in from six days to two months. No matter in what position the cup may be placed, the grease is always forced to the bearing, making it most valuable for loose pulleys.

Any further information may be obtained from Mr. John C. Grout, 17 Newberry & McMillan Building, Detroit, Mich., who is the sole manufacturer of these cups.

WE are pleased to learn that Professor Samuel P. Langley, of the Allegheny Observatory, Pittsburg, has received from the Royal Society of London the Rumford medal for meritorious discoveries in light and heat. The medal is of solid gold, 260 pennyweights, and is accompanied with a facsimile of itself in silver.

REMINISCENCES OF DAGUERREOTYPY.

(Continued from first page.)

rouge. Scrupulous cleanliness was imperative in every step of the process.

The buffs were kept clean and dry, when not in use, by inclosing them in a sort of vertical tin oven, which was warmed by a small spirit lamp. A careful operator would prepare a plate having a bright black polish without a visible scratch, while an incompetent or careless man would fail in this part of the process, and would prepare plates full of transverse grooves and scratches. The beauty of the picture depended very much on the careful preparation of the plate.

Occasionally, a buff would in some manner receive particles of matter which would cause it to scratch the plate. The remedy consisted in scraping the face of the buckskin, and brushing it thoroughly with a stiff bristle brush, generally a hair brush devoted especially to this use. The buff was then recharged by dusting on rouge from a muslin bag.

When the rotary buff wheel was adopted, it insured rapid work, but it was otherwise no improvement over the hand buff. At first, the wheels were made cylindrical, but that incurred the necessity of an objectionable seam or joint where the leather lapped. The conical buff wheel (Fig. 3) allowed of the use of a whole skin, thereby dispensing with the seam.

After buffing, the plate was taken to the dark room to be sensitized. The room had a side window, generally covered with yellow tissue paper, for the examination of the plate during the process. The room contained two coating boxes, one for iodine, the other for bromine. The construction of these boxes is clearly shown in Fig. 9, which is a longitudinal sec-

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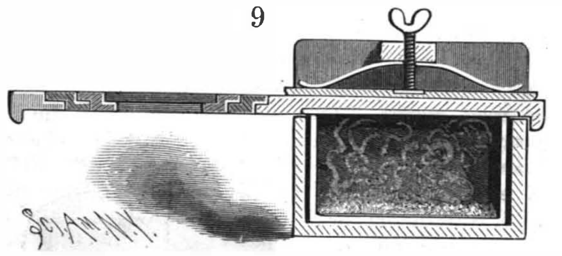


THE COATING BOX.

tion of one of them. The two boxes were alike except in the matter of depth ; the bromine box being about twice as deep as the iodine box.

Each box contained a rectangular glass jar having ground edges. In the top of the box was fitted a slide more than twice as long as the box. In the under surface of one end of the slide was fitted a plate of glass, adapted to close the top of the jar, and in the opposite end of the slide was formed an aperture, furnished with a rebate for receiving the plate. Upon the top of the slide was arranged a spring-pressed board, which held the slide down upon the top of the jar.

On the bottom of the jar of the iodine box were strewn the scales of iodine, and in the bromine box was placed quicklime charged with bromine. The bromine was added to the lime drop by drop, and the lime occasionally shaken until it assumed a bright pink hue bordering on orange. The lime was thus prepared in a glass stoppered jar, and transferred to the jar of the coating box as needed ; one inch being about the depth required in the coating box. The polished plate was placed face downward first in the slide of the iodine box, and coated by pushing in the slide so as to bring the plate over the iodine in the jar. It was there exposed to the vapor of iodine until it acquired a rich straw color, the plate being removed and examined by the light of the paper window, and replaced if necessary to deepen the color. The plate was then in a similar manner subjected to the fumes of the bromine until it became of a dark orange color. It was then returned to the iodine box and further coated until it acquired a deep brownish orange color bordering on purple. The time required for coating the plate depended upon the temperature of the dark room. The process was very rapid in a warm room and quite slow in a cool room.

The plate, rendered sensitive to the light by the thin layer of bromo-iodide of silver, was placed in a plate holder, and exposed in a camera according to the well known method. The time of exposure was much longer than that of modern photography. A great deal depended on the quality of the lenses of the camera. The exposure in the best cameras was reasonably short. The old time gallery, with its antiquated camera and fixtures, and the dark room with the appurtenances, are faithfully represented in the engraving. After exposure, the plate was taken to another dark room for development. It was placed face downward over a flaring iron vessel, in the bottom of which there was a small quantity of pure mercury. The mercury was maintained at a temperature of 120° to 130° Fah. by means of a small spirit lamp. The temperature was measured by a thermometer attached to the side of the vessel. The plate was raised occasionally and examined by the light of a taper, until the picture was fully brought out, when it was removed from the mercury bath and fixed.*

The fixing consisted merely in flowing over the plate repeatedly a solution of hyposulphite of soda, having sufficient strength to remove in about half a minute all the bromo-iodide of silver not acted upon by light. The plate was then thoroughly washed, and afterward glided or toned by pouring upon it a weak solution of chloride of gold and heating it gently by means of a spirit lamp until a thin film of gold was deposited upon the plate and the picture attained the desired tone. The plate was then washed in clean water, and finally dried evenly and quickly over a spirit lamp.

This operation added to the strength and beauty of the picture, and also served to protect the surface of the plate to a great extent against the action of gases.

The finished picture was protected by a cover glass, and the edges of the glass and plate were securely sealed by a strip of paper attached by means of an adhesive coating.

* A fortunate accident led to the discovery of the development of the photographic impression by means of the vapor of mercury. Previous to this discovery, the image was brought out by a long continued exposure in the camera. Daguerre on one occasion placed some under-exposed plates, which were considered useless, in a closet in which there were chemicals. Afterward, happening to look at the plates, he was astonished to find an image upon them. After taking one chemical after another from the closet until apparently all were removed, the images on his plates were still mysteriously developed. At length he discovered on the floor an overlooked dish of mercury, and the mystery was solved. He ascertained that the effects produced by the mercury vapor spontaneously given off could be secured at will by suitable apparatus.

Brains vs. No Brains, and Hiring Steam Power.†

When a machine won't work, the first thing to do is to determine just where the difficulty lies, and what the trouble is. Experience can give odds in this line, and the young mechanic especially must have all his faculties alert to "catch on" to the defective locality.

Go to any first-class watchmaker, and he will tell you that the first and most difficult step in watch repairing is to find what the trouble is. The same applies to larger machinery as well, and the more complicated the mechanism, the more difficult to locate the trouble.

Let two men attempt to "fix" two machines which are "out of-kilter." Let both men be young mechanics, to whom the machines are strange. The character of the two men will be as plainly seen as if it was a printed book. One of these men will go at the job "hammer and tongs." He will hammer this part, screw up a bolt here, loosen a screw there, and rattle and tinker the parts of that machine without even knowing what he does, or why he does it. Perhaps by mere chance he may strike the right lever, and hammer in the right place, thereby effecting a cure, but not by any skill of his own.

His brother workman, on the other hand, will do nothing of the kind. First, he will sit down beside the machine and look at it. He will study each part, see what every lever and cam must do, how they work, and if there is anything to prevent the performance of their duties, he finds it out without fuss or trouble.

This young man has used his brains for the purpose for which they were given him. He will continue to use them until he works himself into a responsible position, which he will fill with credit to himself and satisfaction to his employers.

The first young man, the "thumper," as it were, will knock around the world, much as he knocks around a machine which is above his comprehension. This is the kind of a man who comes on a job with a rush and a hurrah, and who sneaks off in the night, leaving things worse than he found them. He will work around the country, get jobs and get bounced from them when his incapacity is discovered, until some day he goes off for good, in a cloud of steam. Of such is the cheap engineer and the cut-rate workman.

The whole difference between these two men lies in the fact that one of them used his brains to the best of his ability, while the first young man rushed at the work without stopping to think.

Hiring steam power very often becomes a bone of contention between landlord and tenant, which gives rise to much discomfort, to say nothing of hard feelings. If the power could be readily measured, there would be less cause for dissatisfaction; but when the tenant is using but four horse power, and the landlord pays coal bills for twelve, then there is cause for grumbling, and grumbling there surely is.

The indicator card will tell how much power the landlord is furnishing, but it seldom tells how much a tenant is consuming, although by taking a card with tenant's belt off and taking a card with all his machinery at work, will approximate closely to the truth.

By placing a dynamometer on the tenant's shaft, it is easy to see how much power he is consuming at the time, but it is no indication of the power used when the landlord's back is turned. If the tenant be dissatisfied with the amount he is paying for power, let him put on a belt having a width proportionate to the power he thinks he is using. If the amount is estimated at eight horse power, then a belt eight inches wide, running 500 feet per minute, will do the work safely and well. If a six inch belt will do the work, the tenant may depend upon it that he is using only six horse power, and the width for any given speed will be in the same proportion.

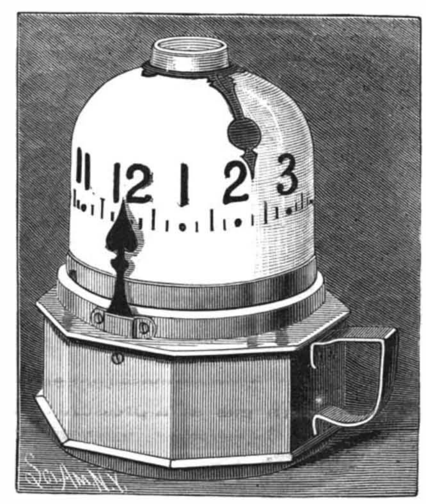
A recording dynamometer is needed, which will tell at any time how much power is passing or has passed. In electrical transmission of power, such a device is in use, and works upon the principle that a given amount of current will deposit a given quantity of copper; therefore a small fraction of the current is led through an electroplating contrivance, and the ratio of the main and fractional currents being known, the amount of electricity furnished can be ascertained at any time by weighing the amount of copper deposited, and multiplying that amount by the ratio of the currents.

Some such device is used for power users and power sellers, and a device could probably be made in which the belt would transfer its energy to the shaft through a set of springs, the tension of these springs to be recorded on profile paper which is advanced a certain distance at every revolution of the shaft to which the device is attached. This paper could be figured up much like an indicator card, and all the foot pounds transmitted through the belt could be accurately determined.

† James F. Hobart, in *The Manufacturers' Gazette.*

ILLUMINATED CLOCK.

The accompanying engraving represents a simple and practical device which embodies a day, night, and medicine clock, and which also provides a night light. Within the base is placed a clock mechanism, the hour spindle of which passes up through the center of the



AN ILLUMINATED CLOCK.

top and is secured to a dished plate, which is by this means revolved once in twelve hours. Resting upon the plate, and, of course, turning with it, is a dome-shaped globe of white glass, having the hours and quarter divisions marked distinctly in a circle upon its exterior. Secured to one side of the base is a pointer which extends to the row of figures. It is evident that as the globe revolves, the time will be indicated by the pointer. Within the globe is placed a small lamp, which serves to render the figures and pointer plainly visible, so that the time may be read at night, and also to illuminate the room with a soft and yet sufficient light. Adapted to rest on top of the globe is a second pointer, which may be placed at any desired distance in advance of the stationary pointer. This will be found of value in the sick room, as, when giving medicines, the second pointer can be placed the required interval between doses—say two hours—in advance of the other, the lapse of the time being noted when the pointers are together. By thus combining a lamp and clock, a most convenient and valuable article is produced.

