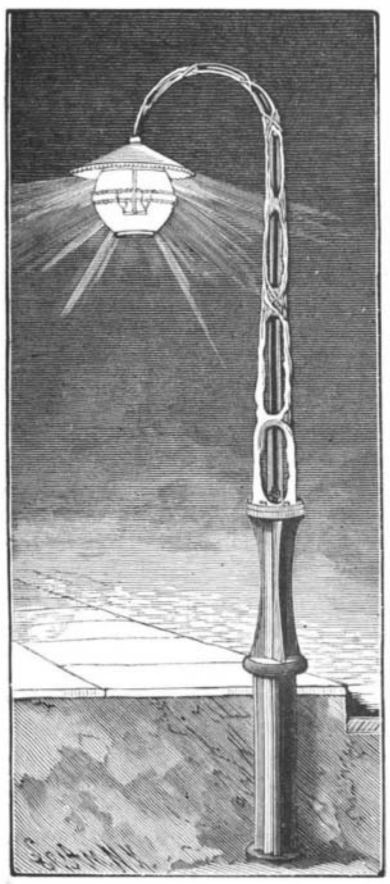
IMPROVED LAMP POST.

This lamp post is designed principally for street lighting purposes in cities and towns. It is composed of two sections, the upper end of the lower one of which is formed with a flange fitting in an inverted cup-shaped flange on the upper section, the two being held together by bolts passed through the flanges. The lower length extends partly into the ground, and is of cylindrical form, with ribs cast on its exterior to give strength and shape. The upper part is cylindrical, and formed with transverse openings, and is artistically ornamented. The upper end bends in the form of a half or part circle, in order that the attached gas lamp may hang over the center of the side walk, out of line or interference with telegraph or other poles, shade trees, or other obstructions. The lower section forms a capacious gas chamber, connected with the top of which is a pipe leading through the upper section to the gas jet. The lower end of this pipe is provided with a stop cock. By this construction there will be no freezing or choking of the gas, on account of the large volume of gas contained in the chamber, and as the gas when not being used is turned off from the upper section of the post. When the gas is burning, the current established will keep the gas in the pipe from stopping or freezing. The gas is thus prevented from stopping or freezing, both when turned on and off. By the downward bend given to the post and pipe at the top, the pipe is extended to pass over the flame down through the lamp, thereby causing the gas to be highly heated and materially increasing its illuminating power. The position of the stop cock is such that a ladder is not necessary in order to light or extinguish the gas. The upper length of the post may be made more ornamental than usual and cheaper, as all expensive core work in its construction is avoided.



This invention has been patented by Mr. Martin N. Diall, of Terre Haute, Indiana.

FOLDING AND PASTING MACHINES.

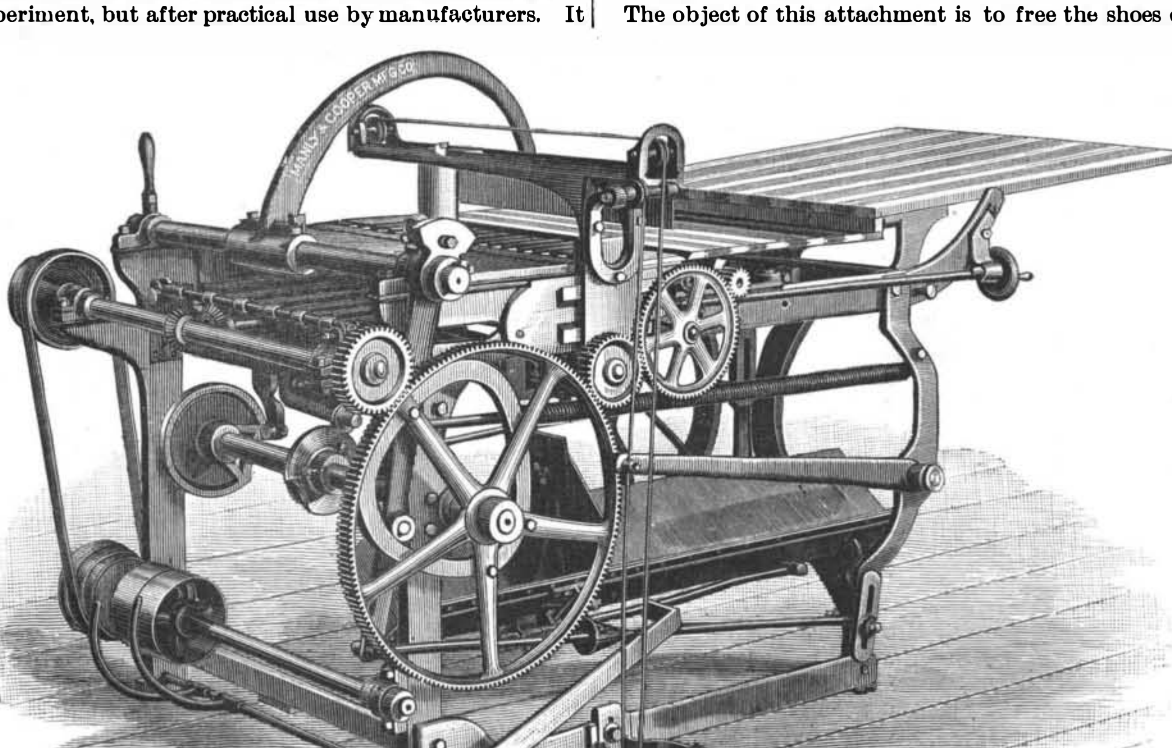
After a long series of experiments, the Manly & Cooper Manufacturing Company, of Philadelphia, Pa., has perfected a practical and efficient paster and folder, an announcement which we are sure will be a most welcome one to all whose business it is to bind books and pamphlets. This machine is not offered as an experiment, but after practical use by manufacturers. It not only folds the sheets, but does the pasting before the sheet leaves the table, and in such way that the operator sees that every sheet is thoroughly pasted before it is folded. The great value of this feature is readily understood by all who have been embarrassed by the negligence and carelessness of workpeople or by the poor performance of their machines, when the putting on of too much or too little paste, or its uneven distribution, have heretofore been frequent cause of complaint against machine folding in all first-class work. Only one paste cup is used, and the trouble of a fountain is saved, while the simplicity of the mechanism secures high speed and ready adjustment.