These clocks are manufactured by the W. C. Vosburgh Manufacturing Company (limited), of 418 Fulton Street, Brooklyn, N. Y., and 184 Wabash Avenue, Chicago, Ill.

Manganese as a Phosphorescent Agent in Minerals.

In a memoir read on December 6 before the Academy of Sciences, M. Becquerel came to the conclusion that the phosphorescence observed in some specimens of limestones is due to the presence of manganese. Having noticed, for instance, that Iceland spar is phosphorescent, he proceeded to the analysis of this substance, and found it to contain manganese. Then, experimenting with carbonate of lime, chemically pure, he tested it with the phosphoroscope, and found it almost inactive. When, however, small quantities of manganese are added to the liquors from which carbonate of lime is precipitated, an active phosphorescent compound is obtained. This phenomenon he considers due to a molecular change adduced in the precipitated carbonate by the presence of manganese.

IN the case of trees which bear in alternate years, judicious thinning will often result in considerable fruit in the off years.

Correspondence.

Bar Lead for Tempering.

To the Editor of the Scientific American:

I notice an article in a recent issue of your paper, on hardening steel by aid of zinc bath. I found a man recently, in the United States Mint here, who bored holes through the hardest steel and plate glass with drills. He told me that he drove the point of the drill, heated to cherry red, into a cold bar of lead, and the result was a much harder temper than the acid bath. S. P. DAVIS.

Carson, Nev., December 17, 1886.

Cause of the Boiler Explosion.

To the Editor of the Scientific American:

In Mark Bacuitt's article in your issue of January 1, entitled "A Remarkable Boiler Explosion," it is stated "the only theory that Master Mechanic Ames can offer is that the cock in the tube connecting the steam gauge with the boiler was partially turned, shutting off half or two-thirds of the actual pressure." I do not see that diminishing the size of the connecting tube alters the pressure in the gauge. Does it? W. P. WOODWARD.

Howard, Pa., January 1, 1887.

Camphor for Drilling Hard Steel.

To the Editor of the Scientific American:

Having occasion to drill through a very hard piece of steel, I tried a saturated solution of camphor (alcohol and gum camphor), and the result was marvelous, the drill apparently "biting" its way through the steel. Thinking your readers might be profited by a knowledge of this feature in drilling, I offer the same for trial, with the hope that those using it may be as well satisfied with the results as your subscriber has been. J. S. CHARLES, D.D.S.

Omaha, Neb., January, 1887.

Gas for Ocean Steamers.

To the Editor of the Scientific American:

Attracted by an article in the SCIENTIFIC AMERICAN, of January, headed, "Gas for Ocean Steamers," and not taking much stock in the fruits of the imagination, the writer would submit the following in answer to the same; 3,800 tons of coal would occupy about 135,700 cubic feet. Now suppose that all this space were to be filled with gas at a pressure of 20 atmospheres (about 300 lb. per square inch), to how many tons of coal would it be equivalent? Allowing liberally for the use of the compressed gas in an engine (which the writer in question neglects) before it is used under the boilers as a fuel, it will be found to be equivalent to less than 200 tons of coal. That is, the gaseous fuel would occupy nineteen times as much space as the solid fuel. F. M. T.

Gas for Ocean Steamers.

To the Editor of the Scientific American:

In Mr. Keller's letter on "Gas for Ocean Steamers," he proposes to store the compressed gas in tanks. A better plan to secure the coal space entire would be, I think, to store the gas in the water tight compartments common to all steamers of recent build. The gas could be conducted to the furnaces by a system of pipes tapping each compartment. The compressed gas would form a far greater resistance to the pounding of the sea, and would also prevent the compartments from filling with water in the event of an accident or collision at sea. The density of the gas would probably wholly, or at least partly, prevent rapid flooding of the compartments.

The greatest point of difficulty it seems would be the establishing of stations for filling the compartments previous to each trip. C. A. COOPER.

Washington, D. C., January, 1887.

Propulsion of Vessels.

To the Editor of the Scientific American:

In your last two issues, I find a controversy about propelling ocean steamers by means of steam jets. It seems to me very strange that neither of these two gentlemen says anything about where to get the water from to generate the steam. On account of heavy incrustation of the salt water, the boilers would be injured, and I don't know whether they could purify enough water for all those boilers necessary to generate the steam. But as a source of safety, I think an auxiliary arrangement of a hydromotor would be very valuable. In case of breakage on the screw, shaft, or rudder, the hydromotor would be, it seems to me, just the thing. With sufficient capacity, the vessel could certainly make about 8 or 9 knots per hour, and this would be enough to bring her to some harbor in safety. Two-screw vessels, of which there is so much talk lately with ocean steamers, is nothing new. We have had them here on the lakes for nearly thirty years. Even if it would cost a little more to run two screws, I think they ought to be inaugurated on the ocean, for two are safer than one. We have here a small pleasure steamer, the Mascotte, with two screws, worked, of course, by two separate engines. She lost one of her wheels twice during the summer, but could run very well with one. With an ocean steamer, safety is the main thing, but it seems it is the last thing shipbuilders or companies think of.

J. BENDER.

Toledo, O., January 1, 1887.

Why the Tall Water Tower Fell.

To the Editor of the Scientific American:

Referring to your account of the rupture and fall of the 250 foot steel plate water tower at Sheepshead Bay in SCIENTIFIC AMERICAN, Dec. 25, 1886, page 405, I note that the contract called for "steel stamped 60,000 lb. tensile strength."

That the pipe was 16 ft. diameter for 70 ft.

That after the first 5 ft. the steel was ¾ in. plate.

I submit that from these data, the pipe being 250 ft. high, the rupture was demonstrably inevitable. Thus, the circumference inside is substantially 50 ft. = 600 in. The pressure per square inch on the ¾ in. steel—the pipe being full—would be substantially 113 lb.; $113 \times 600 = 67{,}800$ lb., the tensile lateral strain on any given vertical inch of the pipe, the pipe being made of ¾ in. plate. Add to this ⅓; $\frac{67{,}800}{3} = 22{,}600 + 67{,}800 = 90{,}400$ lb. pressure. So that steel of 60,000 lb. strength lacked more than one-third of being strong enough to bear the strain. J. C. HODGES.

Morristown, Tenn., December 25, 1886.

Why the Sheepshead Bay Water Tower Burst.

To the Editor of the Scientific American:

The figures given as to the height, diameter, and the thickness and tensile strength of the plates of the stand pipe of the Kings County Water Works, illustrated in the SCIENTIFIC AMERICAN of December 25, 1886, are suggestive, and tell a plain story as to the cause of the stand pipe's bursting. Steel is a very strong material, and a water tower made wholly of steel ought, perhaps, never to burst, but the strength even of steel has its limit. No one, it is clear, ought to expect steel to withstand a stress greater than its tensile strength. And yet that, as it seems, is precisely what was expected of the steel in this Sheepshead Bay tower.

Given a diameter of 16 feet, with the water standing at the height of 227 feet, the rupturing stress on the tower, at points 10, 20, and 30 feet above the base, was respectively, in round numbers, 56,400 pounds, 53,800 pounds, and 51,200 pounds, while the contracted strength of the steel at these points was only 45,000 pounds. At 40, 50, and 60 feet from the bottom, the stress was respectively 48,600 pounds, 46,000 pounds, and 43,400 pounds, against plates that were expected to stand only 37,500 pounds. Had the stand pipe been full, the stress would have been increased about 6,000 pounds.

In this estimate no consideration is taken of any lateral support to the plates. None appears except that offered by the base and the smaller pipe at the taper, and these are too remote to materially strengthen the middle 16 foot sections.

Evidently, the steel was better than Mr. Robinson contracted to furnish. With the extreme stress resulting from the great height and large diameter, plates much thicker and of greater tensile strength should have been required. But, in view of what was required, it is not surprising that this steel tower fell. The only wonder is that men of good mechanical sense and constructive ability should trust themselves anywhere near it when being filled.

S. D. LOCKE.

The Water Tower, Sheepshead Bay.

To the Editor of the Scientific American:

I have just finished reading the very interesting account, given in your issue of December 25 last, of the fall of a stand pipe, or water tower, at Sheepshead Bay. There have been several of these water towers destroyed during the last few years. There should be no difficulty in making these towers strong enough. The method of ascertaining the required strength should be the same as that used in steam boiler construction, and the margin of safety should be no less.

The tower at Sheepshead Bay had not sufficient margin of safety. The diameter was 16 ft., or 192 in.; the pressure 127 lb., which, multiplied by 192, gives 23,784 as the bursting strain. The material was ⅝ thick, which equals 1¼ for the two sides. The tensile strain of the material was 60,000 lb., which would resist 75,000; but as thick plates, even when riveted with three rows of rivets, cannot be depended upon for more than one-half of the original strength, the resisting strain is practically reduced to 37,500, which you will concede to be far from sufficient.

There are agencies which deteriorate and weaken these water towers that are quite as active and as unseen as the agencies which weaken and deteriorate steam boilers. With a view of directing your attention to the probable cause of the destruction of the tower at Sheepshead Bay, I will suppose the following:

The pumps, while filling the tower, also delivered the usual quantity into the general distribution; and in order to deliver 400,000 gallons in two hours, they will run to something over the usual speed. Now, suppose that for some reason the pumps were temporarily slowed down or stopped; the water to supply the general distribution would return from the tower, and would descend from the upper portion of the tower with a velocity of about one foot per second, which flow would be immediately stopped on again starting the pumps, thus subjecting the tower to a much greater pressure than that due to the height of the water.

These water towers, or stand pipes, as is well known to engineers, are of no use whatever except in connection with the Cornish engine. Therefore, if people will have them for landmarks or monuments, they should be closed at the top and used simply as air vessels.

The object for which the Egyptian Pyramids were erected may in time be discovered. But the object for which the stand pipe, or water tower, is erected in connection with the modern pump will forever remain a mystery. WM. GOLDING.

New Orleans, January 5, 1887.

Taking Cold.

To the Editor of the Scientific American:

Reading, in a recent issue of your paper, an article of Dr. Brown-Sequard on "Taking Cold," it occurred to me that colds are peculiar to civilized life, and to our comfortable, warm rooms. I have had colds as frequently perhaps as any one, but during one period of my life I was entirely free from them, with one exception.

I served through the war in the Fifth Ohio Cavalry, beginning at Shiloh, and ending my service with the march to the sea. We were an active regiment, always at the front, and therefore always remarkably unencumbered with tents or comforts. We were exposed to all weathers and all seasons. Many a time we were rained on for a week or more. When the sun came out the next week or the week after, it dried us. Many a time, long after dark, after a march in rain and mud all day, we have been filed into miry woods, where we slept in the rain with the running water washing between us and our blankets. I have seen men wake in the morning with their hair frozen in the mud. But none of us caught cold. We swam the Tennessee River after midnight, when the mercury was at zero, and among floating ice, and came out with our clothes, to our armpits, frozen like sheet iron, and then marched till morning. In the cold winter of 1863–64, we were in the mountainous country of East Tennessee, where it is as cold as Ohio. We were there from November until March, without any tents or shelter of any kind, moving every day, and sleeping in a different place every night, with the temperature frequently below zero.

I have, with my comrades, ridden upon the skirmish line when I could not lift a cartridge out of my box, nor even pick up a carbine cap. I have been on night pickets, mounted, when the pickets had to be relieved every fifteen minutes, because if left longer the men could not load and fire. But we never caught the slightest cold, nor did I ever in times of cold and exposure to wet see a soldier with a cold. But I did catch one cold in the army, and I never had such a one before or since. It came from excessive comfort, or what seemed comfort to us. We were at Camp Davies, Miss., the southern outpost of the great fortress of Corinth. Having been there some months, we began to build neat log cabins, with openings for doors and windows—no glass or doors, of course.

One of our mess being a young bricklayer, we thought to surpass our neighbors in style and comfort, and we sent for brick, and he built us a large chimney and fireplace, and we built a good fire. That settled us. Four of us had to go to the hospital with tremendous colds on our chests and in our heads. We never had such heavy colds in our lives. This was about the middle of our three years of service, and before and after that I never saw an exposed soldier with a cold. (Of course a few days after our cabins were finished we got marching orders.) I believe all old soldiers will bear me out that in active campaigns, where there was great exposure to the weather, no one had a cold. And come to think of it, in my experiences in Colorado and Utah, in recent years, I never saw an Indian with a cold, though they stand more exposure than our cattle do. It is our hot rooms that give us our colds. If a person would camp out from fall till spring, exposed to the weather of a severe winter, he would never take either a cold, pleurisy, or pneumonia, and would be absolutely free from them. But when you are in Rome you must do as the Romans do, and take warm rooms and colds. ANDREW VAN BIBBER.

Cincinnati, O., Jan. 5, 1887.

A PROPER, safe working load for wire ropes is as follows: One-half inch in diameter, 1,000 pounds; five-eighths rope, 1,500 pounds; three-fourths rope, 3,500 pounds; one inch rope, 6,000 pounds. This is for nineteen wires to the strand, hemp centers.

THE SAINT MALO ROLLING BRIDGE.

Some time ago we gave a brief description of this curious system of communication between two jetties, and we now return to the subject because of some beautiful photographs that have been sent us, showing the rolling bridge at low and high tide. We shall remind our readers that the two cities of Saint Malo and Saint Servan are so close together as to nearly touch each other. In order to go from one city to the other, it was formerly necessary to make considerable of a detour. It is now more than fifteen years ago that the architect Leroyer, of Saint Malo, remedied this inconvenience by constructing, not a revolving bridge, but a light iron framework—a genuine rolling bridge—which carried foot passengers from one jetty to the other. This iron structure lies upon a carriage mounted upon wheels that run upon rails. This bridge is moved through two chains, one of which pulls it toward Saint Malo and the other toward Saint Servan. These chains wind over a drum set in motion by a steam engine.

At the upper part of the framework there is a platform for carriages, horses, and merchandise. For foot passengers there is a sort of cabin that protects them against sun and storm. The toll is one cent for the open platform and two cents for the cabin.

The bridge operates at high tide as well as at low. In the former case, nothing is more curious than to see the platform suspended over slender iron rods at the surface of the water. Under such circumstances, travelers sometimes experience a certain shock upon gazing at the ocean beneath them.

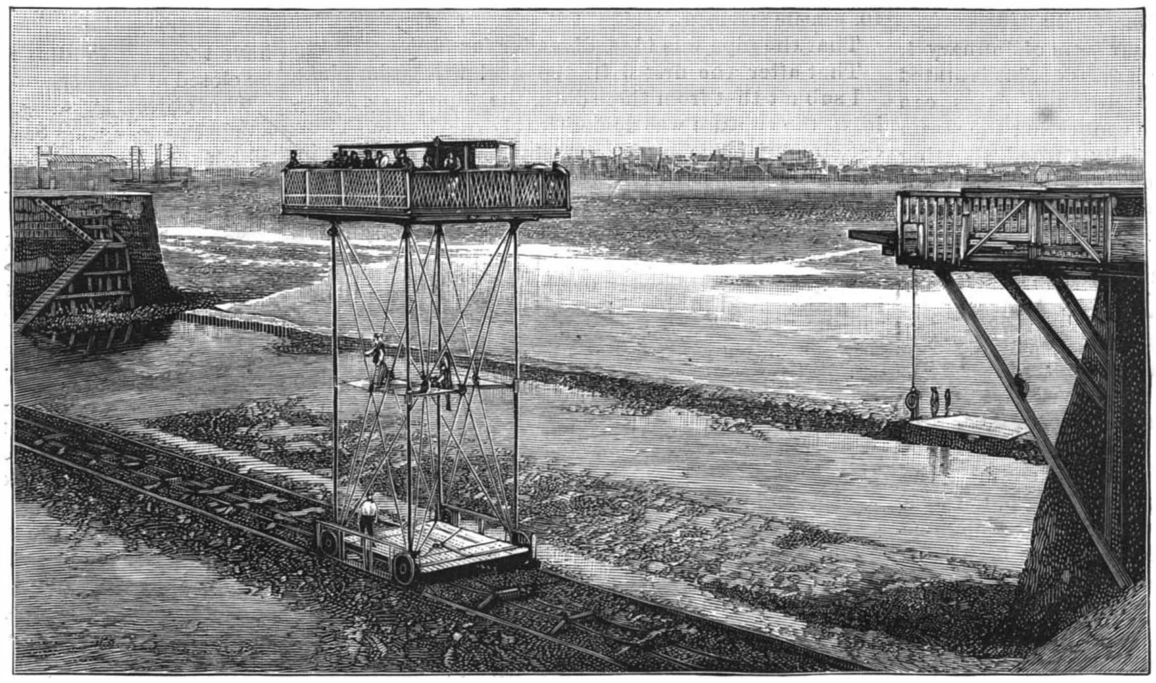


Fig. 1.—THE SAINT MALO ROLLING BRIDGE AT LOW TIDE.

In 1878, at the time of the Paris Exposition, Mr. Leroyer constructed a small model of this bridge, one-tenth actual size. Along with this there was a printed description, which we here reproduce in part.

When at rest, the rolling bridge is entirely out of the way of ships.

On the Saint Malo side it enters a cavity in the wharf wall through its entire length. On the other side there is a short approach, as seen to the right in Fig. 1. The height of the walls above the rails is 34½ feet. At high tide, the bridge is submerged 33 feet. The distance to be traversed is 295 feet, the width of the pass, but it may be prolonged as much as necessary. The velocity of the current to be traversed is sometimes from 5 to 6 knots. The trip is made in 90 seconds, or about 2½ minutes in going and coming.

Since the construction of the bridge in 1871, there has been no accident of any note, and communication between the two cities has been uninterrupted, the structure having operated at all times without the least stoppage, affording a prompt and sure passage from one shore to the other, at night as well as during the day, at high water as well as low, and even when ships could not ride the sea.

The bridge carries horses, carriages, merchandise, and cattle. The platform will hold one hundred passengers.

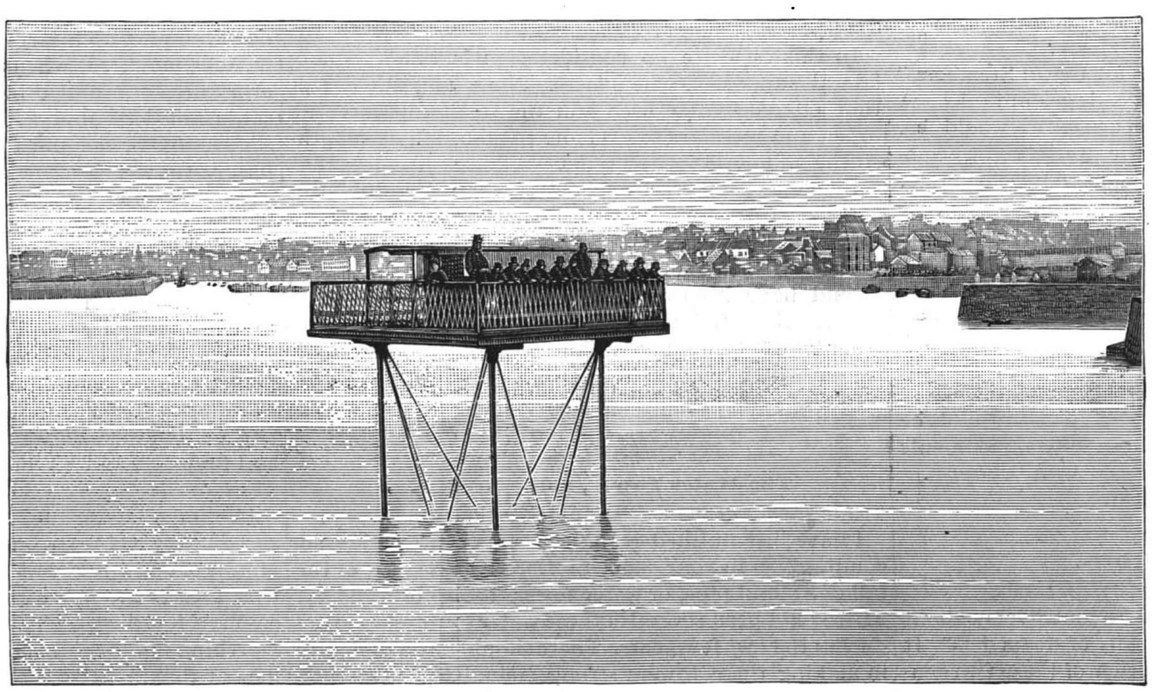


Fig. 2.—THE SAINT MALO ROLLING BRIDGE AT HIGH TIDE.

We are surprised that it has not been imitated in other parts, and we have thought that it would be of interest to again call the attention of engineers and the public to the interesting device.—*La Nature.*

THE remarkable bleaching compound of Mr. Chas. Toppan, of Salem, Mass., consists of 3 parts, by measure, of mustard seed oil, 4 of melted paraffine, 3 of caustic soda, 20° Be., well mixed to form a saponaceous compound. Of this, 1 part of weight and 2 of pure tallow soap are mixed, and of this mixture 1 ounce for each gallon of water is used for the bleaching bath, and 1 ounce caustic soda, 20° Be., for each gallon is added, when the bath is heated in a close vessel, the goods entered, and boiled "until sufficiently bleached."

Packing for Piston Heads and Stuffing Boxes.

At a recent meeting of the Western Railway Club, Chicago, Mr. Johnson said: Metallic packing exclusively has been in use on the Chicago, Burlington & Quincy road since the fall of 1881. We find that piston rods average a mileage of 50,000 miles without turning. We then turn off an average of 1-64 inch. We reduce our piston rods from 3 inches to 2½ inches, or ½ inch, before throwing out, this giving us a wear of 1,600,000 miles on piston rods per engine. Putting the average mileage of all engines at 50,000 miles per year would make the life of piston, so far as packing is concerned, 32 years, or more than the average life of an engine. As a matter of fact, during the past five years that this packing has been used by the Chicago, Burlington & Quincy, in no single instance has there been a piston rod removed on account of wear. There is no case where an engine has been laid in to turn either the piston rod or valve stem, on account of leaking. The wear of the valve stem is greater than the piston rod, though not as true, the valve stem wearing more on the top and bottom, leaving the stem somewhat oblong. We find the average mileage of valve stems to be about 35,000 miles without turning, when they require from 1-64 to 1-32 inch to true up. Of the engines equipped with this packing in 1882, there has yet been no case of a valve stem being removed. This packing costs, complete ready to put on engine, for pistons and valve stems, $23.05. The cost of maintaining this packing is extremely light. Three passenger engines, making 250 miles daily, with our heaviest through trains, being handled by separate crews—there being six crews to run three engines, each following the other around—have, from May 1 to December 1, 1886, only used 36 cents' worth of material each. This represents the 6 pounds of metallic packing rings. Freight engines require a set of packing rings once in three months on an average. Switch engines require a set once each month. I find that the records of the amount of hemp used have been destroyed. Piston and valve stem wear, however, with hemp was very remarkable. The average life of a steel piston rod, with hemp, was four years. The average of a valve stem, with hemp, did not exceed two years. At one shop, where there were 110 engines, it kept one lathe constantly turning valve stems, and two lathes on piston and piston rod work. At the present time, at the same shop, with 120 engines, one lathe does all the piston and piston rod work and a considerable portion of the valve stem work. This includes all new work and repairs.