The machine can be used with or without the paster, and it can be furnished without the pasting attachment, to be used as a book or pamphlet folder only. It folds either to register or to margin, making one, two, three, or four folds, thus producing sections of four, eight, sixteen, or thirty-two pages, and with greater accuracy than if done by hand, and the cost is reduced about five-sixths. The floor space occupied by the machine is small, and its capacity is from 1,200 to 1,600 sheets an hour from a 16 page folder with one operator, or 1,000 to 1,500 sheets for a 32 page folder.

Simplicity of mechanism is a great desideratum, and it has been the aim of the manufacturers to simplify construction, so that any one can readily understand and adjust any part of the machine. The ease of adjustment and the attachment of a micrometer scale allow the machine to be changed without delay, and give an exactness of execution which is unequaled.

In addition to a paster, the folding machine is fitted with a coverer when desired, by which the covers are put on pamphlets before they leave the machine, and another handling is thus saved.

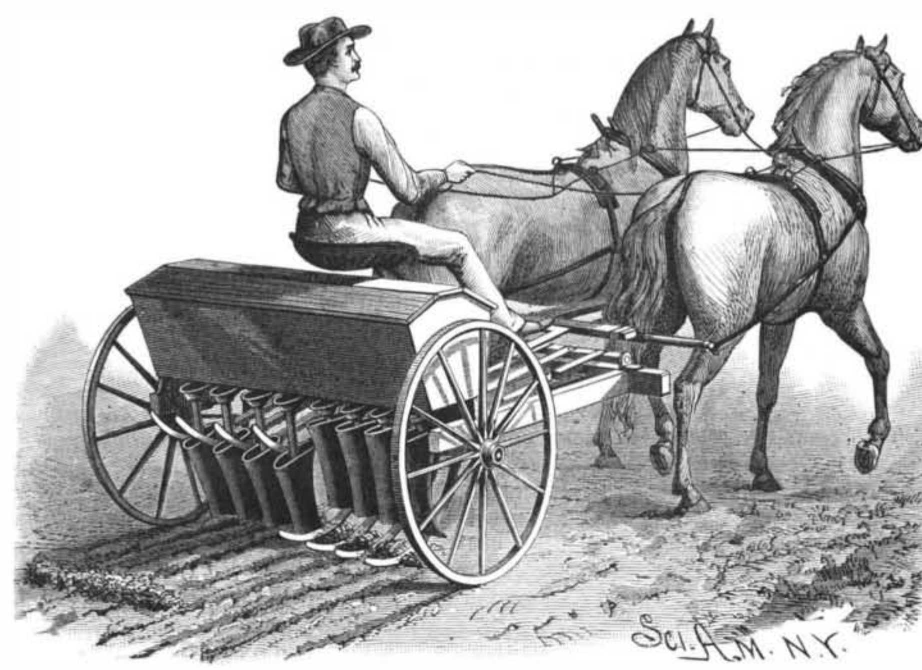
A reference to the cut shows the action. The sheet, laid flat on the table and held in place by the points or margin guides, is struck by a knife on the curved arm and carried through the slit to be taken by tapes along to a knife at right angles to the first knife. Here the second blow is given, and the sheet, folded in two pages by the first knife, is now folded in four pages by the second knife, and caught by the tapes and carried back on a lower level, each cutting doubling the number of pages until the required fold is made, when the folded sheet is placed with its fellows in the trough and is ready to bind, or if the pasting and covering attachment has been used, it is ready for distribution to the book stalls.



FOLDING AND PASTING MACHINE.

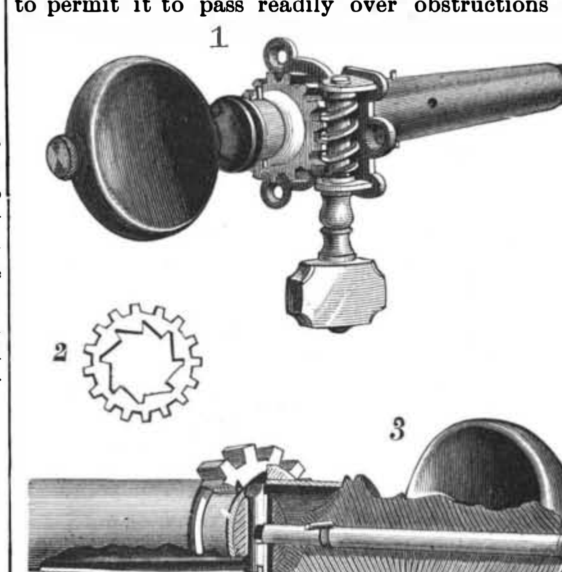
CLEARING ATTACHMENT FOR GRAIN DRILLS.

The object of this attachment is to free the shoes of drills from trash and grass, which greatly impede the progress of the drill when it is used for sowing grain upon land abounding in stalks, or what is known as "crab grass." In ordinary drills four or more hinged carrying arms and attached shoes are arranged at equal distances upon each side of the pole. In this improvement each shoe is provided with a clearing attachment. Upon the upper face of the forward beam of the frame of the drill are secured standards that form bearings for two longitudinal levers having central angular arms projecting outward, and by means of which the levers may be conveniently operated by the driver with his feet. The outer ends of horizontal twisted arms, one for each shoe, are fastened to the levers and their inner ends are pivotally attached to a connecting bar, consisting of one or two bars, made to extend at an inclination forward to a point near the front beam of the frame, and to a pivotal connection with a clearing bar. The clearing bars are fulcrumed upon pins of adjustable plates bolted to the carrying bars, which are preferably formed of two thin bars. The free end of each clearing bar is bent downward and formed with an upward curve, in order to permit it to pass readily over obstructions and prevent entanglement with the grass. When, in the use of a drill provided with this attachment, the shoes become clogged by grass or other refuse, the driver presses upon either or both of the angular arms or treadles of the levers with his feet, and thereby causes the shoes to rise from the ground, the clearing bars being simultaneously pressed upon the obstruction and clearing the shoes. When the levers are released, the shoes will drop to the ground of their own weight, and the clearing bars will be returned to their normal position, a little above the ground. A spring may, if thought desirable, be arranged to assist in the return of the clearing bars.



MITCHELL'S CLEARING ATTACHMENT FOR GRAIN DRILLS.

This improvement, which is the invention of Mr. William H. Mitchell, of Horse Cave, Ky., may be attached to any hoe drill.



GARDNER'S VIOLIN TUNING PEG.

[FOR DESCRIPTION SEE PAGE 309.]

A GIGANTIC GAS WELL.—The largest gas well in the world has just been discovered at Fairmount, Indiana. The test of Professor Orton, State Geologist of Ohio, shows that it is flowing nearly twelve million cubic feet per day.

The National Academy of Sciences—A Historical Sketch.

BY MARCUS BENJAMIN.

Soon after the beginning of the civil war, numerous questions of importance, requiring a scientific solution, came before the national government. A new explosive was submitted to the War Department, a new monitor to the Navy Department, and, indeed, from all directions came suggestions, many of which demanded an official investigation. The scientific experts of the government, prominent among whom were Alexander Dallas Bache, superintendent of the Coast Survey, and Joseph Henry, secretary of the Smithsonian Institution, were in frequent consultation with the leading heads of the departments.

Recognizing the advantage to be derived from the active co-operation of men of science, many of whom, being specialists, could readily furnish desired information at once, the idea of a national academy of sciences, like the Royal Society of England and the Academy of Sciences of France, was urged upon the government.

The duties of this new body were to include, whenever called upon by any department of the government, the investigation, examination, experimenting, and report upon any subject of science or art, the actual expenses of such work and report to be paid from appropriations which may be made for the purpose; but the academy was to receive no compensation whatever for any services rendered to the United States government. Its membership was to consist of not more than fifty ordinary members, who must be citizens of the United States. Subsequently, the limitation to membership was removed, and it was decided to admit fifty foreign associates.