Mr. Johnson: It is the Jerome packing, somewhat modified. We have made some slight improvements—or what we consider improvements—on the original design given us; but it is practically the Jerome packing. Those engines that I spoke of make about 7,000 miles a month. They are operated by new crews; there is no regular engineer on them. Our practice is to have one man in the shop do all the lathe work, and the work in the roundhouse of replacing the packing rings is all done by one man.

Secretary Sinclair: When engines are running in a yard where they are very much pressed for work, and doing work for double crews, it is often of great importance to have no delay in putting in packing, and where you are using hemp packing it often happens that it blows out just at a most inconvenient time, and if you cannot put a new lot in you must lose a good deal of steam before it is possible to repack the engine. In running engines myself I have had experience with most kinds of packing that have been used. I have used flax and hemp and other kinds of piston packing, and I think that hemp is the most expensive packing that was ever put into an engine for any purpose. Some of the metallic packing does not suit well because it is not mechanically a good arrangement. Unless a packing is made so that there will be some means of compensating for the rise and fall of the piston rod, it is not going to wear well; especially is this true of a metallic packing. A fibrous packing, like hemp, may have enough elasticity to it to fill up an opening when a hole is made by the rise and fall of the crosshead, but metallic packing has not that; and unless there are means taken to let the ring rise and fall with the piston, the rod squeezes a hole in the top or bottom of the ring, makes it elliptical, and the steam blows out there. That has been the cause of difficulty with so many kinds of metallic packing, viz., that they did not make provision for that rise and fall. It would be all right so long as the guides were perfectly fitted to the crosshead, or the crosshead to the guides, but as soon as there was some lost motion the ends of the stroke would destroy the packing so that it would leak badly, and in that way it would never be kept tight; and whenever we screw up on it and try to prevent the leaks, it squeezes the sides of the piston rod. Metallic packing of a bad form is much harder on the rod than fibrous packing is, but metallic packing, if well made, is certainly the most economical that can be used.

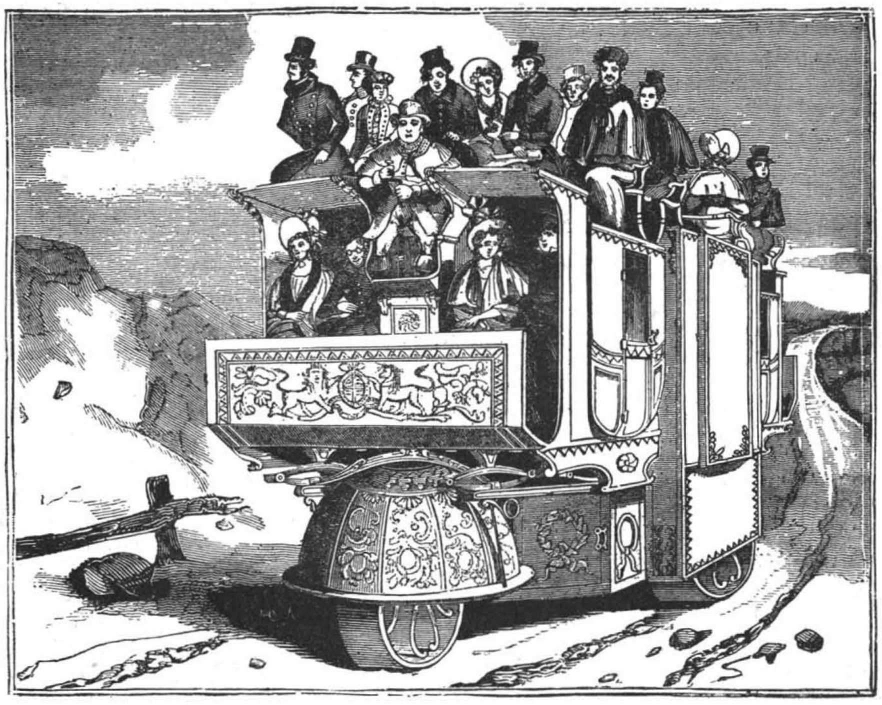
I made some inquiries about it a short time ago on a road where it hadn't done well, and I found that they put the packing on just as the engines happened to come in, without truing up the piston rods or valve stem, and they had no success with it at all. Now, I think that you cannot apply that packing successfully without having the rods perfectly true, and if they are true in the first instance they are liable to continue true; but if you apply the packing when they are worn in the middle, it is impossible to get it to keep tight, and the packing will be destroyed in screwing it up and trying to make it tight.

Mr. Reynolds: We are using metallic packing on all our engines. We have one engine fitted with it, that I remember now in particular, that made about 60,000 miles with no expense whatever. The packing costs about $45, but its manufacture costs only about $13. It is only a question of patent.

STEAM CARRIAGES.

As well known, locomotives and cars on rails were, in the beginning, two absolutely distinct conceptions, which made their way isolatedly, and seemed as if they were never to meet. The fusion of these two ideas was to give us railways such as they now exist. The first steam carriage was built by Joseph Cugnot, and it is quite curious, apropos of this, to recall the terms in which his invention was made known to the Institute, on the 11th of Pluviose, year VI. (January 30, 1798), by Bonaparte:

"The secretary read a note sent by Citizen Bonaparte, who received it from Citizen Roland, relating to a carriage moved by steam. Citizens Coulomb, Perrier, Bonaparte, and Prony are commissioned to make a report upon this machine, and to be present at the trial to be made of it, and, at the same time, to present their views upon the best method of applying the action of steam to the carriage of burdens."



DR. CHURCH'S STEAM OMNIBUS.

The model of the steam carriage constructed by Cugnot in 1771 is preserved at the Conservatoire des Arts et Metiers. Some years later, in 1784, Watt and Murdoch, each in turn, made experiments on the propulsion of carriages by steam, without a thought of anything else than doing away with the horse. The dwarf locomotive constructed by Murdoch is now on exhibition in the Kensington Museum. At the same epoch at which Stephenson was solving the problem of railways, experiments were likewise being made upon ordinary roadways; and much later on, when this great problem had been definitely solved, the roads were still being traversed by steam carriages of a more or less ingenious conception.

By good luck, we have come across an engraving of the period, representing Doctor Church's carriage, which we herewith reproduce.

Dr. Church, of Birmingham, ran over the road that leads from the latter place to London, at a speed of nine miles per hour, with the carriage shown in the cut. His enterprise was kept up for some time, and gave rise to other experiments in England. These experiments gave results full of promise, and perhaps would have disenthroned stage coaches and wagons, had not locomotives upon rails given something better than promises, and quickly revolutionized the economic conditions of civilized countries.—*La Science en Famille.*

THE ST. PAUL ICE PALACE.

The general form of the palace resembles somewhat a Latin cross. It will cover about 42,000 square feet, being 217 feet long by 194 feet wide. The grand central tower will be octagonal in shape, 50 feet in diameter and 105 feet high. The building will be a roofless shell, the surrounding walls averaging 23 feet in height. The main entrance will be in the form of a triumphal arch, surmounted by a sitting figure of King Borealis with his attendant bears (rampant) at either hand, all to be carved in ice. This archway will be 16 feet wide and 15 feet high. The wall will be 9 feet thick. The wing forming the foot of the cross, in which will be the main entrance, is circular in form, 95 feet in diameter. Each of the other wings, forming the head and arms of cross, will also terminate in an entrance, but of minor importance. The whole affair will be pleasing in effect and magnificent in proportions.

Our engraving is from the *Northwestern Architect and Improvement Record.*

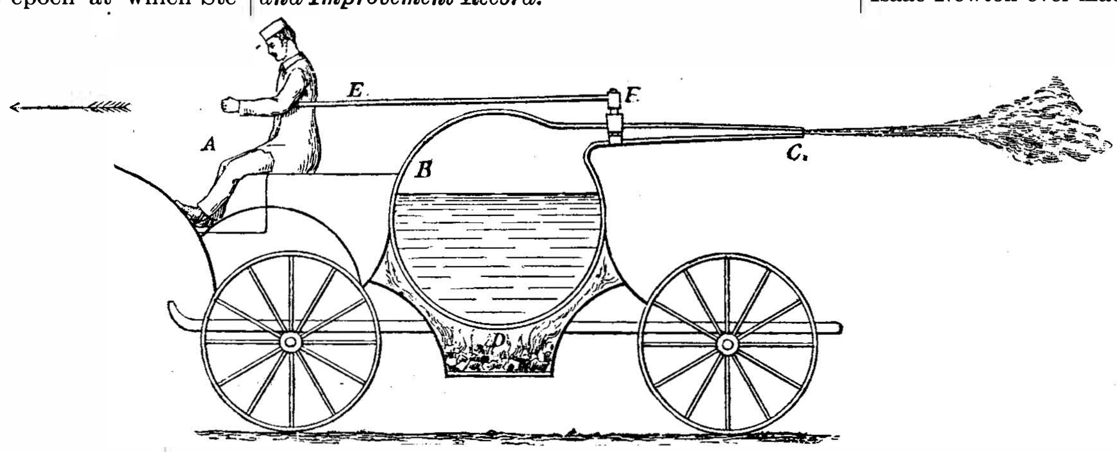
THE ST. PAUL ICE PALACE.

DRUMINE discovered and described by Dr. John Reid (*Australian Medical Gazette*, October, 1886). Drumine is the alkaloid from *Euphorbia Drummondii*, and is an almost tasteless substance, soluble in chloroform and water, and producing local anæsthesia of mucous membranes in a way similar to cocaine.

SIR ISAAC NEWTON'S STEAM CARRIAGE.

It is curious that Sir Isaac Newton, in one of his books, said that it would be necessary that a new mode of traveling should be invented. He prophesied that the time would arrive when, owing to the increase of knowledge, we should be able to travel at the rate of fifty miles an hour; these remarks were ridiculed at the time, but have been more than realized. Moreover, the world is indebted to the same illustrious personage for the first idea of propulsion on land by steam power, for in his "Explanations of the Newtonian Philosophy," written in 1680, he suggested the little locomotive shown by the accompanying engraving, "which will be recognized as representing the scientific toy which is found in nearly every collection of illustrative philosophical apparatus." It consists of a spherical generator, B; the driver sitting at A controls the escape of the steam by the lever, E, and the cock, F; the fire beneath the boiler is seen at D; the whole is mounted on light wheels, so as to move easily on a horizontal plane, and upon opening the cock, F, steam would issue violently out of the nozzle, C, shown pointing backward, and by its reaction the carriage would be driven in the opposite direction, and propelled forward, as indicated by the arrow.

It would be very interesting to know whether Sir Isaac Newton ever made a model of his proposed locomotive; doubtless "he merely threw out the idea for other minds to work upon."



SIR ISAAC NEWTON'S STEAM CARRIAGE OF 1680.

A Rare Bear.

A curious and rare specimen of the bear family, called *Ursus syriacus* by one authority and *Ursus gabellinus* by another, came to New York recently, and is now to be seen at the private menagerie kept by Reiche, the dealer in live animals.