An act was passed through Congress on March 3, 1863, incorporating the National Academy of Sciences, and the first meeting was held in New York, beginning on the 22d of April, 1863. Superintendent Bache was chosen president, and an organization effected by the adoption of a constitution. Among the important provisions of the latter was that the academy shall hold one stated session in each year in the city of Washington, on the third Tuesday in April, and another may be held at such place and time as the council may direct. The later, called the scientific session, was at first called during August, but is now convened in November, has been held in New Haven, Conn.; Northampton, Mass.; Hartford, Conn.; Cambridge, Mass.; New York, N. Y.; Philadelphia, Pa.; Newport, R. I.; and Albany, N. Y. The constitution gives power to the presiding officer to appoint all committees, among which are those "On Ways and Means to provide a Fund for the Academy," "On Weights, Measures, and Coinage," "On the Election of Foreign Associates," "To Co-operate with the National Board of Health," "On Publications of the Academy," and "On the Relation of the Academy to the Government;" and also to refer investigations required by the government of the United States to members specially conversant with the subjects, with request to report thereon to the academy at its session next ensuing. Among such committees of recent standing are those "On Reserving Public Lands on and near Mount Whitney, California, for Scientific Purposes," "On Questions of Meteorological Science and its Applications," "To Report on the Triangulation to Connect the Atlantic and Pacific Coasts," "On the Investigation of Glucose for the Department of Internal Revenue," "On the Total Eclipse of 6th of May, 1883," "On the Organization of National Surveys and Signal Service," and "On Customs Duty on Philosophical and Scientific Apparatus." Many of these committees remain in force for years, or until the purpose for which they were appointed has been accomplished.

Any attempt to review the work performed by the academy is naturally out of the question, but as an illustration of how it is executed a brief description of its action in reference to the "customs duty on philosophical and scientific apparatus" may be made. The Secretary of the Treasury, finding that great difficulty was experienced by appraisers in customs in determining what instruments and other articles were entitled to classification for duty as "philosophical apparatus and instruments," referred the matter to the academy, with a request that a list be reported comprising the different articles which properly come within the scope of such title. A committee, consisting of Prof. George J. Brush, of Yale College; Prof. Wolcott Gibbs, of Harvard University; Dr. Samuel H. Scudder, of Cambridge, Mass.; Prof. Simon Newcomb, of the "United States Nautical Almanac" office, Washington, D. C.; and Prof. George F. Barker, of the University of Pennsylvania, reported that, "First, an instrument is philosophical, not in consequence of its special construction or function, but in consequence of the uses to which it is to be put, and many instruments may be put both to uses which are philosophical and to uses which are purely industrial or commercial. Secondly, the number of different kinds of philosophical apparatus is so great, and new kinds are so constantly added, that an exhaustive enumeration is impracticable." This statement was duly transmitted to the Secretary of Treasury by the president of the academy.

The academy has received by bequest the property of Alexander D. Bache, in trust, the income to be devoted to the prosecution of research in physical and natural science by assisting experimentalists and observers, and the publication of the results of their investigations. From this fund there is derived an annual income of $4,500, which is devoted to a magnetic survey of the United States, under the direction of a committee of the academy. On the death of Joseph Henry, in 1878, a sum of $40,000 was left to the academy, concerning the disposition of which nothing has as yet been done. In 1880, there was received from the estate of James C. Watson an amount equivalent to nearly $14,000, from the interest of which a medal is to be prepared to be awarded to the person in any country who shall make any astronomical discovery or produce any astronomical work worthy of special reward and contributing to the progress of astronomy. Two years later, on the death of Henry Draper, his widow presented to the academy $6,000 for the establishment of a gold medal, to be awarded every two years to the individual, in this or any country, who makes the most important discovery in astronomical physics, the value of the medal to be $200. The sum of $8,000 was placed at the disposal of the academy by the widow of J. Lawrence Smith, as a memorial fund to promote the study of meteoric bodies.

It is customary among the members of the academy to read papers at their meetings descriptive of some investigation or discovery with which they have been engaged during the year. A notice of such a communication must first be given to the secretary, and the academy does not hold itself responsible for the facts or opinions expressed by the author, but considers itself responsible only for the propriety of the paper. In the annual report of 1883, a list of the titles of 777 papers is given, which have been read at meetings. This number was increased by forty-nine in 1884, and by forty-four in 1885, and by fifty in 1886; we have a grand total of 920, or very nearly 1,000 papers presented to the academy since 1864. This list includes not only memoirs by members of the academy, but also papers on the researches of other scientists, who have been invited to attend the sessions.

The publications of the academy are of three kinds—annual reports, memoirs, and biographical memoirs. Of these the first are transmitted each year to the president of the senate, and are published as octavo pamphlets containing the proceedings of the meeting held, list of papers read, and an appendix giving the special reports of the committees appointed to consider subjects referred to the academy by the departments. The memoirs are a series of quarto volumes containing valuable contributions to science, made by the members, and originally presented to the academy in the form of papers, read at its sessions. Two complete volumes and part of a third have already been issued.

The officers are chosen for a term of six years, and the first president, as has been stated, was Alexander D. Bache. He was succeeded on his death, in 1868, by Joseph Henry, who then held office until 1878. William B. Rogers followed, and on his death, Othniel C. Marsh became president. The present officers are, besides Prof. Marsh as president, Simon Newcomb, vice-president; Wolcott Gibbs, foreign secretary; Asaph Hall, home, and John H. C. Coffin, treasurer.

The membership of the academy now includes some ninety-eight scientists. A full list is herewith given, which is taken from the official register of June, 1886. Cleveland Abbe, meteorologist at the U. S. Signal Service Office, Washington, D. C.; Gen. Henry L. Abbot, of the topographical engineers, in command of the station and school at Willet's Point, N. Y.; Alexander Agassiz, naturalist, and considered the best authority in the world on certain forms of marine life; J. Asaph Allen, curator of animals and birds at the American Museum of Natural History, New York; Spencer F. Baird, naturalist, and secretary of the Smithsonian Institution, Washington, D. C.; George F. Barker, professor of physics at the University of Pennsylvania, Philadelphia, Pa.; Frederick A. P. Barnard, president of Columbia College, New York; Col. William H. C. Bartlett, professor of natural sciences and experimental philosophy at the U. S. Military Academy until 1871, since when he has lived in retirement at Yonkers, N. Y.; Alexander Graham Bell, inventor of the telephone, Washington, D. C.; Dr. John S. Billings, compiler of the "Index Catalogue of the Surgeon-General's Office," Washington, D. C.; William H. Brewer, agricultural chemist, and Norton professor at the Sheffield Scientific School, New Haven, Conn.; William K. Brooks, naturalist, and professor of morphology at the Johns Hopkins University, Baltimore, Md.; Dr. Charles E. Brown-Sequard, physiologist, and professor of experimental medicine in the College of France, Paris; George J. Brush, mineralogist, and director of the Sheffield Scientific School of Yale University, New Haven, Conn.; Charles F. Chandler, professor of chemistry at Columbia College and dean of the faculty at the School of Mines, New York; John H. C. Coffin, senior professor of mathematics of the U. S. Navy, on the retired list, and formerly in charge of the "American Ephemeris and Nautical Almanac," Washington, D. C.; Gen. Cyrus B. Comstock, of the engineer corps, and superintendent of the geodetic survey of the northern and northwestern lakes, New York; Josiah P. Cooke, professor of chemistry at Harvard University, Cambridge, Mass.; Edward D. Cope, naturalist and paleontologist, connected with the U. S. geological survey, Philadelphia, Pa.; Elliott Coues, naturalist and professor of biology in the Virginia Agricultural and Mechanical College, Washington, D. C.; James M. Crafts, chemist, and formerly professor at the Massachusetts Institute of Technology, Boston, Mass.; Dr. John C. Dalton, physiologist and president of the College of Physicians and Surgeons, New York; Edward S. Dana, mineralogist and assistant professor of natural philosophy and astronomy at Yale University, New Haven, Conn.; James D. Dana, mineralogist and Silliman professor of mineralogy and geology at Yale University, New Haven, Conn.; George Davidson, assistant on the U. S. Coast Survey, and in charge of Davidson Observatory, San Francisco, Cal.; Capt. Clarence E. Dutton, connected with the U. S. Geological Survey, Washington, D. C.; James B. Eads, civil engineer and builder of St. Louis Bridge; William G. Farlow, professor of cryptogamic botany at Harvard University, Cambridge, Mass.; William Ferrel, meteorologist and late connected with U. S. Signal Service, Kansas City, Mo.; Frederick A. Genth, chemist and professor of chemistry and mineralogy at the University of Pennsylvania, Philadelphia, Pa.; Josiah W. Gibbs, physicist and professor of molecular physics at Yale University, New Haven, Conn.; Wolcott Gibbs, chemist and Rumford professor of the application of the useful arts to life at the Lawrence Scientific School of Harvard University, Cambridge, Mass.; Grove K. Gilbert, geologist of the U. S. Geological Survey, Washington, D. C.; Theodore N. Gill, ichthyologist and connected with the Smithsonian Institution, Washington, D. C.; Benjamin A. Gould, astronomer and late director of the Cordova Observatory, Argentine Republic, Cambridge, Mass.; Asa Gray, the Nestor of American botanists, and professor of botany at Harvard University, Cambridge, Mass.; Arnold Hague, geologist, in charge of the Yellowstone division of the U. S. Geological Survey, Washington, D. C.; Asaph Hall, astronomer at the U. S. Naval Observatory and discoverer of the moons of Mars, Washington, D. C.; James Hall, paleontologist and director of the New York State Geological Survey, Albany, N. Y.; Ferdinand V. Hayden, late geologist of the Montana division of the U. S. Geological Survey, Philadelphia, Pa.; Eugene W. Hilgard, professor of agricultural chemistry at the University of California, Oakland, California; Julius E. Hilgard, late superintendent of the United States Coast Survey, Washington, D. C.; George W. Hill, astronomer and assistant at the office of the "Nautical Almanac," Washington, D. C.; Edward S. Holden, astronomer and president of the University of California, also director of the Lick Observatory, Berkeley, California; T. Sterry Hunt, scientist and president of the Royal Society of Canada, Montreal, Canada; Alpheus Hyatt, naturalist and curator Boston Society of Natural Science, Boston, Mass.; Charles L. Jackson, Cambridge, Mass., professor of organic chemistry at Harvard University; Samuel W. Johnson, chemist and director of the Connecticut State Board of Agriculture, also professor of theoretical and agricultural chemistry at Yale University, New Haven, Conn.; Clarence King, geologist and late in charge of the United States Geological Exploration of the 40° parallel in New York; Samuel P. Langley, astronomer and assistant secretary of the Smithsonian Institution, Washington, D. C.; Joseph Leidy, naturalist and professor of anatomy at the University of Pennsylvania, Philadelphia, Pa.; J. Peter Lesley, geologist and chief of the Geological Survey of Pennsylvania, Philadelphia, Pa.; John Le Conte, physicist and professor of physics and industrial mechanics in the University of California, Berkeley, Cal.; Joseph Le Conte, geologist and professor of geology and natural history in the University of California, Berkeley, Cal.; Leo Lesquereux, makes a specialty of fossil botany, and his work appears in the reports of United States and State Geological Survey reports, Columbus, O.; Miers F. Longstreth, Derby, Pa.; Elias Loomis, mathematician and professor of natural philosophy and astronomy at Yale University, New Haven, Conn.; Joseph Lovering, physicist and professor at Harvard University, Cambridge, Mass.; Theodore Lyman, naturalist and commissioner of inland fisheries of Massachusetts, Cambridge Mass.; Othniel C. Marsh, paleontologist and curator of the Peabody Museum of Yale University, New Haven, Conn.; Alfred M. Mayer, professor of physics at the Stevens Institute of Technology, Hoboken, N. J.; General Montgomery C. Meigs, of the United States Engineers, now retired, Washington, D. C.; Henry Mitchell, in charge of the Eastern division of the United States Coast Survey, Boston, Mass.; Dr. S. Weir Mitchell, noted for his researches in serpent poisons, nerve physiology, and similar subjects, Philadelphia, Pa.; Edward S. Morse, naturalist, late professor at the University of Tokio, Japan, Salem, Mass.; Henry Morton, physicist and president of the Stevens Institute of Technology, Hoboken, N. J.; John S. Newberry, professor of geology and paleontology at the Columbia College School of Mines, and late State geologist of Ohio, New York; Simon Newcomb, astronomer and superintendent of "Nautical Almanac," Washington, D. C.; Hubert A. Newton, mathematician and professor of mathematics at Yale University, New Haven, Conn.; General John Newton, late chief of the corps of engineers, U. S. army, and commissioner of public works, New York; James E. Oliver, professor of mathematics at Cornell University, Ithaca, N. Y.; Alpheus S. Packard, naturalist and professor of natural history at Brown University, Providence R. I.; Charles S. Pierce, late assistant and acting superintendent, United States Coast Survey, Washington, D. C.; Charles H. F. Peters, astronomer and director of the Litchfield Observatory, Clinton, N. Y.; Edward C. Pickering, astronomer and director of the Harvard Observatory, Cambridge, Mass.; Raphael Pumpelly, geologist, and has had charge of the Missouri State geological survey, and the transcontinental survey of the Northern Pacific Railway, Newport, R. I.; Frederick W. Putnam, ethnologist and curator of the Peabody Museum, Cambridge, Mass.; Ira Remsen, professor of chemistry at the Johns Hopkins University, Baltimore, Md.; Fairman Rogers, engineer, and formerly lecturer on mechanics at Franklin Institute, and professor of civil engineering at the University of Pennsylvania, Philadelphia, Pa.; William A. Rogers, Cambridge, Mass.; Ogden N. Rood, physicist and professor of physics at Columbia College, New York; Henry A. Rowland, professor of physics at the Johns Hopkins University, Baltimore, Md.; Lewis M. Rutherfurd, astronomer, New York; Charles A. Schott, connected with the United States Coast Survey, Washington, D. C.; Samuel H. Scudder, naturalist, and late editor of *Science*, Cambridge, Mass.; William Sellers, mining engineer, Philadelphia, Pa.; Sidney I. Smith, professor of comparative anatomy at Yale University, New Haven, Conn.; John Trowbridge, professor of physics at the Lawrence Scientific School of Harvard University, Cambridge, Mass.; William P. Trowbridge, professor of engineering at the Columbia College School of Mines, New York, N. Y.; James H. Trumbull, philologist and superintendent of the Watkinson Library, Hartford, Conn.; Addison E. Verrill, naturalist and professor of zoology at Yale University, New Haven, Conn.; Francis A. Walker, statistician, late superintendent of the census, and president of the Massachusetts Institute of Technology, Boston, Mass.; Dr. Horatio C. Wood, professor of materia medica, pharmacy, and general therapeutics, and clinical professor of nervous diseases of the University of Pennsylvania, Philadelphia, Pa.; A. H. Worthen, geologist, and in charge of the State Survey of Illinois, Springfield, Ill.; Arthur W. Wright, physicist and professor of molecular physics and chemistry at Yale University, New Haven, Conn.; Charles A. Young, astronomer and professor of that branch at the College of New Jersey, Princeton, N. J.