This species is both unusually powerful and vicious; two qualities of which he gave apt illustration recently by breaking through the heavy iron bars of his cage and attacking his keepers. During the struggle between men and bear, Mr. Reiche, who, from experience, knows a fierce animal when he sees it, decided that the odds were in favor of the bear, and was about to use his rifle when the bear succumbed, and was forced back into his cage. The Syrian bear is both a meat and vegetable eater; being particularly fond, it is said, of a kind of chick pea (*Cicer arietinus*) growing about the snowy regions. The present specimen is fulvous brown, but his kind are often fulvous white, and sometimes spotted.

This Syrian bear is particularly interesting, because supposed to be the first of the bear family known, and presumably the same species as those "she bears" which, we are told by the Bible [II. Kings, ii., 23 *et seq.*], lay hid in the wood, and coming forth, "tare forty and two" of them who persecuted Elisha. Matthew Paris, in his History of England (tom. ii., p. 34, London, 1640), describes this bear as the one which attacked Godfrey. The latter, while the siege of Antioch was in progress, was riding in the neighborhood, when he came upon a poor wood gatherer seeking to escape from a ferocious bear. The soldier rode at the bear, was unhorsed by the brute, and only succeeded in driving his sword into it after he had got an ugly wound.

SCIENCE IN TOYS.

III.

The toy hygrometer serves to show approximately the hygrometric state of the atmosphere. One of the several forms in which it is made is shown in the annexed engraving. A perforated metal tube, projecting from the back of the figure, contains a short piece of catgut cord, which is fastened in the rear end of the tube by closing the sides of the tube down upon it. The opposite end of the cord projects beyond the front of the figure, and is attached to the arm of the boy. In the hand of the arm thus supported is carried an umbrella. When the air is dry, the catgut cord retains its twist, and the arm holds the umbrella out of the position of use; but when the air becomes moist, the cord swells slightly, and untwists, and in so doing raises the boy's arm and brings the umbrella over his own head and over the head of his companion.

HYGROMETER.

Another form of the same device consists of a house having two doors and containing two figures—a man with an umbrella and a woman in fair-weather dress; the figures being supported on opposite ends of a bar suspended centrally by a catgut cord. When the cord is untwisted by the action of moisture, the man with the umbrella sallies out; when the cord becomes dry, the man returns indoors and the woman appears.

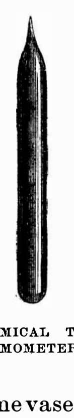
These simple, pleasing, and instructive toys illustrate the action of moisture on certain porous bodies, and are of interest, if not of actual use, to the meteorological observer.

The action of the sensitive leaf shown in the engraving is also due to expansion by absorption of moisture. The leaf consists of a piece of thin gelatinized paper, or gold beater's skin, or even of gelatine, printed in some fantastic design, that of the mermaid being the favorite.

SENSITIVE LEAF.

When the leaf is laid upon the palm of the hand, the moisture of the hand is absorbed by one side of the leaf, and more in some places than in others, owing to imperfect contact with the hand. The moistened portions rapidly swell, thus warping the leaf, which twists and writhes in every possible direction, as if it were possessed of life. The leaf, being extremely thin, quickly becomes dry, so that the various contortions succeed each other rapidly.

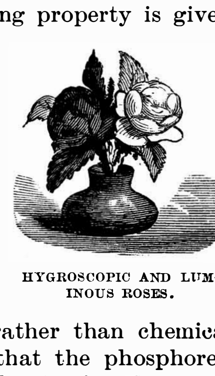
The chemical thermometer is made by sealing in a tube a solution of chloride of cobalt in dilute alcohol. When the tube is subjected to a temperature of 40° to 50° Fah., the solution becomes pink, and as its temperature is raised to 90° or 100°, it passes through various shades of purple, and finally becomes blue.



CHEMICAL THERMOMETER.

The same salt applied to an artificial flower, a rose for example, renders it visibly hygroscopic. When the air is humid, the rose is pink; and when the air is warm and dry, the rose will be purple or blue. A solution of the same salt constitutes one of the sympathetic inks.

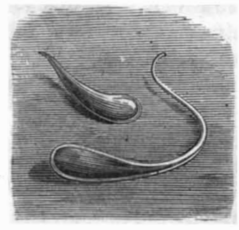
The luminous rose shown in the same vase with the hygroscopic rose is a beautiful example of the wonderful property of storing light possessed by some bodies. The light-storing property is given the rose by a coating of luminous paint, the basis of which is sulphide of calcium. This rose, if exposed to a strong light during the day, will be luminous throughout the night.



HYGROSCOPIC AND LUMINOUS ROSES.

The exact nature of the change which takes place in the phosphorescent substance while exposed to the light is unknown. It is supposed to be due to some modifying action of the light, rather than chemical action. It has been ascertained that the phosphorescence takes place *in vacuo* as well as in air.

Prince Rupert's drops, or Dutch tears, show in a striking manner how a body under sufficient internal strain may contain within itself the elements of destruction. These drops have a long, oval form, tapering at one end to a point, which is more or less curved. They are made by dropping melted glass into water, thus suddenly cooling the glass and putting it under great strain.



PRINCE RUPERT'S DROPS.

The larger part of the drop may be struck with a hammer without breaking; but on breaking off the point, thus relieving the strain at one place, the glass instantly flies into pieces. So complete is the destruction, that the fragments are like fine sand.

The Bologna flask is of the same nature as the Prince Rupert's drops. It is an unannealed glass flask, having

BOLOGNA FLASK.

a very thick bottom, which is under great strain. The flask will receive a hard blow without breaking, and a lead bullet may be dropped into it without producing any effect, but on dropping into it a quartz crystal, or in some other way slightly scratching the inner surface of the flask at the bottom, the flask at once goes to pieces. The action may be compared to the destruction of a superstructure of masonry by weakening or destroying the keystone of the arch which supports it.

A common example of action of this kind is met with in lamp chimneys, which break without any apparent cause. Engineers often find glass water-gauge tubes which will readily stand steam pressure, but which, when scratched even imperceptibly on the inner surfaces, will break. G. M. H.

Iconomatic Writing.

A recent lecture on this subject by Prof. Daniel G. Brinton, A.M., M.D., has been published in pamphlet form, and in view of the recent developments in the deciphering of Mexican inscriptions, possesses peculiar interest. We are mainly familiar with two ways of expressing thought in visible character—one by purely arbitrary signs, the other by pictures representing the objects described. Many of the Egyptian inscriptions are in a character derived and developed from the latter method. Now, if a punning system be used, if for an adjective, or any word, a representation of an object having a similar name be employed, we have an example of the ideographic method. A Cockney desiring to express thus the adjective "high" might draw a human eye. The similarity of sound would make the drawing answer for the expression of the adjective. Again, taking an infinitive case of a verb, the words "to hide" might be expressed by the figure 2 and a picture of a skin or hide.

These instances will recall rebuses or pictorial puzzles to the reader's mind. In them the iconomatic system often appears, though mixed of course with the literal and the picture systems of expressing ideas. Iconomatic writing, it will be observed, occupies an intermediate position, standing in some sense in relation to both letter and picture writing. Both Egyptian and Chinese writing, in all probability, began as picture writing. How complete a system of iconomaticism they passed through is unknown, yet in the Egyptian hieroglyphs examples are found. Thus Dr. Brinton cites the word *nefer*, which in Coptic signifies a number of things—a *lute*, a *colt*, a *conscript soldier*, a *door*, and the adjective *good*. The picture of a lute was employed to signify any of these words. Going a step further, a symbolic or arbitrary representation of a familiar object might be used in picture writing. As this developed, this arbitrary figure would acquire new meanings. In the hieroglyphics of Egypt, a three-sided square was used to represent a *house*, but in the broader sense to signify the sound *per*, which means not only a house, but several other things.

To fix the individual meaning of any of these characters, unpronounced determinative characters were used. Thus, if a lute, *nefer*, was drawn or inscribed to represent a conscript, a picture of a man would be annexed as a determinative. This precluded it from meaning a *colt*, or a *door*, or a *lute*, but fixed its meaning as a *conscript*.

The probability that all Egyptian writing had this origin is increased by the fact that several signs were used in its highest development to represent the same sound. Four signs exist for the sound of the letter M, four for that of T, three for N, and so on. On the Rosetta stone, the words Alexander and Alexandria in the Egyptian sectors are expressed by rebus-like signs of the Egyptian language.

In heraldry numerous examples of this principle occur; they were mostly used in the older times, before reading and writing were common acquirements. Now they are considered in bad taste. Of those cited by Dr. Brinton, the Bolton shield may be quoted—a cask, or "tun," transfixed by a crossbow, or "bolt."

The instances taken from the Mexican language are most curious and interesting. Thus a town is cited which was called *Tamneh* in the Huastecan language. In the Aztec tongue it became *Tamnoc*. This in Huastecan means "near the scorpions," but in Aztec has no meaning at all. But the word *tamachina* means to measure, a measuring stick is rendered by *octocall*, footprints by *xoctli*. Hence the name of the town was indicated by a man holding a measuring stick, which gave the syllable *tam*, from the verb, and *oc*, from the noun, while footprints marked upon the stick reaffirm the syllable *oc*. In Nahuatl, the name of a certain town, Mapachtepec, means badger hill or badger town. The native scribe preferred a punning to a pictorial rendering of the word, and showed a hand, *maitl*, giving the syllable *ma*, grasping a bunch of Spanish moss, *pachtli*, giving the syllable *pach*, while *tepec* is denoted by a picture of a hill.

Dr. Brinton cites as an illustration the well known rebus or puzzle $\frac{\&}{\text{Mass}}$ meaning Andover, Mass. A similar "position" meaning was used by the Aztecs. The word *itzmiquilpan* is represented by a stone knife, *itzli*, and a plant, *quilitl*, placed over *pan*, the symbol for cultivated land, *milli*. This gives all the syllables of the name, the final syllable, *pan*, depending on position, like the syllable "over" in the Andover rebus.

Even colors are thus employed in the Nahuatl hieroglyphs. Yellow is translated *cuztic* or *coztic*, and a yellow color in the character is used to denote the syllable *coz*; and parallel cases are cited for other colors.

This gives an idea of this interesting subject, treated even in Dr. Brinton's lecture at comparatively slight length. When Mrs. Zelia Nuttall Pinart attracted so much attention at the Buffalo meeting (1886) of the American Association for the Advancement of Science, it was in this field that her researches lay. The full results of her labors are not yet public, but Dr. Brinton argues a high standing for them when published eventually, from what he has been allowed to see of them. It is to be hoped that he will soon give a more extended treatise on the subject of this most interesting pamphlet.

Asthma in Cage Birds.

Canaries are often troubled with a wheezing in the chest, which, from its resemblance to what is known as asthma in human beings, is given the same name. It is not, however, asthma, but an affection of the lungs. The cause is not far to seek. Canaries can bear great extremes of heat and cold, delicately framed though they be; but they cannot stand sudden transitions from one to the other. When they are kept in a room where the temperature is very variable, perhaps close to a draughty window during the day, with hot, vitiated atmosphere from burning gas in the evening, and later on the other extreme of cold, we must not wonder if the lungs are affected. It is therefore important that care should be taken to prevent such a state of things, and this is best done by hanging the cage below the middle bar of the window, or, what is better, standing it on a table some distance away, and then, when the gas is lit, the cage can be covered over and put on the floor in one corner of the room, as the temperature will be much more equal there than higher up. If such a plan be adopted, the so-called asthma will be prevented; but if it is found, a little tincture of aconite is the best remedy, say a drop to a teaspoonful of water divided into two doses.