The foreign associates, limited to fifty members, include: John C. Adams, astronomer, discoverer of Neptune, Cambridge, England; Sir George B. Airy, astronomer royal of England, Greenwich, England; Arthur Auwers, astronomer, Berlin, Germany; Joseph L. F. Bertrand, mathematician, Paris, France; Pierre E. M. Bertholet, chemist, Paris, France; Jean B. J. D. Boussingault, chemist, Paris, France; Robert W. Bunsen, chemist, Heidelberg, Germany; Hermann Burmeister, naturalist, Buenos Ayres, S. A.; Arthur Cayley, mathematician, Cambridge, England; Michel E. Chevreul, chemist, Paris, France; Rudolph Clausius, physicist, Bonn, Germany; Alphonse De Candolle, botanist, Geneva, Switzerland; Baron Hermann v. Helmholtz, physicist, Berlin, Germany; Thomas H. Huxley, naturalist, London, England; Sir Joseph D. Hooker, botanist, Kew, England; Gustav R. Kirchhoff, physicist, Berlin, Germany; Rudolf Albert von Kolliker, physiologist, Wurzburg, Germany; Theodore von Oppolzer, astronomer, Vienna, Austria; Richard Owen, anatomist, London, England; Louis Pasteur, chemist, Paris, France; Ferdinand v. Richthofen, geologist, Berlin, Germany; George G. Stokes, mathematician, Cambridge, England; Otto N. von Struve, astronomer, St. Petersburg, Russia; James J. Sylvester, mathematician, Oxford, England; Sir William Thomson, Glasgow, Scotland; Rudolph von Virchow, anatomist, Berlin, Germany.