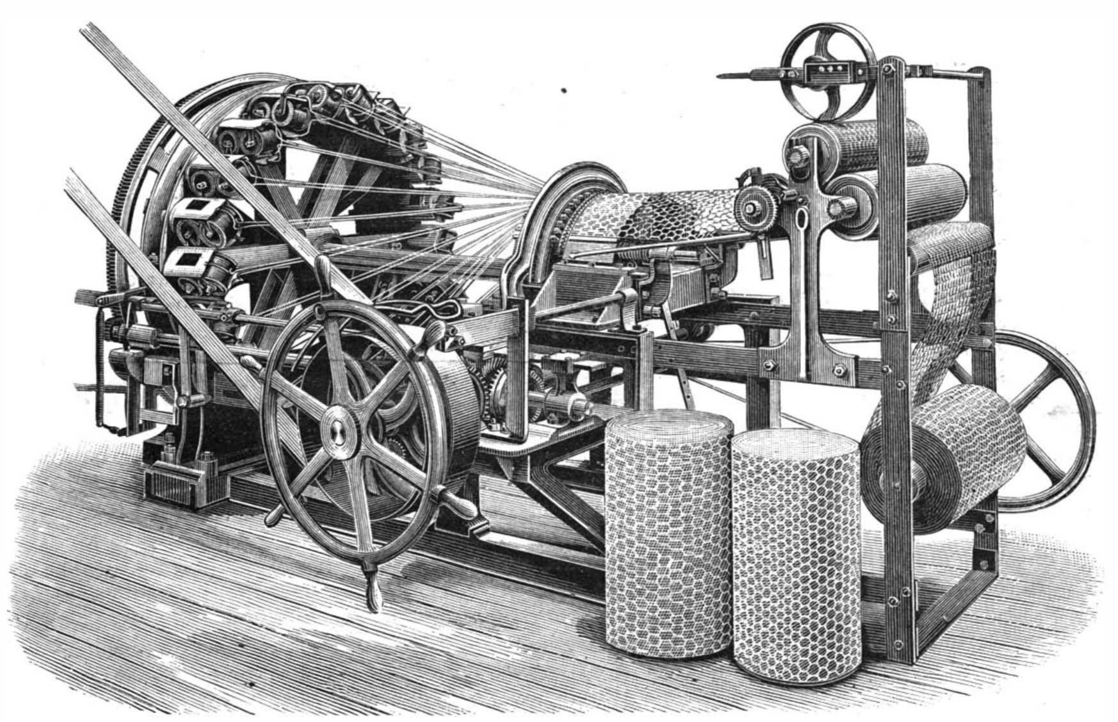
A BRIDGEPORT paper says that a detective of that city recently received the following letter: "Will you oblige me by going to some picture gallery and set for my pictures. I will pay you. My children and relations are bothering me to have one took as I am grown in' old, and as I am buzzy gitting in crops I can't spair time to come down. I hear you have disgizes so you can do as well as me. Have on red side whiskers and good clothes. Make the picture good lookin' and when you laff show your teeth, as I have a bran new set of false ones. I am 48 years old and a widower."

IMPROVED WIRE NETTING MACHINE.

A very ingenious machine for manufacturing wire netting has been invented by Mr. W. F. Dennis, of 101 Leadenhall Street, London.

In the Dennis machine is a disk mounted on a central pivot, to which a rocking motion is imparted. In the periphery of the disk are a series of semi-cylindrical spindles, each of which carries at one end a bobbin and at the other a toothed pinion. Surrounding the disk is a ring secured to the framing of the machine. In the internal surface of this ring is a second series of semi-cylindrical spindles, each of which carries at one end a bobbin, the bobbins being on the same side of the ring as those on the disk. The toothed pinions gear with a central toothed wheel, by means of which they twist each pair of wirestogether. The disk partakes of a rocking motion, the extent of its circumferential travel corresponding with the distance apart of the spindles mounted in its periphery. At a short distance from the face of the disk and ring carrying the bobbins is apparatus for twisting the several pairs of wires together in the formation of the netting. This mechanism consists of two series of half spindles, each series being carried in semi-cylindrical bearings formed in a bar. The faces of the bars in which these bearings are formed are opposite to and in contact with one another; and the pitch of adjacent bearings in each bar corresponds with that desired for the mesh. Each bar carrying half spindles receives an intermittent reciprocating motion equivalent to half the pitch, the motions of the two bars being in opposite directions. Corresponding ends of the half spindles are furnished with half pinions, which, gearing with racks, enable each pair of half spindles to be rotated. The half spindles employed in the twisting mechanism permit the passage of the wires employed in making the netting. The wires from the bobbins mounted on the disk and ring are led through the half spindles in the twisting mechanism; and, according to the number of the twists desired in the netting, the bobbins and twisting spindles are rotated. The bobbins mounted on the disk of the countertwist apparatus are then shifted to the next adjacent bobbins carried by the wheel; and similarly the two reciprocating bars of the twisting mechanism shift the half spindles they carry, so that the combination of wires thereby established corresponds with that prevailing in the countertwist apparatus. These wires, having been twisted and countertwisted as before, but in the reverse direction, the disk returns to its original position, and the twisting spindles, together with the wires they carry, resume their normal relationship. Beyond the twisting mechanism is a roller, provided with projections for engaging in the meshes of the netting. This roller has an intermittent rotative motion, and exercises a pulling action as the netting is formed.

It will thus be seen that the Dennis continuous wire netting machine possesses great advantages over those of the ordinary type. With the latter, a considerable waste of time and material arises in production, in consequence of the employment, besides bobbins, of a number of spools, each containing only a very short length of wire, which, moreover, must be of a soft description, and which has to be coiled into spirals ready for the spools. In the Dennis machine bobbins only are employed, and all the wire is drawn direct from them, thus obviating the evils already referred to, as well as that of the frequent stoppage of the machine for inserting fresh spirals in the spools. Besides these, there is in the old machine the difficulty of equalizing the tension between the bobbin wires and those drawn from the tubes, which difficulty disappears in the Dennis machine. Beyond this we have the fact that hard iron or steel wire can now be employed for the manufacture of the netting, which hitherto has not been possible. The bobbins contain a sufficient quantity of wire to keep the machine running continuously the whole day. The machine at Millwall, which we inspected, measures about 11 feet long by 8 feet wide and 6 feet high over all, and its output is 350 yards of 1 inch mesh continuous wire netting 2 feet wide per ten hours, or 1,050 yards for a machine 6 feet wide. Our inspection of the working of the Dennis machine leads us to the conclusion that it effects a considerable saving in labor, gives a largely increased output, and forms an important advance in machinery for the manufacture of wire netting.—*Iron.*



IMPROVED WIRE NETTING MACHINE.

Men of Thought.

A young assistant of chemistry in the Boston Institute of Technology happened some years ago to be in the northern peninsula of Michigan, says the New York *Sun*. While there he observed that the Portage River and Lake Linden were of a peculiar copper color, and, when he asked the cause, was told that it was copper that escaped from the smelting and stamping mills of the Calumet and Hecla mines. The young teacher put his thinking cap on, and then requested the company to allow him to experiment, with a view of saving this copper. The company was only too glad to offer facilities. So the young man gave up his summer vacation and set to work, and was able to devise a method by which about 4 per cent of the copper mined was saved, and almost pure copper, too. The young professor no longer earns a trifling salary, but has acquired a comfortable income by this summer's vacation.

Some years ago, a mechanic near New Haven was riding in a railway train, and was jolted and jarred as in the early days of railway travel passengers were apt to be. He didn't fret and fume, as the other passengers did, but began to study and experiment, with a view to making a spring that would reduce the jolting to a minimum. He at last succeeded, and his spring was adopted by every railroad in the country. He is no longer a poor young mechanic. His name is Carlos French, and he has just been elected to Congress from the New Haven district.

There died, a few days ago, in Waterbury, a man who began life in the narrowest circumstances. He learned the trade of a machinist, and he gave his whole soul to his trade. By and by he startled wire manufacturers by producing a cold reducing machine, by which wire was drawn cold. Seeing one day a woman fretting because she had pricked her finger with a pin, he was set to thinking, and in a week had devised the valuable safety pin. His name was E. J. Manville. He died a rich man.

If we take the railway business in all its branches, we shall find that in every one of them the men who now are at the head, and who are getting large salaries and are making money, began life without a cent, except in a very few instances. Thirty odd years ago a rosy-cheeked young man ran one of the engines on the New York and New Haven road. He spent every moment of his spare time in studying mechanical engineering and surveying. Soon his suggestions respecting the building of engines, and also respecting the construction and building department of that road, became so valuable that his services were recognized by promotion. He became assistant superintendent, then general superintendent of the whole system, and is now vice-president and director, and has control of the entire mechanical department of the road. This is E. M. Reed, and when he sees a discontented engineer, he says to him that the opportunities for advancement to-day are just as great, probably greater, than they were thirty odd years ago, when he fired on the road. Another superintendent, C. N. Davidson, of the Hartford division, years ago stood at the footboard, and secured his promotion because he made his services so valuable that the company could not do else than appoint him to responsible places. The general superintendent of the great Wabash system some years ago was a common telegraph operator in Delphi, Ind., earning barely enough to pay his board and clothing. But he made a study of the railroad business as opportunity presented in that obscure town. By and by the opportunity came for making a suggestion to the managers. It was a good one. Railway managers are constantly on the lookout for men who show their competency. No men in the world are quicker to recognize and reward fidelity and ability. This operator was promoted to a more responsible post. Here his whole time was given to mastering his duties and bettering the service. So he was promoted again and again, until a year ago he was made the general superintendent of the vast system, and with a salary commensurate with his responsible duties. His name is Wade.

General Superintendent Kerrigan, of the whole five or six thousand miles of the Missouri Pacific system, began his career as an ordinary axman on the Iron Mountain road. He handled the ax well, and was next made rodman. He was absorbed in his work, and the company recognized his industry and value, and to-day he receives $10,000 a year for managing the system. The late Vice-President Hoxie himself, whom the Knights of Labor regarded with so much bitterness, was in his early life a laboring man, even performing such duties as taking care of horses. But he did that work thoroughly, and when he was twitted with having once been a hostler, he laughed and replied: "Yes, and I was the best one in Des Moines."

The late President Rutter, of the New York Central road, began life as a station agent on the line of the Erie road, but he wasn't satisfied simply with being prompt and accurate with his accounts. He made a study of the freight business, so far as he could at his station, and opened the eyes of his manager with his valuable suggestions and his quick and successful solution of some of the troublesome problems of freight transportation that he had to meet in that early day, before the business was systematized and so well understood as now.

Some years ago two long freight trains met at a siding on one of the Illinois prairies. The siding was not long enough to allow the trains to pass. The assistant manager of the road happened to be on one of the trains, and he was at his wits' end to know what to do. There stepped up a young brakeman, who said he could manage the trains so as to enable them to pass. The engineers laughed at him, but the manager asked him to explain. With a stick he traced in the ground his plan, and it was so simple that every one at once comprehended it. In fifteen minutes the two trains had been moved by, and the operation is now universally adopted on sidings that are too short. It is called sawing. The young fellow, while riding on the top of his car across the dreary prairies, had studied out and solved the problem, and when the opportunity came, he was ready for it. He is now the general manager of the great Northwestern system.

The Great Lenses Safe at Mount Hamilton.