Relative Cost of Water and Steam Power.

A subscriber at Portland, Ore., writes to the *Lumber Trade Journal*, and wants to know "whether it is cheaper to run a saw mill by water or steam power." He further says: "I am about to engage in a large enterprise at a point in Washington Territory where there is abundant water power, but sometimes the river falls low, and is not available for a steady manufacturing business. Had I better rely upon steam power or water power; which, in the end, is the cheapest?"

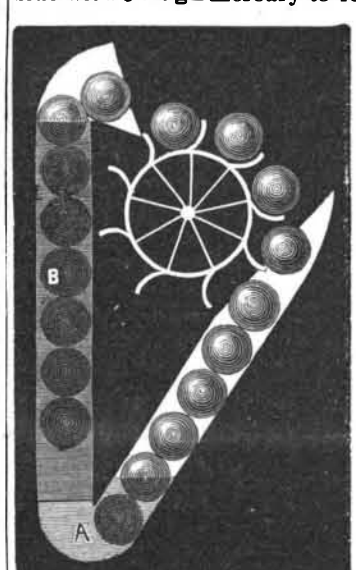
In reply, the editor says that the water equipment at Lowell, Mass., was for canals and dams $100, and for wheels, etc., another $100 per horse power. But this as a first experiment was more costly than a similar experiment need be. At Saco, Me., the expense incurred was $165 per horse power; but at a later period, for turbines with high heads, the expense would be less. A construction and equipment, solidly carried out, with the latest improvement in wheels, would not cost over $200 per horse power (probably less) under favorable circumstances. If we remember correctly, an estimate at Penobscot, Me., was for $112.50 per horse power. If the construction be with wooden dams, and the equipment with lower grade wheels, then the cost would be less than $50 per horse power; and although the construction would be less permanent than the more solid, it would outlast any steam apparatus. On the other hand, Fall River (Mass.) estimates of steam equipment, exclusive of foundations and engine houses, run from $100 to $115 per horse power. A Boston authority gives $110 for nominal 300 horse power and upward, inclusive of foundations and masonry. Similarly a Portland (Me) authority places it at $100 per horse power for nominal 300 horse power.

A PERPETUAL MOTION MACHINE—WILL IT WORK?

I herewith send you my thoughts on a perpetual motion arrangement that I have never noticed in print. It is very simple, and I would very much like to see it illustrated and commented upon by you.

I use a tubular tank, in which the balls to be used just fit. The power wheel is arranged to catch these balls, and the turning of the wheel by the weight of the balls is the power produced.

The tube is filled one side with water and the other side with enough mercury to force the water up to the top of column. In the figure, A is mercury, and B the water. The balls to be used are made of iron, with an air tight chamber filled with gas to make them float in water.



The machine is supposed to operate in this way: The balls are started on mercury side. Several will be needed to force the first ball through the mercury, but the moment it has passed the center it will rise to the top of column of water. The next coming balls will force it out until it rolls off on to the proper place on the power wheel. Here the balls exert their weight, turn the wheel, and then drop back into starting channel to force the ones ahead of it through the mercury back into the water again.

If each ball weighs say ten pounds, it seems as if there would be enough weight to force it through the mercury into the water, and then it would at once rise up higher than from where it started.

The difference of power seems to be the *weight* of the ball on one side and the *buoyancy* of the same ball on the other, *but I am afraid that the mercury is so dense that the amount of weight needed to force the first ball through the mercury will just balance the weight of the column of water.* If we take two tubes, partly fill the one with water, and the other partly fill with just enough mercury to balance each other. Now, if we take iron balls that will float, and place the balls one over the other in each tube, which one will require the greatest number of balls to force the first ball to the bottom? Can this be determined by science, or must it be found out by experiment?

New Albany, Ind. HENRY A. GOETZ.

[The writer of the above communication outlines pretty clearly the fallacy. With regard to the question at the end of the letter, we reply: The same number of balls will be required to force the first ball to the bottom, whether through mercury on one side or through mercury and water on the other side. The amount of weight required to force the first ball through the mercury will just balance the increased pressure due to displacement of the water or additional raising of the height of its column.—ED.]

Telegraph Wires in New Orleans.

The city of New Orleans is about to adopt a system of Colonel Flad for overhead wires. This consists in erecting tall towers at the street corners, which will carry the wires over the roofs. The system will be under the supervision of the Commissioner of Public Works, and the older method of running the wires, telegraphic, telephonic, and electric lighting, on poles will be abolished. The towers will be classified for the different classes of wire; and the wires are not to be less than 10 ft. above the roofs. The Star Iron Tower Company, of Fort Wayne, has received an order for 224 towers.

Correspondence.

Casting Steel Ships.

To the Editor of the Scientific American:

Being greatly interested in our coast defenses, I would like to make a suggestion, after reading Sir Henry Bessemer's proposal to cast *in situ* the whole face of a fort. Why not cast the hulls of our new war vessels? There are no insurmountable obstacles in the way, and the plant once established could be used for a hundred or more vessels, which, when cast, could be cleared and floated away to be finished, the moulds replaced and another cast in the same moulds. R. GLEASON.

Egan, Dakota.

Singular Upheavals.

To the Editor of the Scientific American:

About three years ago, a company was constructing a wharf at Pyramid Harbor, Chilcat Inlet. The bottom was covered with silt to the depth of about 10 feet, lying on a bed of cement or gravel from 8 to 12 inches thick. Under it is a bed of clay or blue mud.

The piler, on being driven through the cement, would be thrown up with great violence. She was thrown on top of the wharf (that part finished), over 20 feet above the water, it being at low tide, and the rise and fall is about 16 feet. Another time, a pile was driven, and in the gin, with the monkey on it. It was thrown out with such force as to raise the monkey to the top, a distance of 60 feet. The weight of the monkey was 1,500 pounds.

To me it was such an uncommon occurrence, and can be so easily substantiated by respectable parties, the contractor, and the members of the corporation for whom the wharf was constructed, I consider it worthy of notice. W. H. WOODCOCK.

Fort Wrangel, Alaska, April, 1887.

VIOLIN TUNING PEG.

The barrel of this peg may be turned to take up any undue amount of slack that there is in the string connected to the peg, after which the necessary fine adjustment may be obtained by turning the barrel, through the medium of a worm gear. On a tapered wooden core formed at one end with a head or thumb-piece is placed a metallic sleeve formed with an annular flange, against which fits a plate formed with a number of apertured ears, through which pass screws connecting the peg with the instrument. Against the face of the plate is placed a gear, engaging with which is a worm carried by a short vertical shaft supported in bearings extending outward from the plate. The gear is formed with an internal ratchet, Fig. 2, engaged by a pawl mounted in a transverse recess formed in the core and pushed into engagement with the teeth by a spring. In order that the pawl may be withdrawn from the teeth, it is formed with an aperture, which is entered by an eccentric projection formed upon a bar fitted within the core, Fig. 3, and held in position by a pin entering a groove formed in the bar. The end of the string, in connection with which the peg is employed, is passed through an aperture in the core and sleeve, and the slack is taken up by turning the key, the pawl being pressed inward against the tension of its spring. When a tension approaching that required for a proper tuning of the instrument has been imparted to the string, the required accurate tension is obtained by turning the vertical shaft. If the string should break, it may be stripped from the peg by turning the bar so that its eccentric projection will force the pawl against the tension of its spring; and when the pawl has been forced out of engagement with the ratchet, the string may be grasped and pulled from the barrel of the peg, the parts being then free to turn in either direction required.

This invention has been patented by Mr. James H. Gardner, of Elkhart, Indiana.

Another Remarkable Torpedo Boat.

In our paper for April 23 last we gave an account of a new torpedo boat built in London for the Italian government, 140 feet long, 1,400 h. p., 100 tons displacement, which runs 25 knots or 28 miles an hour—the fastest boat ever produced.

Another torpedo boat for the Imperial Chinese navy, by Messrs. Yarrow & Co., had her official trial on March 31, and attained the remarkable speed of nearly 24 knots per hour, as a mean of six runs over the measured mile in the Lower Hope, three with and three against tide. To be exact, the speed was 23·882 knots; and a subsequent run of two hours' duration gave a mean speed of 22·94 knots, with the engines running easy. She had on board her torpedo armament complete and ballast to represent four torpedoes, also a fair quantity of coal and twenty-four persons. This boat is 128 feet long, and constructed on Messrs. Yarrow & Co.'s rapid-steering principle, which enabled her afterward to make circles to both sides, having diameters of about 230 feet.