The San Francisco *Chronicle* says the crown and flint glasses of the great objective of the Lick Observatory have arrived safely at the summit of Mount Hamilton. The boxes containing the glasses were taken to the south room of the observatory, where a fire had been started hours before to produce the proper temperature.

When the covers of the boxes were removed, it was found that the glasses had not moved out of place in the slightest degree. The wrappings of cotton flannel, forty yards to each glass, were then carefully cut away, and the glasses brushed and wiped with the utmost delicacy by Mr. Frazer, in accordance with instructions given him by Alvan Clark. This done, the glasses, set on edge on steel rollers, were put in a cast iron cell inlaid with silver, with a space of six and a half inches between them. This space has eight oval houses for cleaning and ventilation.

The next move was to transport the cell, with its valuable attachment, weighing altogether 600 pounds, to the vault in the north room under the pier which supports the twelve inch equatorial. Here every precaution had been taken to prevent moisture, and here the glasses will remain until the time comes for mounting them. Investigation shows that neither the flint nor the crown glass had been injured at all. Each was in as good a condition as when it left the hands of the Clarks. Captain Floyd thinks that the observatory will be ready to be turned over to the trustees of the university by the 1st of September.

To kill or keep roaches away, use borax or Persian insect powder. These must be renewed frequently, as they deteriorate by exposure to the air, and lose their power.

Our Warbler (*Muiotiltidæ*).

E. M. HASBROUCK.

In writing this article, I do so, not with the intention of giving something strictly scientific, but with the hope of awakening in the mind of the reader an interest in the various forms of bird life that surround him, and which, could he once see clearly, would always hold a prominent place in his memory. To accomplish this, then, I have chosen this family of birds as my subject, and having set forth a few of its handsomer members as an introduction to the whole, leave it with the interested to pursue his investigations, which, if he does, my aim will have been accomplished.

This family of birds, although composed of many of our smaller songsters, unquestionably contains the handsomest specimens of the North American ava fauna.

What casual observer of nature, in passing through the woods in spring time, has not noticed numerous brightly colored little forms flitting about through the bushes and tree-tops, and heard a constant faint chippering, that evidently came from somewhere, but apparently nowhere; he might have wondered what these were, and from whence these notes proceeded, without once realizing that he was in the presence of some of the most exquisitely colored creatures of the feathered kingdom.

They do not frequent the woods alone, but often stray into the cities and into our yards and parks, where, although they are not seen by the "man of the world," they are at once espied by the passing naturalist, and welcomed by him with gladness.

I remember one spring of passing down a noisy, dusty street of one of our large cities, and on coming to a few sickly looking elm trees naturally cast my eyes toward their tops and instantly paused, for there, in the midst of the noise and turmoil, was a single specimen of the black-throated green warbler (*Dendroica virens*), a bird that I had long sought for in vain. It carried me back to the previous spring, when I had been almost constantly in the field; and as I watched the little bird, I wondered how it was that men could be so wrapped up in this world as to be insensible to the presence of the many beautiful forms in nature that surround them, and are intended to cheer them on their path through life.

To become acquainted with these beautiful little creatures, one should go into the woods about the first of May, and search them diligently—not only the woods, but the swamps and overgrown pasture lands, each of which places will be found to contain its own particular set of birds.

You who have access to the country, arise some morning bright and early, take a small gun with you, and go to some patch of hemlocks that you may have noticed within a short distance, and which looked so dreary and uninviting. Seat yourself on a log, and remain quiet for an hour or two; my word for it, if you have never observed bird life before, you will see more beauty in those two short hours than you ever dreamed could exist in the wild woods; for here you will find the parula warbler (*Compsothlypis americana*—that matchless combination of blue, yellow, and old gold) flitting about as numerous as the sparrows in the noisy streets, uttering their sweet, quaint little warble, and hard at work catching the insects that are just starting out on their day's journey.

Turn your attention upward now to the tops of the trees, and try to find the source of that silvery little song that now and then breaks in upon your ears. You may search and search, and almost dislocate your neck in the attempt to discover the author of it, and yet not succeed; but have patience. Suddenly, what appears to be a small ball of fire darts out from the branches of a tall hemlock, seizes an insect, and is back again in a trice; but you have got trace of him at last, and by moving a little can obtain a good view of him at work, as he moves here and there among the branches, gleaning his morning's meal. He is so high up that you cannot see him clearly, so resort to your gun. At the report he comes down, whirling over and over, and as you pick him up you cannot help exclaiming, "How beautiful! how exquisite!" and beautiful he certainly is, and well worth the trouble you have taken to secure him, for you have before you a specimen of the Blackburnian warbler (*Dendroica blackburniæ*), one of the handsomest of the family. His back is black, but his throat is the color of flame. One would think that such a one would be named after the gods, but no, he was destined to bear the name of a discoverer—Blackburn; hence the name, and surely with his fiery throat it is an appropriate one.

Turn your attention to another part of the woods now, where the trees are less thick, and where there is considerable underbrush; here, if you are still, you will see the hooded warbler (*Sylvania mitrata*), a bird whose colors are so brilliant as to attract your attention at once. Such a tasty arrangement of black and yellow I have never seen equaled; and as you examine a specimen in your hand the thought comes to you, as it often has to me on similar occasions, Why will men doubt the truth of the existence of an Almighty power, when such evidences as these are continually confirming it?

While lost in such thoughts as these, a sharp chirp is uttered close beside you, and you look up to see a bird about the size of the last named, but of a clear golden yellow, with a bluish ash color on the back and wings; it is the prothonotary or carbonated warbler (*Protonotaria citrea*), a species rare in most localities and unknown to some, and consequently much sought after by collectors, and classed among the golden swamp warblers.

Another busy little songster is the Maryland yellow throat (*Geothlypis trichas*). You will find him in the bushes and swampy thickets, where his loud song will at once force itself to your notice; but although you may desire a specimen, you will have to search carefully for them, as they are exceedingly shy, and no sooner are they aware that you are desirous of seeing them than they at once become silent and cautious in their movements; and it is only with careful maneuvering that you can obtain a glimpse of him, and then only for a moment, as he peers out at you from some bunch of grass or from behind some stump, and is instantly off to safer quarters. I have had them skulk through the grass a few feet in advance of me for quite a distance, without once catching sight of them, following them only as I would hear some slight rustling, and then for a time losing track of them, would suddenly hear them back in the same place they started from. They are a handsome bird, although plainly dressed, the ashy line over the forehead being the most prominent marking.

One of the handsomest birds, and also one of the rarest, is the cerulean or blue warbler (*Dendroica cœrulea*), and if you are interested in birds, as I hope you are, go to some woods in which grow either elm, linden, or sugar maple, and there you will find them in considerable numbers. They are a beautiful bird, with their mantle of blue, white breast, and blue ring around the throat; but you will have to search the tops of the taller trees for them, as they seldom come low enough to be closely observed. You will find them fully as interesting as the preceding birds, and that they illustrate a fact in regard to many species known only to a few, and that is the difference in plumage between the males and the females. You have undoubtedly noticed that all you have seen are alike, but has it ever occurred to you that these were all males, and that the females are an entirely different looking bird, which, on account of their plain colors, were very hard to discover? Yet it is a fact, and a wise provision of the Almighty, that provides for the safety of the nests and eggs, which would be more easily discovered were they of the same color as their mates.

Who, then, can say that nature has no charms, or that he who spends his time in studying her is a fool?

But come with me, you who are not wearied, and take a peep into a Florida swamp at the time when spring migration commences, and see for yourselves a dozen different species in sight at once, and hundreds and hundreds of them within a radius of a quarter of a mile. Look on all these brilliant colors flitting about, and see if you do not agree with me when I say that this is the most beautiful of all the families, and that the study of them is well worth the time and trouble it takes to hunt them out.

How to Secure Good Prices and Ready Sales for Furs.

Cased.—Ermine, fisher, fox, lynx, martin, mink, opossum, otter, skunk, must be cased; that is, not cut open. In skinning, cut at the rump, and turn the skin inside out (like a glove) over the body of the animal, leaving the pelt side out.

Then, after scraping, cleaning, and drying, turn the skin back again while it is soft and easily managed, leaving the fur side out.

Then put a thin board inside the skin, cut the natural shape of it, stretching the skin to its fullest extent, but not so much as to make the fur thin. Too much stretching spreads the fur over a large surface and makes it thin and lacking in richness. A liberal supply of good boards should be kept on hand. Stand or hang in a dry, airy, shady place.

Keep out of the sun, away from fire and smoke.

Remove board when fairly dry.

Never use bent sticks, bows, or anything irregular in shape, or that yields.

When the above are opened, they have a Southern appearance that lessens the value greatly.

Open.—Badger, bear, beaver, cat, raccoon, wolf, wolverine, must be open; that is, cut open up the belly from rump to head. After scraping, cleaning, and drying, stretch a uniformly oblong shape, to the fullest extent of the skin, but not so much as to make the fur thin.

When thoroughly dry, trim off legs, shanks, flippers, and any little pieces that spoil appearance of skin, but leave on heads and noses.

Beaver are sometimes stretched almost round, but appear very much better stretched oblong. Value by the skin, never by the pound. They rapidly lose heavily in weight. They bring most sold by the skin.

Muskrats must be cased, but with the fur side in. Chop off the tails as explained. Skin at the nose and make rumps square. Round tails have less value, and do not sell well.

Muskrats must not be injured by shot or spearing. Trap them.

Skins that have dried without proper care can be treated same as fresh, green skins. Otherwise they have no value. Dissolve a handful of common salt in a pail of fresh water, and apply frequently with brush or rag (to pelt side only, as it spoils appearance to wet the fur) until the pelt becomes perfectly soft. Then handle as explained.

The same with open skins.

Trap furs. Spearing tears the pelt. Shot cuts the pelt and shaves off the fur. Both do bad injury and lessen selling price.

Do not cure with alum or salt. It injures them for dressing and spoils their sale.

Do not dry skins at a fire, or in the sun, or in smoke. It often burns them, when they spoil and ruin on being dressed. Dry in the open air where shady.

Meaty skins often burn. The meat and fat on them heats and burns them, and they then go to pieces and rot on being dressed. Skins should be attended to at once, when fresh, and every particle of fat and flesh removed, when it can be done easily, and without tearing or injuring the pelt.

Too much warmth curls and spoils the top fur or hair.

Never stuff furs of any kind; dry and stretch as explained.

Do not stretch out the noses and make them pointed. It gives a Southern appearance and lessens value.

Do not cut off heads, ears, or noses, or mutilate in any way. It lessens value and injures sale.

Remove as much of bone from the tail as possible; otherwise the tail rots.

The pelt should be as clean and smooth as a piece of paper.

Skunk with the white stripe (or any portion) shaved out, blackened, or tampered with, must be collected at half price.

Trapping.—Fur-bearing animals must not be killed till they have at least a fair growth of fur.

Stop trapping as soon in early spring as the fur begins to shed or become thin or a little faded.

These too early or too late caught furs are a disgrace to fur trappers and collectors, and a wasteful, worthless slaughter.

How to Tell the Age of Any Person.

When the writer was a good deal younger than he is now, and attended school, he possessed what was termed an "age card," which created considerable interest among his schoolmates of both sexes. It was a perplexing problem at that time how six rows of figures could be so arranged as to produce by so simple a rule an accurate answer. The Hartford *Daily Times* recently published the table above referred to under the above new heading, and as a good deal of amusement may be derived from it by young people, we copy the following magical table of figures.

Just hand this table to a young lady, and request her to tell you in which column or columns her age is contained, and add together the figures at the top of the columns in which her age is found, and you have the great secret. Thus, suppose her age to be 17, you will find that number in the first and fifth columns; add the first figures of these two columns, and you have her correct age.

1	2	4	8	16	32
3	3	5	9	17	33
5	6	6	10	18	34
7	7	7	11	19	35
9	10	12	12	20	36
11	11	13	13	21	37
13	14	14	14	22	38
15	15	15	15	23	39
17	18	20	24	24	40
19	19	21	25	25	41
21	22	22	26	26	42
23	23	23	27	27	43
25	26	28	28	28	44
27	27	29	29	29	45
29	30	30	30	30	46
31	31	31	31	31	47
33	34	36	40	48	48
35	35	37	41	49	49
37	38	38	42	50	50
39	39	39	43	51	51
41	42	44	44	52	52
43	43	45	45	53	53
45	46	46	46	54	54
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THE nearer the freezing point the cellar can be maintained without actually endangering the stored fruit, the better for apples. Heat and light do more damage than cold. Alternate freezing and thawing will soon destroy fruit or vegetables.

ENGINEERING INVENTIONS.

A rotary engine has been patented by Messrs. Charles F. Sleigh and Harrie V. Smith, of Parkersburg, W. Va. The invention consists of an elongated piston turning in a cylinder in which slide two gates operated from a cam on the piston, with steam inlet and outlet ports entering the cylinder through the piston, and a device for reversing the engine.

A car axle has been patented by Mr. William J. Murray, of Jolon, Cal. The axle is made in sections, each section having a flange where they come together in the middle, with boxes, in which is an oil receptacle, the construction being such that each wheel is allowed to revolve independently of the other, thus avoiding the wear of wheels and track by sliding in going around curves.

MECHANICAL INVENTIONS.

A wool combing machine has been patented by Mr. William Wardman, of Bristol, Pa. This invention relates to improvements in the Noble wool combing machine, and is designed to prevent the slivers coming from opposite directions from the rollers from breaking down at the union, as they may be liable to do from insufficient material and insufficient twist.

A machine for sawing shingle bolts has been patented by Mr. Eugene H. Allman, of Mobile, Ala. This invention covers a novel construction and combination of parts, whereby the saw arbor with its saw, through a system of shafts and pulleys, rotates the feed shaft, with other special features, making an improved machine for cutting shingle bolts, and for carrying away the bolts after they have been cut by the saw.

A circular sawing machine has been patented by Mr. Everell S. Collins, of Nebraska, Pa. A vertically sliding rod actuates the mechanism for raising and lowering the saw, a forked arm operated by a rotating shaft being pivoted to the sliding rod, and there being a device for throwing the forked arm into frictional contact with the rotating shaft, the invention being an improvement on a former patented invention of the same inventor.

AGRICULTURAL INVENTIONS.

A fender for plows has been patented by Messrs. Abraham Stoner, Simeon J. Hatcher, and William H. Carroll, of Stony Point, La. It is designed to prevent plants from being covered or injured by soil, clods, or lumps thrown by the plows, and is so made that it can be readily adjusted to allow any desired quantity of soil to be thrown around the plants.

A listed corn cultivator has been patented by Mr. Linden Kirlin, of Axtell, Kan. The parts are so arranged that two rows of corn may be cultivated at the same time, the blades being adjusted so that they will cut through the crust upon the side of the furrow to loosen and mellow the ground, the evener and drawbar, to which the horses are attached, resting upon the tops of the ridges between the furrows.

A planter has been patented by Messrs. James P. Hasty and George L. Hise, of Honey Grove, Texas. The frame carries furrow opening and covering plows, and a hopper with apertures having seed slides in its bottom, the slides having pins and slots and the hopper having a stirrer, with other novel features, making a cheap and efficient machine for corn or cotton planting or fertilizer distribution.

MISCELLANEOUS INVENTIONS.

A draught equalizer has been patented by Mr. Henry Williams, of Doylestown, O. It is a novel device, providing for an equal distribution of the power of three horses, and at the same time calculated to be used with but two horses, should this number only be needed to do the required work.

A vehicle seat has been patented by Mr. William K. Howes, of Strong, Me. The back is adjustably connected to the main portion of the seat frame, so that it may be adjusted to vary its inclination to meet the requirements of the occupant of the seat, the construction being cheap, efficient, and durable.

A cooking utensil has been patented by Frances P. Hervey, of Brenham, Texas. This invention covers an ordinary vessel fitted to contain water, to the interior of which is fitted a gauze or perforated inner vessel, in which the food to be cooked is placed, there being various novel features of construction.

A road cart has been patented by Messrs. James A. and Joseph O. White, of Winston, N. C. This invention covers a novel construction and combination of parts in a vehicle, the body of which will hang low, and which is so made that the jerking, jarring horse motion, common to two-wheel vehicles, is avoided.

A gas meter has been patented by Mr. John A. Fardy, of Brooklyn, N. Y. This invention provides a filter within the gas meter, to extract foreign matters from the gas and confine the deposit thus obtained to a given space, whereby the valves and diaphragm are left free to act, and a more steady light will be obtained.

A sign has been patented by Mr. Patrick J. Dalton, of New York city. It is a novel construction of a sheet metal sign, comprising a frame with a recess into which a metal sign plate fits flush with the surface of the frame, in such way that it can be sealed and the whole effectually protected from the influence of the weather.

A vermin exterminator and process of preparing it has been patented by Mr. Cornelius A. Donovan, of Abilene, Texas. The exterminator consists of wheat or other grain saturated with a solution of strychnia in water, the grain afterward being coated with a solution of simple sirup and arsenic, a small quantity of oil of rhodium being applied to the grain thus prepared.

Business and Personal.

Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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

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

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) F. B.—For safety valve pressure, get the area of the valve by squaring its diameter and multiply by 0·7854. Multiply the whole weight by the leverage, and divide this product by the area. As in your case Area=4·9 square inches,

$$\text{Leverage } \frac{20}{2} = 10,$$

$$\text{Whole weight } 50+15=65 \text{ pounds,}$$

$$\text{then } 65\times10=\frac{650}{4\cdot9}=132\cdot6 \text{ pounds pressure per square in.}$$

(2) W. B. J.—You may repolish the agate point of your stylus with rouge or crocus on the grain side of a piece of sole leather. Wet the rouge or leather. It will bring up a fine polish in from 15 to 20 minutes. See that the point is not broken or has a sharp corner from fracture, in which case it must be ground on a grindstone to the proper shape and again polished as above.

(3) T. J. H.—Brands on cattle are burnt in and the skin more or less scarified; the hair follicles are injured or destroyed, and there is no way of removing the brand, although when the branding is done on animals quite young it becomes partially overgrown as they get older.

(4) J. W.—Holes in glass plate or windows may be cut with a diamond by making a disk of wood and using it as a guide to the diamond. It requires a delicate touch to make the first cut so a crack will not start outwardly therefrom; but when properly cut, so that the crack can be seen all around the circle, the glass can be gently tapped with a small piece of wood directly under the cut, when the fracture will run through the glass, and follow the tapping all around the circle. When the separation is complete, the center may be gently pushed out. If it should appear to be interlocked or dovetailed, a few cuts across the center will enable you to take it out in pieces.

(5) Y. T. asks whether glass will mix with metals and make a solid composition. A. It will not.

(6) A. F. G. asks: Your last week's issue gave a formula for making soap for scouring woolen goods, embracing as one of its ingredients fatty acid. Would you please let me know what fatty acid is? A. Fatty acids are a component part of fats; to supply these acids in soap making, fats are generally employed, and the alkali used appropriates the fatty acid by chemical reaction and combines with it, forming soap.

(7) R. B. B. desires a recipe for making mocking bird food. A. Mix together two parts corn meal, 2 parts pea meal, and 1 part moss meal; add a little melted lard, but not sufficient to make the mixture too greasy, and sweeten with molasses. Fry in a frying pan for half an hour, stirring constantly, and taking care not to let it burn; this makes it keep well. Put it in a covered jar.

(8) H. A. D. wishes to know where he can obtain mushroom spawn, and also desires directions for cultivating the mushroom. A. Mushroom spawn is sold in the form of what are called "bricks," and may be obtained of any large seed house, such, for example, as that of P. B. Henderson & Co. or of J. M. Thorburn & Co., of this city. A very complete and valuable illustrated article, giving directions for cultivating the mushroom, either for family use or the market, may be found in SCIENTIFIC AMERICAN SUPPLEMENT, No 178.

(9) J. S. B. writes: Will you please explain how cut glass table ware is made? A. Ordinary pressed glass is cut on wheels and polished.

(10) A. S. asks what to line a wooden tank with, which will withstand the action of nitric and sulphuric acids. A. Cover the inside with paraffine; go over the inside with a sadiron heated to the temperature used in ironing clothes. Melt the paraffine under the iron so as to drive it into the wood as much as possible, then with a cooler iron melt on a coat thick enough to completely cover the wood.

(11) J. W. P.—For brassing small articles: To 1 quart water add half an ounce each of sulphate copper and protochloride of tin. Stir the articles in the solution until the desired color is obtained. Use the sulphate of copper alone for a copper color.

(12) O. F. B. desires (1) recipe for making stove blacking. A. Take of black lead pulverized 1 pound, turpentine 1 gill, water 1 gill, sugar 1 ounce. 2. A recipe for cleaning isinglass. A. Micas may be cleaned by taking them out and thoroughly washing with vinegar, a little diluted. If the black does not come off at once, let it soak a little.

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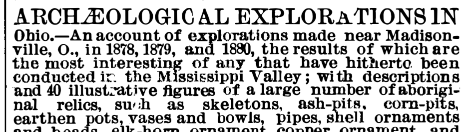

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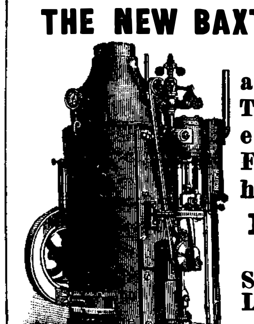

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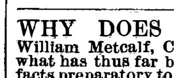

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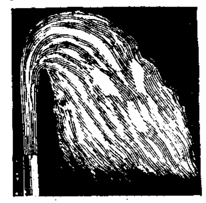

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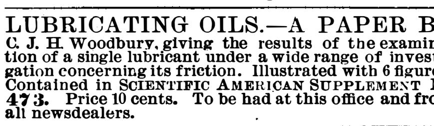

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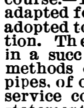

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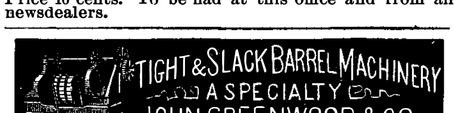

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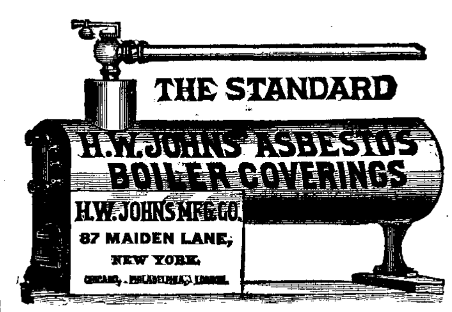

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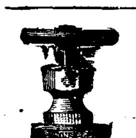

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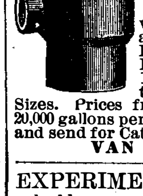

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